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Journal of  
**Economics and  
International Finance**

October-December 2020  
ISSN 2006-9812  
DOI 10.5897/JEIF  
[www.academicjournals.org](http://www.academicjournals.org)



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*Full Length Research Paper*

# The effect of monetary policy and inflation on the exchange rate: A case study of Ghana

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Received 5 August, 2020; Accepted 27 August, 2020

The Ghanaian Cedi has recently experienced persistent depreciation against its major trading partners. This paper investigates the contribution of inflation and monetary policy in this persistent depreciation. The paper makes use of the Autoregressive Distributed Lag (ARDL) and Bounds test of cointegration and the Toda and Yamamoto (1995) Augmented Granger Causality test to determine the long and short-run dynamics of the impact of monetary policy and inflation on exchange rates in Ghana, using data ranging from 1970 to 2017. The paper finds a short-run depreciation effect of contractionary monetary policy on the exchange rate, reflecting the exchange rate puzzle. The long-run results however show an appreciating effect. Inflation is also found to depreciate the currency both in the short and long-run. The causality tests also reveal a bi-directional relationship between the exchange rate and the inflation rate, while a unidirectional causal relationship exists between monetary policy and the exchange rate. The paper recommends that inflation stabilization policies should be prioritized in Ghana, as a means to curb the rising exchange rates. Improvement in terms of trade through export value promotion should also be given the needed attention as this is found to appreciate the currency in the long-run.

**Key words:** Exchange rate, inflation, money supply, Autoregressive Distributed Lag (ARDL), cointegration, Ghana.

## INTRODUCTION

The recent surge in free trade among countries has made the exchange rate one of the most significant macroeconomic variables that are widely studied in the literature. Exchange rates have an effect on the returns to trade among countries as it determines the value of exports and imports. As a result, the exchange rate stabilization has become a major target for governments of most developing countries. Being heavily import-dependent, developing countries have had to face a recurring depreciation of their currencies. This has had a very significant effect on domestic businesses that are mostly dependent on imported raw materials and

intermediate goods. The exchange rate has implications for the rate of economic growth of countries because of the effect it has on the demand for imports and exports.

The demise of the Bretton Woods system in 1973 has seen countries abandon the fixed exchange rate system and adopt floating exchange rate systems. The exchange rate is now determined by the demand and supply of a currency against other currencies. This change has exposed the exchange rate to severe volatility as it is easily affected by factors that affect the demand and supply of a particular currency. The exchange rate is therefore one of the most volatile macroeconomic

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variables today. This has triggered attempts to understand the effect of fluctuations of other macroeconomic variables on the exchange rate. Both country-specific and cross-country studies on factors affecting the exchange rate have been conducted worldwide and these factors have been well documented.

Theories such as the International Fisher's Effect (IFE), purchasing power parity (PPP), and Mundel Fleming models have linked exchange rates to inflation and interest rates (Ebiringa and Anyaogu, 2014). The IFE and PPP theories for instance establish a depreciating effect of high inflation on the local currencies of countries. The IFE states that the future spot exchange rate is determined by the nominal interest rate differential (Sundqvist, 2002). The theory suggests that countries with high-interest rates will have their currencies depreciating with increasing nominal interest rates, compared to their trading partners, reflecting differences in the expected inflation (Ebiringa and Anyaogu, 2014). Countries with high-interest rates have high levels of inflation rates than those with lower interest rates. Hence, the currency depreciates when inflation rates are high. The PPP, attributable to Cassel (1918) also states that the equilibrium rate of exchange between currencies is determined by the quotient between the purchasing power of both currencies. Therefore, when a country's rate of inflation rises compared to its trading partners, its currency will depreciate and vice versa.

Ghana has experienced a consistent decline in the value of the currency against the major trading currencies. Several measures undertaken by the Bank of Ghana, such as the re-denomination of the currency in 2007 has seen little success. This situation has shifted a lot of attention to examining the factors responsible for the continuous depreciation of the currency. This paper, therefore, seeks to determine if the rising levels of inflation have been particularly responsible for the rising exchange rates. The paper also seeks to test the validity of the exchange rate puzzle for Ghana.

The paper adopts an Autoregressive Distributed Lag (ARDL) and Bounds testing technique to determine the short and long-run dynamics of the relationship between the exchange rate, the inflation, and monetary policy rate in Ghana, using annual time series data ranging from 1970 to 2017. A test of long-run causality will also be done to further establish these relationships. The paper hypothesizes that higher inflation rates and expansionary monetary policy lead to exchange rate depreciation, in line with conventional macroeconomic thinking.

## RELEVANT LITERATURE

### Theoretical review

The International Fisher's Effect (IFE) otherwise known as Fisher's hypothesis, credited to Irving Fisher

establishes a relationship between the differences in nominal interest rates and the spot exchange rates between countries. It suggests that the future spot exchange rate is determined by the nominal interest rate differential (Sundqvist, 2002). It states specifically that, the exchange rate is expected to change in the opposite direction to the interest rate differential. It is an extension of the Fisher effect, which shows that the difference between the nominal interest rate and the real interest rate is the expected inflation. Hence, a higher interest rate differential reflects a higher rate of inflation. Therefore, countries with low-interest rates have a lower inflation rate compared to countries with high-interest rates. High rates of inflation in a country are therefore expected to lead to a depreciation of the currency of the country compared to her trading partners. This theory, therefore, establishes a positive relationship between the exchange rates and the inflation rate.

The Purchasing Power Parity (PPP) also establishes a relationship between the price level and the exchange rates across countries. The theory states that the rate of exchange between the currencies of two countries is determined by the ratio of the purchasing power between the two countries. The theory builds on the Law of One Price (LOP) which asserts that the tradable value of goods across countries will be equal if converted to the same currency (Adrangi et al., 2011). If this is not the case, the exchange rates between these countries will adjust to ensure that the value of the good remains the same across countries. The theory, therefore, attempts to quantify the relationship between exchange rates and inflation by establishing that, exchange rates are caused by differences in the inflation rates across countries (Kara and Nelson, 2002). Therefore, higher inflation rates in one country will lead to the depreciation of its currency. This is due to the fall in the demand for its exports relative to its imports. This adjustment in the exchange rate is expected to continue until the inflation rate is equalized across countries. Though theoretically appealing, the PPP theory has faced several criticisms from empirical studies. Much of the criticisms have been based on its assumptions which are considered unrealistic, its neglect of the effect of the supply and demand of foreign exchange, and the fact that it rarely occurs. Eleftheriou and Müller-Plantenberg (2018) argue that the prices of traded goods affect the exchange rate through two major means, the price level effect and the interest rate effect. The price level effect reflects the PPP theory. They however argue that the two effects move in opposite directions. Hence the interest rate effect works to neutralize the price level effect, suggesting that market arbitrage is not a conducive condition for the PPP theory. They rather argue that the main force driving the exchange rate is the currency market pressure.

The interest rate parity theory has mostly been used to explain the relationship between interest rates and exchange rates. The theorem links the forward exchange

rate to the market interest rate differential (Aliber, 1973). In other words, the interest rate charge reflects the exchange value of a currency with other currencies (Ebiringa and Anyaogu, 2014). Therefore, lower interest rates are associated with a lower exchange value of the domestic currency (depreciation) and higher interest rates imply higher exchange value (appreciation) of the domestic currency. This assertion is in line with traditional macroeconomic thinking that higher interest rates or contractionary monetary policy tend to appreciate the domestic currency while lower interest rates or expansionary monetary policy depreciates the currency. Hnatkovska et al. (2016) however find that contrary to conventional thinking, contractionary monetary policies lead to depreciation of the currencies of developing countries, a phenomenon they call the exchange rate puzzle. This paper will attempt to determine if the exchange rate puzzle exists for Ghana, in the short and long run.

### Empirical review

Expansionary monetary policy is generally known to result in the depreciation of a country's currency relative to its trading partners, while contractionary monetary policy leads to currency appreciation. High-interest rates lead to a fall in output, relative domestic prices, and demand, which includes demand for imports. Lower domestic prices imply higher export demand which increases the demand of the local currency relative to other currencies, resulting in domestic currency appreciation. Several empirical studies have established this fact. Zettelmeyer (2004) studies this situation for Austria, Canada, and New Zealand. He finds that on average, a 100 basis point contractionary shock appreciates the currency by 2 to 3%. Using intra-day data, Kearns et al. (2006) also study the impact of monetary policy on the exchange rate in the US economy. They find that a 25 basis point monetary policy tightening will cause the dollar to appreciate by 0.35%. They further argue that the effect depends on how the tightening affects the expectations of future monetary policy. If expectations are revised by the full amount of the change in interest rates, the impact on exchange rates is higher. Khordehfrush and Tehranchian (2015) also found similar results for selected developing economies using a GMM approach. They found that expansionary monetary policy depreciates the currencies of developing countries while contractionary monetary policy appreciates the currency.

Hnatkovska et al. (2016) however discover an exchange rate puzzle. They found that unlike developed countries, contractionary monetary policy depreciates the currencies of developing countries. They identify three major channels through which monetary policy affects the exchange rate, namely: the liquidity demand effect, the

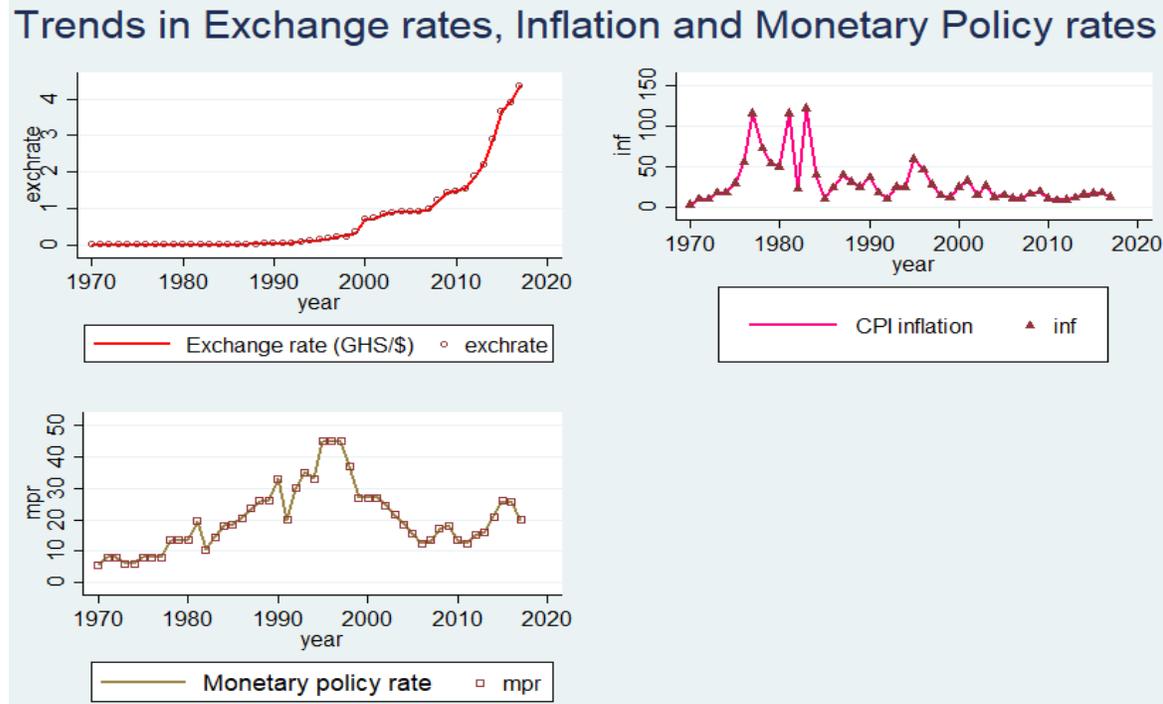
fiscal effect, and the output effect. The liquidity demand effect leads to currency appreciation in response to contractionary monetary policy while the output and fiscal effects lead to currency depreciation. They argue that for developing countries, the effect of the output and fiscal effects outweigh that of the liquidity effect, resulting in currency depreciation. They call this phenomenon the exchange rate puzzle. De Leo et al. (2017) however argue that the source of the puzzle was more empirical than theoretical. They argue that the puzzle emerged because of the failure of Hnatkovska et al. (2016) to account for responses of developing economies to business cycle shocks in the US economy. They argue that if these shocks are accounted for, the puzzle disappears. They see the exchange rate puzzle as a consequence of model misspecification.

This controversy calls for further analysis of this relationship, especially on a country basis. In this spirit, this paper will attempt to determine the short and long-run impact of monetary policy on the exchange rate, for the Ghanaian economy.

Several country-specific studies have established a significant relationship between inflation, monetary policy, and the exchange rate. The nature of the relationships is however varied across studies. Ali et al. (2015) study the impact of interest rates, inflation, and money supply on the exchange rate volatility in Pakistan using a Vector Error Correction Model (VECM), for monthly data from July-2000 to June-2009. They found that contrary to conventional thinking, higher inflation leads to the appreciation of the currency of Pakistan. Higher interest rates were also found to depreciate the currency. This goes against earlier findings of Bashir and Luqman (2014) for Pakistan. They found that high inflation depreciates the currency, using time series data from 1972 to 2013. Abbas et al. (2012) also explore the relationship between interest rates, inflation, and the exchange rate for 10 African countries for 15 years. They found positive but insignificant relationships between inflation, interest rates, and the exchange rate, using OLS estimations. Amin et al. (2018) found similar insignificant results for Bangladesh, using VECM on time series data from 1980 to 2015. Ebiringa and Anyaogu (2014) use ARDL cointegration analysis to explore the exchange rate, inflation, and interest rate relationships for Nigeria using time series data from 1971 to 2010. They found a positive relationship between inflation and the exchange rate, and a negative relationship between interest rates and the exchange rate.

Nucu (2011) also study the relationship between exchange rate and key macroeconomic variables for Romania. The results establish a direct relationship between the exchange rate, inflation, and interest rate.

The review reveals the varied nature of the relationship between inflation, monetary policy, and the exchange rates across countries. This makes it relevant to undertake a study for Ghana to understand the dynamics



**Figure 1.** Trends in exchange rate, inflation, and monetary policy.  
Source: Author's generation using data from WDI BOG.

of the effect of these variables on the exchange rate. Previous studies in this area have concentrated on the effect of exchange rates on inflation. Mahamadu and Phillip (2003) for instance, study the relationship between inflation and exchange rate for Ghana. Their empirical results show that inflation is positively related to the money supply and exchange rate. Nchor and Darkwah (2015) also study the effect of exchange rates on inflation for the Ghanaian economy, using data from 1991 to 2013. They found that in the short run, depreciation of the Ghana Cedi increases inflation. Adu et al. (2015) also found evidence of an exchange rate pass-through effect for Ghana, using quarterly data from 1980 to 2014. They further found that positive supply-side shocks appreciate the exchange rate while demand-side shocks depreciate the exchange rate.

Other macroeconomic variables such as GDP growth rates, external debts, and trade openness have been identified by other authors as significantly affecting the exchange rate. This paper will control for some of these variables.

#### Evolution of the Ghana cedi and exchange rates in Ghana

After independence in 1957, Ghana dropped the British West African pound and adopted the Ghanaian pound between 1958 to 1965. In 1965, the government adopted

the decimal system and hence changed the currency to the Cedi, which after undergoing several revisions through the years was renamed the Ghana cedi in 2007, after a re-denomination exercise which was meant to help manage the rapid depreciation of the currency.

Ghana's story with the exchange rate started with the abandonment of the British West African pound. Ghana used a fixed exchange rate regime from 1957 to 1982 in line with the Bretton Wood agreement. The cedi was fixed to the British pound up to 1966 and the American dollar up to 1982 by law. The economic liberalization of 1983, following the Economic Recovery Program and the subsequent Structural Adjustment Program, saw a slow movement of the exchange rate till 1991 when the inter-bank exchange rate system was adopted. Currently, Ghana runs a managed float system. The exchange rate is determined by the forces of demand and supply but with some level of intervention by the Bank of Ghana.

Some major events in the exchange rate history include several devaluation episodes from 1983 until 1991 when the inter-bank system was adopted. Persistent inflation significantly eroded the value of the Cedi until 2007 when the government decided to re-denominate the currency and the name was changed to the Ghana Cedi. This has however not helped much as the currency continues to depreciate significantly against the major trading currencies in the world. Figure 1 shows the trends in exchange rates, policy rates, and inflation from 1970 to 2017.

## METHODOLOGY

### Data and variable description

The data sets for the estimations are retrieved from the 2018 World Bank Development Indicators data set for Ghana and from the Bank of Ghana database. The period ranges from 1970 to 2017. This period was chosen based on data availability. The dependent variable is the exchange rate, represented by the end of the period exchange rate (Local currency per dollar). By this definition, a high value of the exchange rate implies a depreciation of the local currency while a lower value implies an appreciation. The independent variables of interest include the consumer price index which proxies for inflation and the monetary policy rate and money supply which are the tools of monetary policy. A broad measure of money is taken here. Specifically, the paper uses M2+ which is the highest monetary aggregate used by the Bank of Ghana. It is the sum of M2 and foreign currency deposits. M2+ as a percentage of GDP is used in this study. Control variables include the GDP growth rate, government consumption expenditure as a percentage of GDP, terms of trade, which is proxied by the net barter terms of trade index, and debt service on external debt as a percentage of GDP. Consumer price index, the monetary policy rate, and the money supply are obtained from the bank of Ghana database, while the rest of the variables are obtained from the 2018 Word Development Indicators database.

By way of prior expectations, inflation is expected to have a positive relationship with the exchange rate as the conventional economic theory stipulates. The monetary policy rate is expected to have a negative effect on the exchange while the money supply is expected to have a positive effect. GDP growth rate and the terms of trade index are expected to have a negative effect on the exchange rate, while government expenditure and debt servicing are expected to have a positive effect.

### Estimation technique

To determine the long and short-run effects of monetary policy and inflation on the exchange rate, the paper uses the ARDL model and Bounds testing of cointegration, espoused by Pesaran et al. (2001). The advantage of this technique is that it works with a combination of I(0) and I(1) integrated processes, unlike the Vector Error Correction which requires that all the series be I(1). Hence the long-run relationships can be accurately estimated irrespective of the order of integration, as long as no series is I(2). Also, since the ARDL model ensures that each underlying variable stands as a single equation, the problem of endogeneity is managed well (Nkoro and Uko, 2016). However, before the ARDL model can be used, preliminary tests such as stationarity need to be conducted to ensure that no variable is I(2), and the determination of the appropriate number of lags required for the model. The bounds test of cointegration then has to be conducted to determine the existence of long-run relationships. The error correction model will then be estimated to determine the short-run dynamics of the model. For the results to be valid, the model must pass diagnostic tests of heteroscedasticity, autocorrelation, and model stability.

The general form of the model is specified as:

$$exch = f(mpr, cpi, gdp, tot, gxp, dse, ms) \quad (1)$$

The specific form of the model is written as:

$$lnexch_t = \beta_0 + \beta_1 lnmpi + \beta_2 lncpi + \beta_3 lngdp + \beta_4 lntot + \beta_5 lngxp + \beta_6 lndse + \beta_7 lnms + \varepsilon_t \quad (2)$$

where  $lnexch$  is the log of the exchange rate,  $lnmpr$  is the log of the

monetary policy rate,  $lncpi$  is the log of CPI,  $lngdp$  is GDP growth rate,  $lntot$  is the log of terms of trade,  $lngxp$  is the log of government consumption expenditure (% of GDP),  $lndse$  is the log of debt service on external debt (% of GDP) and  $lnms$  is the log of M2+ as a percentage of GDP.  $\beta_0$  is the intercept and  $\beta_1, \beta_2, \dots, \beta_7$  are the respective coefficients.  $\varepsilon_t$  is the random error term.

### Test of stationarity

Nkoro and Uko (2016) define a non-stationary series as a stochastic process that contains unit roots or structural breaks. A time series is non-stationary if it has a time-varying mean and variance (Gujarati and Porter, 2009). To run an ARDL model, the order of integration of the various series used is very important. As stated earlier, no variable should be an I(2) series. For this paper, the Augmented Dickey-Fuller test is used to determine the stationarity of the variables. The ADF test is a test of the presence of unit root in a series. This test is better than the standard Dickey-Fuller test because it is still valid even if the errors are correlated. The general ADF test model is stated as:

$$\Delta Y_t = \gamma_0 + \rho_1 Y_{t-1} + \sum_{i=1}^n \gamma_i \Delta Y_{t-i} + \mu_i \quad (3)$$

where  $\Delta$  is the difference operator. The null hypothesis of the test is that the series contains a unit root process. This is the same as saying  $\rho_1 = 0$ . Failure to reject the null hypothesis means the series is non-stationary. This test will be conducted on all the variables in the model. The Phillip-Perron test will be used as a further check on stationarity.

### ARDL bounds test of cointegration

Cointegration tests are necessary for the establishment of long-run relationships between variables. This idea was formalized by Granger (1981) and Engle and Granger (1987). The presence of cointegration provides the statistical basis on which an error correction model can be run. The error correction model provides both the short and long-run dynamics of the relationships between the variables. The ARDL bounds test of cointegration, attributable to Pesaran et al. (2001) will be used in this paper. This technique is used because of several advantages it has over other conventional Johanson cointegration tests. First, it does not require any unit root pre-testing and also allows for various variables to have different optimal lags (Ozturk and Acaravci, 2010). The ARDL model is specified as:

$$\Delta lnexch_t = \alpha + \sum_{j=1}^n b_j \Delta lnexch_{t-j} + \sum_{j=1}^n c_{ij} \Delta X_{(t-j)} + \gamma_1 lnexch_{t-1} + \beta_i X_{t-1} + \mu_t \quad (4)$$

$i, t, j = 1, 2, \dots, n$ ;  $i$  = coefficient number;  $j$  = lag number; and  $t$  = time period. Where  $\mathbf{X}$  is the vector that represents the set of independent variables listed in Equation 2. The short-run parameters are represented by  $\mathbf{c}_{ij}$  while the long-run parameters are represented by  $\beta_i$  and  $\Delta$  is the difference parameter.

The bounds test of cointegration conducts a joint significance test of all the long-run parameters. The null hypothesis, therefore, is that there exist no long-run relationships. Pesaran et al. (2001) provide

a set of critical values for I(0) and I(1) variables. The I(0) critical bounds assume that all the variables are I(0) or in other words, there is no cointegration and the I(1) critical bounds assume that all the variables are I(1), suggesting the presence of cointegration. The updated test computes the critical values and the p-values according to Kripfganz and Schneider (2018). The null hypothesis is rejected if the F-statistic is more extreme than the critical values for the I(1) bounds.

**Error correction model**

If the bounds test establishes the existence of cointegration in the model, the ARDL model is re-parameterized into an error correction model that espouses the long-run and short-run relationships. Equations 5 and 6 show the long-run and short-run ECM equations respectively.

$$lnexch_t = \alpha_0 + \gamma_1 lnexch_{t-1} + X_{t-1}\beta + \mu_t \quad (5)$$

$$\Delta lnexch_t = \sum_{j=1}^n b_j \Delta lnexch_{t-j} + \sum_{j=1}^n c_{ij} \Delta X_{(t-j)} + \varphi ECT_{t-1} + \epsilon_t \quad (6)$$

The error correction term  $ECT_{t-1}$  is the error correction term. Its coefficient ( $\varphi$ ) represents how much of deviations away from the long-run results are corrected each period. The coefficient is expected to be negative and statistically significant.

For the results to be valid, the model must be free from heteroscedasticity and autocorrelation. The models must also be dynamically stable. A heteroscedasticity test will be conducted using White’s test. The Breusch-Godfrey test will also be used to test for autocorrelation. The CUSUM and CUSUM squared graphs will be used to determine if the model is dynamically stable.

**Causality tests**

The paper also seeks to determine the direction of causality between the exchange rate, inflation, and the monetary policy variables used in the model. This follows from the findings from the literature. Most authors for instance have focused on the impact of the exchange rate on inflation rather than the direction of causality taken by this paper. The goal here will be to determine if such long-run reverse causation between these variables exist in the Ghanaian economy.

The paper will resort to the approach of Toda and Yamamoto (1995) in estimating long-run causality between time series variables. It is noted generally that the use of conventional Granger (1969) causality tests among cointegrated series may end up in spurious results (Aziz et al., 2000). Toda and Yamamoto (1995) argue that the F-statistic of the Granger causality test may not be valid since its distribution is not standard when the series are cointegrated. The Toda and Yamamoto (1995) test is applied to level VARS irrespective of whether they are cointegrated or not. The test procedure involves the estimation of an augmented VAR ( $p + d$ ) model. Where  $p$  is the optimal lag length for the original VAR and  $d$  is the maximum order of integration of the variables. The test involves two basic stages. The first stage involves the determination of the maximum order of integration  $d$  and the optimal lag length of the VAR. For this paper, the Akaike Information Criteria (AIC) is used to determine the optimal lag length. The second stage involves the estimation of the VAR ( $p + d$ ) system and conducting the relevant tests of causality.

Concentrating on only the main variables of interest in this paper, the Toda and Yamamoto (1995) test equations, in line with Seabra et al. (2005) are presented as:

$$lnexch = \sum_{i=1}^{k+d} \alpha_{1i} lnexch_{t-1} + \sum_{i=1}^{k+d} \beta_{1i} lncpi_{t-1} + \sum_{i=1}^{k+d} \phi_{1i} lnmpr_{t-1} + \sum_{i=1}^{k+d} \varphi_{1i} lnms_{t-1} + u_{1i} \quad (7)$$

$$lncpi = \sum_{i=1}^{k+d} \beta_{1i} lncpi_{t-1} + \sum_{i=1}^{k+d} \alpha_{1i} lnexch_{t-1} + \sum_{i=1}^{k+d} \phi_{1i} lnmpr_{t-1} + \sum_{i=1}^{k+d} \varphi_{1i} lnms_{t-1} + u_{1i} \quad (8)$$

$$lnmpr = \sum_{i=1}^{k+d} \phi_{1i} lnmpr_{t-1} + \sum_{i=1}^{k+d} \alpha_{1i} lnexch_{t-1} + \sum_{i=1}^{k+d} \beta_{1i} lncpi_{t-1} + \sum_{i=1}^{k+d} \varphi_{1i} lnms_{t-1} + u_{1i} \quad (9)$$

$$lnms = \sum_{i=1}^{k+d} \varphi_{1i} lnms_{t-1} + \sum_{i=1}^{k+d} \alpha_{1i} lnexch_{t-1} + \sum_{i=1}^{k+d} \beta_{1i} lncpi_{t-1} + \sum_{i=1}^{k+d} \phi_{1i} lnmpr_{t-1} + u_{1i} \quad (10)$$

Out of these estimations, the various direction of causality can be tested using a Wald test. The test and the various null hypothesis are presented in Table 6 in the analysis. The null hypothesis is rejected when the p-value of the test statistic is less than the chosen level of significance.

**ESTIMATION RESULTS AND DISCUSSION**

**Summary statistics**

Summary statistics of the variables used in the model are presented in Table 1. Exchange rates had a mean value of 0.687 and a standard deviation of 1.093. Monetary policy rate averaged 20.198% with a variance of 10.307. Money supply, proxied by M2+ as a percentage of GDP averaged about 23.433% over the period. The CPI has averaged 37.18 over the entire period with a variance of 59.257. It can be inferred that that inflation has been very volatile over the period.

The exchange rate has a negative correlation with the monetary policy rate as expected. It suggests that high policy rates go with currency appreciation and lower policy rates go with currency depreciation. The exchange rate also has a positive correlation with the money supply. These correlations reflect the conventional idea that expansionary monetary policy goes with currency depreciation while a contractionary monetary policy goes with currency appreciation. The correlation matrix generally shows low levels of correlations. Exceptions are the correlation between exchange rate and CPI which is expected. Most of the goods that are captured in the CPI basket are imported and hence are affected by exchange rate fluctuations. Since the exchange rate is the dependent variable, this does not pose a problem in terms of multicollinearity. Debt service and monetary

**Table 1.** Descriptive statistics and correlation matrix.

Variable	Mean	Std Dev	Min	Max	1	2	3	4	5	6	7	8
Exchange rate(GHS/\$)	0.687	1.093	0.001	4.351	1.000							
Monetary policy rate	20.198	10.309	5.5	45	-0.081	1.000						
Consumer Price index	37.818	59.279	0.002	232.257	0.99	-0.1260	1.000					
M2+ (% of GDP)	23.422	5.707	12.577	36.77	0.339	-0.247	0.348	1.000				
Terms of Trade index	145.097	39.088	89.216	215	0.300	-0.666	0.337	0.322	1.000			
Gov't Con. Exp. (% of GDP)	10.633	2.077	5.861	15.308	-0.154	0.229	-0.159	0.322	-0.092	1.000		
Debt serv. on External debt (% of GDP)	3.908	2.570	0.890	10.498	-0.285	0.728	0.-0.348	-0.368	-0.647	0.159	1.000	
GDP growth rate	1.568	4.688	-14.455	12.424	0.477	0.168	0.512	0.174	-0.102	0.112	-0.021	1.000

**Table 2.** Test of Stationarity.

Variable	Augmented Dickey-Fuller		Phillip Perron		Order
	Levels	First Difference	Levels	First Difference	
lnexch	-0.709	-4.764***	-0.911	-6.221***	I(1)
lnmpr	-1.810	-4.702***	-2.305	-7.899***	I(1)
lnpci	-2.885*	-	-3.046**	-	I(0)
lnatot	-1.515	-5.886***	-1.669	-8.257***	I(1)
gdpgrowth	-3.398**	-	-4.176***	-	I(0)
lnmse	-1.674	-4.656***	-1.718	-6.762***	I(1)
lnexp	-3.071**	-	-3.45**	-	I(0)
lnms	-2.029	-4.479***	-1.987	-6.07**	I(1)

\*\*\*Significance at 5%; \*\*Significance at 1%.

policy rate also record a correlation of 0.728 which is relatively high.

### Stationarity test results

As stated earlier, the stationarity test of the various variables used in the model is done using the Augmented Dickey-Fuller test. The Phillip-Perron test is also used to further confirm the

results of the ADF test. The results are presented in Table 2. Log of exchange rates, the log of the monetary policy rate, log of terms of trade, log of debt servicing, and log of money supply are stationary at first difference while log of the consumer price index, log of government expenditure and GDP growth rate are stationary at levels.

The mix of I(0) and I(1) integration orders of the variables necessitate the use of the ARDL model.

### Bounds test of cointegration results

Before the ARDL Bounds test of cointegration is run, it is necessary to determine the optimal number of lags that are necessary for the model. The Akaike Information Criterion and the Hannan and Quinn Information Criterion (HQIC) suggest optimal lags of 3 while the Schwarz's Bayesian information criterion suggests 1 lag. I choose a maximum lag order of 2 for this paper. The optimal

**Table 3.** Pesaran et al. (2001) bounds test results.

Critical value	10%		5%		1%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F	2.223	3.644	2.681	4.295	3.781	5.870
t	-2.446	-4.067	-2.821	-4.534	-3.589	-5.493

Test results	Values	P-values	
		I(0)	I(1)
F	8.549	0.000	0.001
t	-4.217	0.002	0.081

lag selection results are presented in Table 3. The Bounds test of cointegration results is conducted on the ARDL model of order ARDL(2,1,1,1,1,1,1,1). The results are presented in Table 3. From the table, the F-statistic of 8.549 is more extreme than the critical I(1) bounds. This implies that there is cointegration among the variables. In other words, there exist long-run relationships among the variables. This then allows for the estimation of the error correction model which provides the long-run results as well as the short-run adjustments.

### Long-run and error correction results

The results for the Long-run and the short-run error correction model are provided in Table 4. From the table, the error correction term is -0.529 and statistically significant at 1%. This implies that 52.9% of any disequilibrium in exchange rates in the current period is corrected in the next period. The model reflects a slow rate of convergence to the long-run equilibrium. The short-run results show that the monetary policy rate, the terms of trade index, debt-servicing, money supply, and GDP growth rate have a significant effect on the exchange rate. The monetary policy rate has a positive short-run effect on the exchange rate. Other variables held constant, a 1% increase in the monetary policy rate increases the exchange rate by 0.805%. This result confirms the existence of an exchange rate puzzle in the short-run. Contractionary monetary policy, depicted by higher policy rates, result in the depreciation of the currency<sup>1</sup>, ceteris paribus.

This is further confirmed by the short-run coefficient of the money supply. The money supply is found to have a negative effect on exchange rates in the short run. A 1% decrease in the money supply results in a 0.653% increase in the exchange rate. This implies that ceteris

paribus, a contractionary monetary policy or a reduction in money supply lead to a depreciation of the currency.

The long-run results however show a negative relationship between monetary policy and exchange rate as expected conventionally. A 1% increase in the policy rate reduces the exchange rate by 0.825% in the long-run ceteris paribus. This implies that contractionary monetary policy in the long-run will appreciate the currency while an expansionary monetary policy will depreciate the currency. This result is further supported by the long-run coefficient of the money supply. The money supply shows a positive relationship with the exchange rate in the long run. A 1% increase in the money supply results in a 1.288% depreciation of the Ghana cedi. This is significant at 5%. This implies that irrespective of the monetary policy tool adopted, the long-run effect of expansionary monetary policy is a depreciation of the local currency.

Inflation, proxied by the log of CPI is found to have a negative effect on the exchange rate in the short-run and a positive effect in the and long run. The short-run result is however statistically insignificant. The long-run results show that a 1% increase in the price level will depreciate the cedi by 0.988%. This implies that in the short-run, higher inflation may not have a significant effect on the exchange rate. However, in the long-run, higher inflation depreciates the currency. Terms of trade are found to have a very strong effect on the exchange rate both in the short and long-run. The short-run effect is positive while the long-run effect is negative. The negative sign of the long-run coefficient is as expected. A 1% increase in the terms of trade index reduces the exchange rate by 2.285%. Higher terms of trade imply a rise in the value of exports. This implies that export demand is high and hence, the local currency appreciates. The coefficient is significant at 1%. The positive sign of the short-run coefficient is against prior expectations. The short-run results show that a 1% increase in the terms of trade depreciates the cedi by 1.475%. This relationship, though unexpected is possible. This is especially true when the factors driving the rise in export value are not related to the demand for exports, but due to other factors such as

<sup>1</sup>Per the definition of the exchange rate, a higher value implies a depreciation of the local currency

**Table 4.** Long-run and error correction results.

Variable	(1)	(2)	(3)
	ADJ	LR	SR
LD.Inexch	-	-	-0.0584 (0.109)
D.Inmpr	-	-	0.805*** (0.222)
D.Incpi	-	-	-0.349 (0.509)
D.Intot	-	-	1.475*** (0.343)
D.Ingxp	-	-	0.128 (0.277)
D.Indse	-	-	0.289** (0.132)
D.Inms	-	-	-0.653* (0.380)
D.gdpg	-	-	0.023* (0.0122)
Inmpr	-	-0.825* (0.464)	-
Incpi	-	0.988*** (0.0702)	-
Intot	-	-2.285*** (0.726)	-
Ingxp	-	-1.211 (0.783)	-
Indse	-	0.616** (0.232)	-
Inms	-	1.288** (0.524)	-
gdpg	-	0.069* (0.0346)	-
L.Inexch	-0.529*** (0.125)	-	-
Constant	-	-	4.117** (1.996)
Observations	42	42	42
R-squared	0.827	0.827	0.827

\*\*\*p<0.01, \*\*p<0.05, \*p<0.1; Standard errors in parentheses.

**Table 5.** Diagnostic tests.

Test	Hypothesis	Test-statistic	p-value	Decision
Heteroscedasticity	Ho: Homoskedasticity	Chisq = 42.000	0.427	Homoskedasticity
Autocorrelation	Ho: No serial correlation	Chisq=2.258	0.132	No serial correlation
Model Stability	Ho: Model is dynamically stable	CUSUM and CUSUMSQ graphs lie with the 5% critical bounds		

the higher cost of production. In cases like these, higher terms of trade will reflect higher prices rather than a rise in export demand. This scenario has a tendency to depreciate the currency.

Government spending was found to have a negative effect on exchange rates in the long-run, while the short-run effect is positive. Both coefficients are however not statistically significant. Debt service on external debt also has a depreciating effect on the exchange rate in the long- run and short-run as expected. In the short-run, a 1% increase in debt-servicing depreciates the cedi by 0.289%. The long-run effect is stronger with a 0.616% depreciation, *ceteris paribus*<sup>2</sup>.

They are both significant at 5%. GDP growth rate is also found to have a positive effect on the exchange rate in both the short and long-run. A 1% point increase in the GDP growth rate depreciates the cedi by about 2.33% in

the short-run and by 6.86% in the long-run. Both coefficients are significant at the 10% level. This finding is against prior expectations.

### Diagnostic tests results

To ascertain the validity of the results, tests for autocorrelation, heteroskedasticity, and stability must be conducted. The White's test of heteroskedasticity and the Breush-Godfrey test of autocorrelation is used. The stability test is conducted using the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) attributable to Brown et al. (1975). These tests are general tests of structural breaks and do not require a prior determination of where the structural breaks occur (Ozturk and Acaravci, 2010).

The results and conclusions are presented in Table 5. Figure 2 presents the CUSUM and CUSUM square graphs. The results show that the error variance is homoscedastic, the errors are not autocorrelated

<sup>2</sup>Higher debt service implies higher demand for foreign currency which results in the depreciation of the local currency

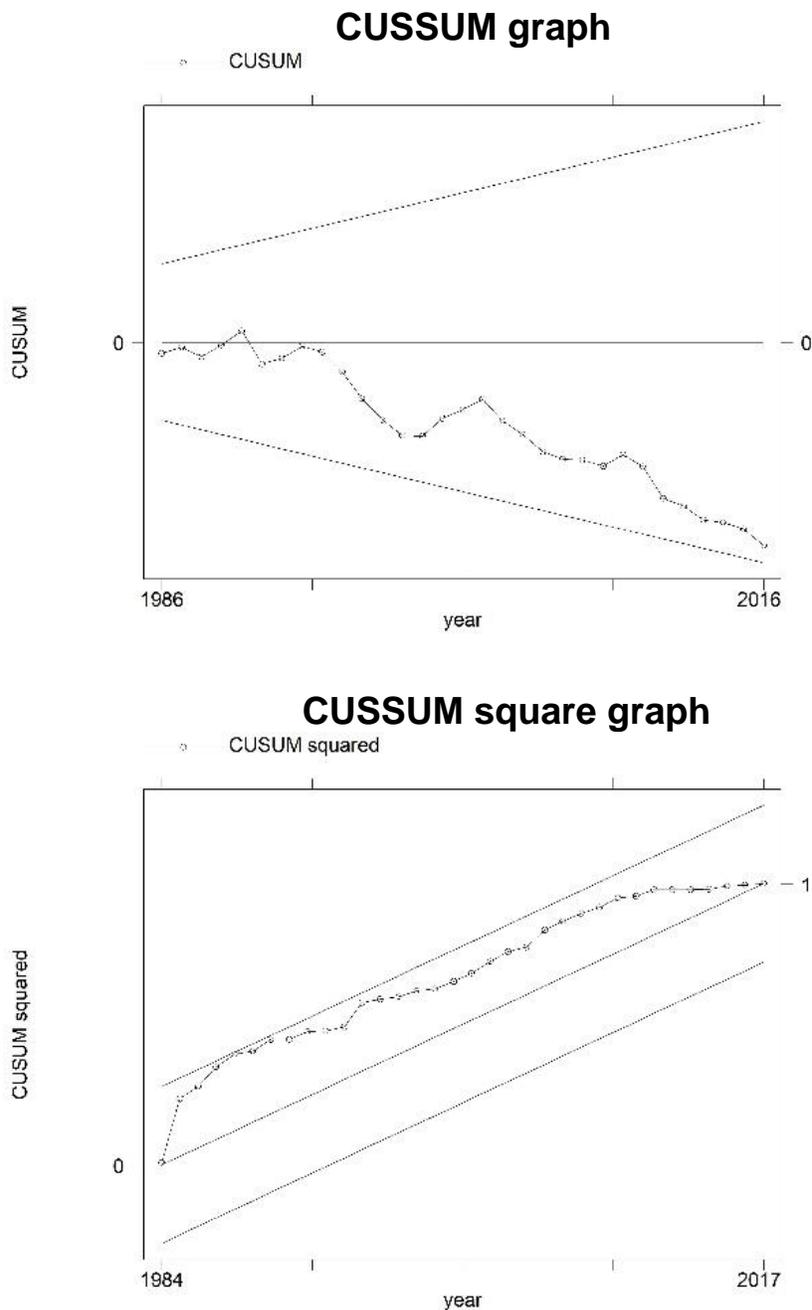


Figure 2. CUSSUM Graphs: test for stability

and the model is dynamically stable.

**Causality test results**

To further determine the validity of the long-run model, a levels causality test is conducted between the main variables of interest in the model. The Toda and Yamamoto (1995) procedure is used in this paper. The

optimal lag length for the VAR,  $p$  according to the Akaike Information Criterion (AIC), Hannan and Quinn Information Criterion (HQIC) and Schwartz-Bayes Information Criterion (SBIC) is one. The variables  $lnexch$ ,  $lnmpr$ , and  $lnm2p$  are all  $I(1)$  while  $ln CPI$  is  $I(0)$ . Therefore, the maximum order of integration,  $d$  is 1. A VAR(2) is therefore run. The test results are presented in Table 6.

The results show that both the money supply, the policy rate, and inflation Granger cause the exchange rate, as

**Table 6.** Toda and Yamamoto (1995) Augmented Granger causality test.

Null hypothesis	Wald-test statistic	P-value
Lncpi does not Granger cause Lnexch	28.450***	0.000
Lnexch does not Granger cause Lncpi	19.130***	0.000
Lnmpr does not Granger cause Lnexch	13.630***	0.001
Lnexch does not Granger cause Lnmpr	3.730	0.155
Lnms does not Granger cause Lnexch	6.010*	0.074
Lnexch does not Granger cause Lnms	3.490	0.322
Lncpi does not Granger cause Lnmpr	0.630	0.730
Lnmpr does not Granger cause Lncpi	9.660***	0.008
Lnms does not Granger cause Lncpi	15.650***	0.000
Lncpi does not Granger cause Lnms	11.180**	0.004
Lnmpr does not Granger cause Lnms	3.880	0.144
Lnms does not Granger cause Lnmpr	1.320	0.517

\*\*\*Significance at 1%; \*\*significance at 5%; \*significance 10%.

expected. However, there is bi-directional causality between exchange rate and CPI. Several studies have focused on the effect of exchange rate on inflation and have found that higher exchange rates lead to higher inflation. Monfared and Akin (2017) and Osabuohien et al. (2018) found this positive effect for Iran and Nigeria, respectively. Much care must, therefore, be taken in exploiting the relationship between these two variables.

The monetary policy rate is found to Granger cause inflation. There however appears to be a bi-directional relationship between money supply and inflation. The money supply is expected to Granger cause inflation. However, CPI is not expected to Granger cause money supply. The finding of a bi-directional relationship is therefore unexpected and presents an empirical relationship that can be further explored. There appears to be no causality between money supply and the monetary policy rate. As required for the validity of the results, the VAR is free off autocorrelation.

## Conclusions

The recent persistent depreciation of the Ghana cedi has stirred up a discussion on the factors responsible for this phenomenon. Popular among the culprits have been inflation and monetary policy. The study, therefore, centered on the impact of inflation and monetary policy on the exchange rate. Additionally, this study sought to determine the direction of causality between inflation, exchange rates, and monetary policy. The main goal is to understand the dynamics of the relationship between these variables as a basis for policy formulation and implementation. A data set covering the period 1970 to 2017, compiled from the WDI database and the Bank of Ghana database was used. The study used the end-of-period exchange rate as the dependent variable. The

consumer price index (CPI) was used as a measure of inflation. The monetary policy rate and the money supply (broadly defined) as a percentage of GDP, were the main monetary policy tools used. Other variables such as GDP growth, terms of trade, government expenditure, and debt servicing were controlled for. The paper adopted an ARDL model and Bounds test of cointegration to explore the long-run and short-run dynamics of the relationships. The augmented Granger causality test by Toda and Yamamoto (1995) was used to perform a long-run causality test.

The results established a long-run depreciating effect of contractionary monetary policy on the local currency, irrespective of the tool of monetary policy used. Inflation is also found to depreciate the currency in the long-run as expected. Terms of trade and government expenditure were found to have an appreciating effect on the currency while the GDP growth rate depreciates the currency in the long-run.

The error correction term also showed a very high rate of adjustment towards the long-run equilibrium. The short-run model reveals that the lag-value of exchange rates has a positive and significant effect on the exchange rate. The results also showed a positive short-run relationship between the policy rate and the exchange rate. This result is against prior expectations and reflects the presence of an exchange rate puzzle in the short-run. Terms of trade are also found to have a short-run positive effect on the exchange rate.

The causality test results confirm that inflation and monetary policy indeed affect the exchange rate. It also reveals bi-directional relationships between inflation and exchange rates. Similar bi-directional relationships were found between inflation and money supply.

The results lead to the conclusion that rising inflation contributes to the depreciation of the local currency in Ghana. Both the long and short-run effects are

consistent, although the latter was not statistically significant. It can also be inferred that contractionary monetary policy appreciates the currency in the long-run. The short-run effect was however the opposite. Contractionary monetary policy tends to depreciate the currency in the short-run. The exchange rate puzzle espoused by Hnatkovska et al. (2016) is confirmed to exist in Ghana in the short-run.

The implication of this is that the bank of Ghana should act more carefully in attempting to use monetary policy to stabilize the exchange rate in the short-run.

## POLICY RECOMMENDATIONS

Based on the findings in this paper the following recommendations were made:

(1) Inflation stabilization should be given more attention in an attempt to stabilize the exchange rate. Measures put in place to stabilize the inflation rate will contribute to stabilizing the exchange rates. The discovery of a bi-directional relationship between these two variables also implies that more research should be conducted into the dynamics of the relationship between these variables to better inform policymaking.

(2) Contractionary monetary policy is also found to depreciate the local currency in the short-run. The use of monetary policy as a tool to stabilize the exchange rate should, therefore, be done with caution.

(3) Terms of trade were found to have the strongest impact on exchange rates both in the short and long run. Therefore, efforts should be made to improve the value of Ghana's exports. This will help stabilize the exchange rates.

## CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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*Full Length Research Paper*

# **Financial sector readiness to support economic activities under COVID-19: The case of African continent**

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Received 5 August, 2020; Accepted 28 August, 2020

**Organizational readiness for change is considered a critical precursor to the successful implementation of complex changes. Indeed, some suggest that failure to establish sufficient readiness accounts for one-half of all unsuccessful, large-scale organizational change efforts. The African economy and the world at large are at brink of economic depression as result of devastating effect of COVID-19. However, it is equally important to determine the readiness of countries to absorb the economic shock of the pandemic. Using the model by Battese and Coelli (1995), the translog production frontier was adopted to estimate technical efficiency of the financial sector of the continent. The 24 countries selected in Africa were based on the availability of data to cover our variables of interest for period 2000 to 2018. The findings were that financial sector in the continent have performed above average (72%) over the period of study and hence they are slightly ready to support ailing economy. Also lower middle income countries are relatively going to have more problems with pandemic. However, the probability of the continent not plunging into economic depression with the support of the financial sector is 0.42 which is not encouraging. It is recommended that policies to address interest rate margin, liquidity and market concentration should be managed properly to improve technical efficiency of the financial sectors on the continent.**

**Key words:** Africa, COVID-19, financial sector, technical efficiency, translog production frontier.

## **INTRODUCTION**

Readiness is the state of preparedness of organizations to meet a situation and carry out a planned sequence of actions. Organizational readiness for change is considered a critical precursor to the successful implementation of complex changes. Indeed, some suggest that failure to establish sufficient readiness accounts for one-half of all unsuccessful, large-scale organizational change efforts. Drawing on Lewin's three-

stage model of change, change management experts have prescribed various strategies to create readiness by 'unfreezing' existing mindsets and creating motivation for change. These strategies include highlighting the discrepancy between current and desired performance levels, fomenting dissatisfaction with the status quo, creating an appealing vision of a future state of affairs, and fostering confidence that this future state can be

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achieved.

Future economic environment is very difficult to predict hence it is contingent on every economy to efficiently utilize its resources. For this reason countries or firms always have to strive to make the best out of the available resources so as to be able to weather the storm in future. A country or firm that has been performing in the past always stands the chance to support their economy when the need arises. During economic depression, countries that over the years have been doing well are always in better position to give stimulus packages to support livelihood and also to bring the economy back on track on time. For this reason the readiness of an economy to fight economic depression depends on the efficiency of the economy over the years. Efficient economies are able to save enough to cover unforeseen contingencies.

In the 80's most emerging economies through directives from International Monetary Fund were taken through different forms of Financial Sector Adjustment Program (FINSAP). The objective was to address the institutional deficiencies of the financial system, and developing money and capital markets (Brownbridge and Gockel, 1996). According to Bikker (2010) banks contribute to investments, employment creation and the process of economic growth and development. They are the corner stone of an economy of a given nation (Omankhanlen, 2012; Athanasoglou et al., 2006; Sergeant, 2001). However, the continent Africa is always referred to as low income or developing countries. Since the mid-1990s, this continent have seen steady economic growth but struggled to sustain that development. United Nations Economic Commission for Africa (UNECA) is predicting a fall in the growth rate from 3.2 to 1.8% for emerging due to the novel virus COVID-19 (IMF, 2020).. The existence of a solid and efficient financial system is a crucial condition for a sustainable economic growth for the continent Africa.

The pandemic has posed a major disruption to economic activity across the world. It is estimated by World Bank that economic growth in sub-Saharan Africa will decline from 2.4% in 2019 to -2.1 to -5.1% in 2020, the first recession in the region in 25 years. Even though events on the coronavirus pandemic are still unfolding, a preliminary analysis of the impact of the coronavirus menace on the real sector for most countries if not all shows that the 2020 projected real GDP growth rate could decline significantly (AUC, 2020).

It is also stated that the effect will also depend on how countries India, China, the USA will perform or deal with the crisis. However, it is equally important to determine the readiness of countries to absorb the economic shock of the pandemic.

According to WHO as at 4th August, the situation by WHO regions were Americas 9,741,727, Europe 3,425,017, South-East Asia 2,242,656, Eastern Mediterranean 1,574,551, Africa 825,272 and Western

Pacific 332,754. This is an indicative that relatively African is not had hit by the virus but it is a novel virus. On 17 April, the World Health Organization (WHO) warned that Africa could be the next epicentre of the Coronavirus. It worth noting that South Africa is fifth country in the world with the highest cases of COVID-19. Bloomberg estimates that in a pandemic situation, Covid-19 could cost the world economy \$2.7 trillion Equivalent to UK's economy. This implies that if developing countries and emerging economics will be significantly impacted without support. However, the global financial crisis in 2008 also did not spear emerging economies. Every single person on the continent must exercise the highest level of self-discipline which is evidently clear in the economic numbers. The greater the level of self-discipline and civic responsibility the greater chances of avoiding mass job losses and its concomitant hardships.

According to African for Center Economic Transformation (ACET), the continent needs growth with diversification, export competitiveness, productivity increases, technological upgrading and improve human well-being (DEPTH). To achieve DEPTH requires mobilization of savings and channeling of financial resources to seekers of loan (Gulde et al., 2006). In this era of COVID-19 the efficiency of the financial sector becomes more pronounced when it comes to economic development of the continent. The financial sector is crucial to the economies of various countries, and banks remain a core of the sector, especially in emerging economies where the capital market is not strong enough (Matthew and Laryea, 2012). Delis and Papanikolaou (2009) indicated that an efficient financial sector will be better able to withstand negative shocks and contribute to the stability of the financial system. Thus, it is crucial to analyze the efficiency performance of banks and the factors behind their efficiency performance.

This article seeks to determine the readiness of financial sector on the continent Africa to surpass the effect of COVID-19. To be precise on how market concentration, market liquidity and net interest margin account for efficiency of the sector. The main objective of our study is to identify the determinants of the technical efficiency. This is because what happens in the financial sector has impact on the productive capacity of the nation's economy. Relieves and grants from World Bank, IMF, governments and other organizations and associations to members and various economic sectors will be implemented through the financial sector of various countries and hence the need for the sector to be relatively efficient in their activities with their stakeholders to get value for money.

## LITERATURE REVIEW

### Economic impact of COVID-19

The COVID-19 pandemic thus poses important risks, not

only for people's health but also for their economic wellbeing. Already disadvantaged groups will suffer disproportionately from the adverse effects. Low-income earners, especially informal workers, who earn a living on a day-to-day basis and have limited or no access to healthcare or social safety nets, are severely hit.

Informal sector businesses are like any other businesses. With COVID-19 bringing transportation and market demand to a halt, informal sector businesses, such as drinking and chop bars, small retail shops, hairdressers, and taxi drivers will see a reduction in customers because of the pandemic and they form the majority Africa.

Africa's GDP growth at 2019 was 3.6%. This is not sufficient to accelerate economic and social progress and reduce poverty. Since 2000, Africa's GDP growth has largely been driven by domestic demand (69% of the total), rather than increases in productivity. Africa's labour productivity as a percentage of the US level stagnated between 2000 and 2018, and the Africa-to-Asia labour productivity ratio has decreased from 67% in 2000 to 50% today (AUC, 2020; OECD, 2020). Global markets account for 88% of Africa's exports, mostly in oil, mineral resources and agricultural commodities.

At the onset of the crisis, prospects differed across economies. Some were displaying high growth-rates, in excess of 7.5% (Rwanda, Côte d'Ivoire and Ethiopia), but Africa's largest economies had slowed down. In Nigeria (GDP growth of 2.3%), the non-oil sector has been sluggish, in Angola (-0.3%) the oil sector remained weak, while in South Africa (0.9%) low investment sentiment weighed on economic activity.

In response to the pandemic, most countries in the continent have come up with relief packages to support businesses and individuals. Côte d'Ivoire, Ethiopia, Nigeria, Senegal and Uganda are spending CFAF 96 billion, USD 1.64 billion, N 500 billion, CFAF 1 000 billion and USD 7 million respectively to support their economy. In the case of South Africa the government is assisting companies and workers facing distress through the Unemployment Insurance Fund (UIF) and special programmes from the Industrial Development Corporation. A new 6-month COVID-19 grant is also created to cover unemployed workers that do not receive grants or UIF benefits and the number of food parcels for distribution was increased. Funds are available to assist SMEs under stress.

### **Liquidity and technical efficiency**

Liquidity plays a central role in its successfully functioning as a profitable firm. Liquidity has major importance to both shareholders and potential investors. The goal of liquidity management should be to enable a firm to maximize profits of its operations while meeting both short term debt and upcoming operational expenses, that is, to preserve liquidity (Panigrahi, 2014). Excessive

investments in liquidity may lead managers to make investments towards maximizing their own utility, thus to the detriment of profitability (Fama and Jensen, 1983). Ensuring adequate liquidity is essential in banking operations because of the financial intermediation role of banks. This intermediation role of banks exposes them to an inherent liquidity risk, which can have dire consequences on the banks' earnings and solvency (Berger and Bouwman, 2009). The ability to meeting obligations as and when they fall due is an important determinant of bank efficiency. Literature on banking failures has provided sufficient evidence showing that undue liquidity shortage has a predominant impact on the efficiency and solvency of banks. This determinant, called liquidity is measured by the ratio of loans to assets. The lower the variable (ratio) the higher the bank's liquidity and the vice versa. The article expects liquidity to have a positive impact on the efficiency of banks (Nassreddine et al., 2013). Tochkov and Nenovsky (2009) also revealed that liquidity has positive effect on financial sector efficiency.

### **Market concentration and technical efficiency**

Market concentration is an important indicator to define the bank sector stability in financial terms. Shim (2019) examines the effect of loan portfolio, market concentration on the bank's financial stability. He has investigated the effect of loan diversification and concentration factor in banking market. Findings of the study explains that factor of market concentration is negatively associated to financial strength of the banks. Additionally, those banking firms which are operating in more diversified situation and highly concentrated markets are more stable, comparatively to those which are dealing under less concentrated market. Some of the other studies have provided their limited contribution in the literature for market concentration and financial stability in banking sector (Ghosh, et al., 2018; Syadullah, 2018; Cheng et al., 2018; Omodero and Ogonnaya, 2018; Hallunovi and Berdo, 2018; Elkhayat and ElBannan, 2018). The article proxy market concentration with HHI because it is better than market shares of the big three (CR3) banks or five banks (CR5). This is a good proxy because it reflects the degree of market share inequality across the different banks in the banking industry (Schumann, 2011). This article expected that highly concentrated markets will lower the cost of collusion and foster tacit and/or explicit collusion on the part of banks; hence, all banks in the market earn monopoly rents. The range of this variable is within the ranges from zero to one, where large number of banks, each with a small share, produces an HHI close to zero, while a single monopolist bank with a 100% share produces an HHI of one. Koutsomanoli-Filippaki et al. (2009) and Brissimis et al. (2008) findings also suggest

strong links of competition and concentration with bank efficiency while credit risk have negative effect on efficiency.

### Interest margin and technical efficiency

Seelanatha (2012) evaluated the drivers of Technical Efficiency with different approaches and the conclusion was that gross interest margin has positive impact of technical efficiency. However, Řepková (2015) evaluated the banking efficiency determinants in the Czech Banking Sector over the period 2001 to 2012 reveal that interest rate have negative impact of technical efficiency. Also, Shanmugam and Das (2006) reveal that technical efficiency of raising interest margin is varied widely across sample banks and is time-invariant. Even though several reform measures have been introduced since 1992, they have not so far helped the banks in raising their interest margin.

### METHODOLOGY

Our sample covers a balanced panel dataset of 486 observations over the period 2000 to 2018 with 24 groups. The groups are the financial sector for 24 African countries. The selection of these countries was based on the availability of data. The data on the financial sector of these countries were collect from Global Findex Database 2018 and the unit of analysis is the financial sector.

Literature for estimating bank efficiency is Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA) and Thick Frontier Approach (TFA). The non-parametric methods that have been employed in literature for estimating bank efficiency are Data Envelopment Analysis (DEA) and Free Disposable Hull (FDH). The SFA and DEA are the most commonly used parametric and non-parametric methods, respectively. The SFA approach is a stochastic technique which integrates the random errors but also requires the predefinition of the functional form (Eisenbeis et al., 1999). This article uses the stochastic frontier efficiency estimates since it present more precise stock price behavior and adopts the standard translog functional model for multi products in estimating efficiency. This is specified as follows:

$$\ln Y_t = \beta_0 + \beta_1 \ln X_{1t} + \beta_2 \ln X_{2t} + \beta_3 \ln X_{3t} + \dots \dots \dots \beta_{23} \ln X_{23t} + V_t + \mu_t \quad (1)$$

where  $t = 1, 2, \dots, 18$

$$\begin{aligned} \ln Y_t = & \beta_0 + \beta_1 \ln X_{1t} + \beta_2 \ln X_{2t} + \beta_3 \ln X_{3t} \dots \dots \dots + \beta_3 \frac{1}{2} (\ln X_{1t})^2 + \beta_4 \frac{1}{2} (\ln X_{2t})^2 + \beta_5 \frac{1}{2} (\ln X_{3t})^2 \\ & + \dots \dots \dots \beta_6 (\ln X_{1t})(\ln X_{2t}) + \beta_7 (\ln X_{1t})(\ln X_{3t}) + \beta_8 (\ln X_{2t})(\ln X_{3t}) \dots \dots \dots + V_t \\ & + \mu_t \dots \dots \dots \end{aligned} \quad (2)$$

where  $Y_t$  is the dependent variable of a country in the  $t$ th time period;  $X_{1t}$ ,  $X_{2t}$  and  $X_{3t}$  are the independent variables of the  $t$ th time period;  $V_{it}$  are random variables which are assumed to be *iid*  $N(0, \sigma_v^2)$ , and independent of the  $\mu_{it}$ ;

$$\mu_t = \{\exp[-\eta(t-T)]\} \mu_t, \quad t = 1, 2, \dots, 18$$

where the  $\mu_t$  are non-negative random variables which are assumed to account for time-varying technical inefficiency in production and are assumed to be *iid* as truncations at zero of the  $N(\mu, \sigma_u^2)$  distribution;  $\varepsilon_t = v_t + u_t$ ,  $\varepsilon_t$  is an error item (or disturbance item); and  $\beta_k$  is an unknown parameters to be estimated  $k = 0, 1, \dots, 23$ ;  $\eta$  is an unknown scalar parameter to be estimated.

The truncated-normal distribution of the technical inefficiency effect ( $u_t$ ) is  $E[u_t | \varepsilon_t]$  which is the "mean inefficiency" at any time  $t$ . The article fits the SFA using maximum likelihood estimation technique.

To determine the technical efficiency effect, the article employs the one-side generalized likelihood-ratio test express as the following.

It is important to conduct a number of diagnostic checks to see whether the stochastic frontier model is a relevant model. To do that the article estimates the total variance  $\sigma^2 = (\sigma_v^2 + \sigma_u^2)$  or use the likelihood ratio model recommended by Kumbhakar et al. (2015).

$$LR = -2\{\ln[L(H_0)/L(H_1)]\} = -2\{\ln[L(H_0)]\} - \ln[L(H_1)]$$

where  $H_0$  and  $H_1$  are restricted and unrestricted model  $-2\{L(H_{restricted}) - L(H_{unrestricted})\}$ . Where  $L(H_0)$  and  $L(H_1)$  are the values of the likelihood function under the null hypothesis:

$$H_0: \gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2) = 0 \text{ and alternative hypothesis } H1: \gamma > 0, \text{ respectively.}$$

When this statistic by Kumbhakar, Wang and Homcastle is computed the article compares it with the critical values that are reported in Kodde and Palm (1986).

The efficiency score will be between zero (0) and one (1) with closer to one meaning technical efficient and closer to zero (0) implying low technical efficiency. The article estimates the probability of economic depression with the efficiency scores.

### Data presentation and analysis

To analyze the readiness of African countries to give relief support and manage the economy our sample covers a balanced panel dataset of 486 observations over the period 2000 to 2018 with 24 groups. The countries selected can be categorized into low income country (12), low middle income country (8) and then upper middle income country (4). The database was extracted from global Findex database 2018. Adopting Sealey and Lindley (1977), the article considers financial sector as intermediary that used inputs like deposit and overhead cost to generate assets. Through the efficiency scores, the article will identify the difference between countries as well economic blocks over the period 2000 to 2018.

Table 1 shows all the variables predicted to influence efficiency in the model presented. Each variable have mean, standard deviation and min-max. The standard deviations are given in three categories: overall, between and within. The between variation implies the variation of the same variable over time. On the other hand, within variation refers to the variable among the different countries in different time periods. The mean of interest margin (IM) variable is 7.085, the minimum is 1.162 and maximum is 28.982. The overall variation is 3.472, with between variation of 2.77 and within variation of 2.15 which implies between variations in relation to interest margin dominates the variations in interest margin. In the case of the variables concentration and liquidity between variations dominated the variations in the data as shown in Table 1.

Figure 1 shows the trend net interest margin, bank concentration, liquid liability and technical efficiency over the period 2000 to 2020.

**Table 1.** Summary statistics of variables that influence technical efficiency.

Variable		Mean	Std. Dev.	Min	Max	Observations
Net interest margin	Overall		3.4723	1.162	28.982	N = 522
	Between	7.085	2.770	3.501	12.617	n = 24
	Within		2.150	-2.240	25.522	T-bar = 21.75
Concentration	Overall		18.959	22.281	100	N = 504
	Between	74.849	14.829	40.891	95.052	n = 24
	Within		12.0479	37.403	107.886	T-bar = 21
Liquid liability	Overall		16.295	6.0241	110.812	N = 526
	Between	26.330	15.232	15.243	88.703	n = 24
	Within		6.502	9.858	48.439	T-bar = 21.92

Source: Author

**Table 2.** Regression results.

Variable	RE
IgC (Credit)	-0.373*** (0.135)
Lgcost	0.614 (0.663)
IgD (Deposit)	0.477* (0.244)
IgOVC (Overhead cost)	0.764*** (0.150)
T (Technology)	0.002 (0.007)
TxC	-0.000 (0.000)
TxD	-0.000 (0.000)
TxOVC	-0.000** (0.000)
Txcost	-0.000*** (0.000)
Mu:IMsq (Net interest Margin)	-0.019* (0.011)
Mu:CCsq (Concentration)	-0.001** (0.000)
Mu:LQsq (Liquid Liability)	-0.006** (0.002)
Usigma:_cons	1.261*** (0.252)
Vsigma:_cons	-2.626*** (0.125)
Obs.	486
Pseudo R <sup>2</sup>	z

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1. Standard errors are in parenthesis.

Source: Author

On the average, net interest margin and bank concentration are all on the downward trend which is good for the continent. Also, wealth noting is the trend for liquid liability and technical efficiency which on the average have been positive indicative of the fact that the financial sector in the continent are in the position to pay their liabilities as when they fall due and efficiently managing resources to get the returns. However, with technical efficiency, Figure 1D shows that most of the countries selected have their technical efficiency dipping at around 2016 onwards even though the average for period is on the upward trend.

The trend of net interest margin, liquid liability and concentration converge with time is as shown in Figure 1E. This is indicative of the similarities in the sampled countries and also readiness of the sector to support economic growth on the continent.

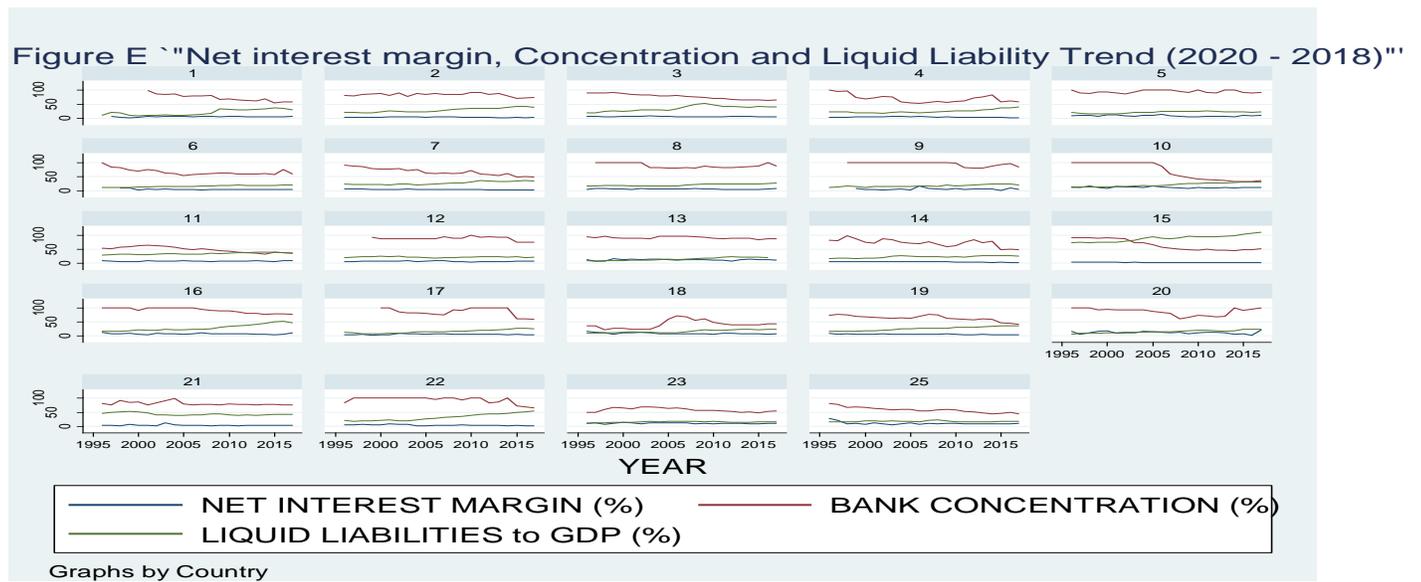
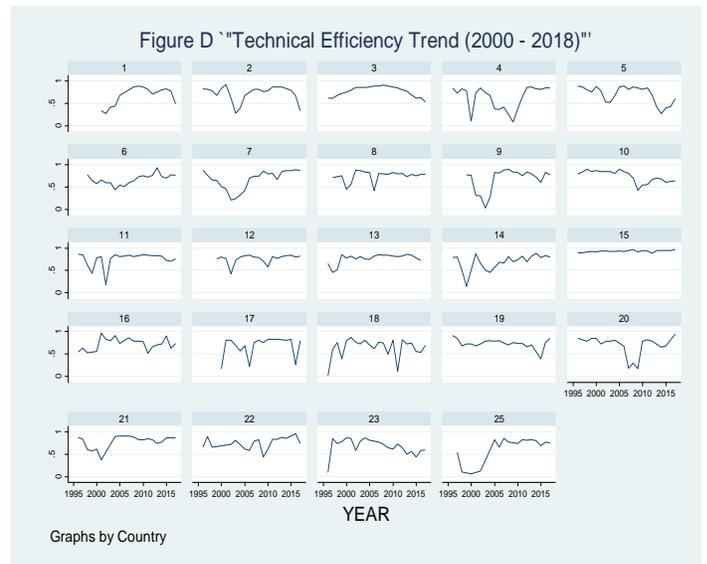
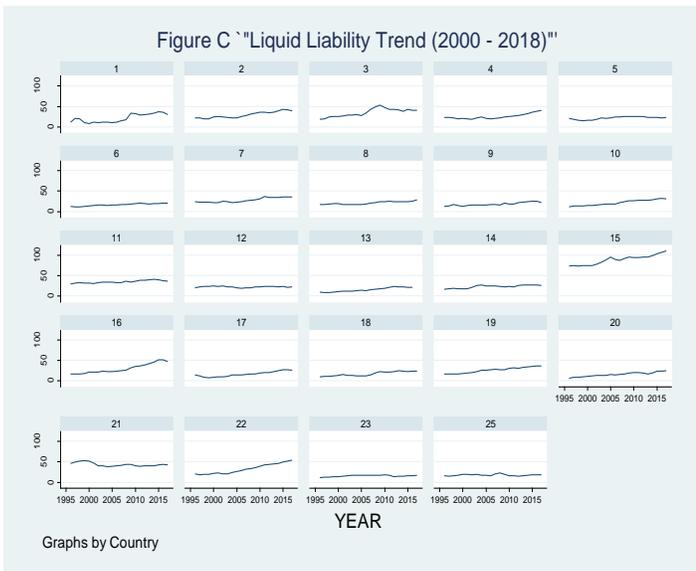
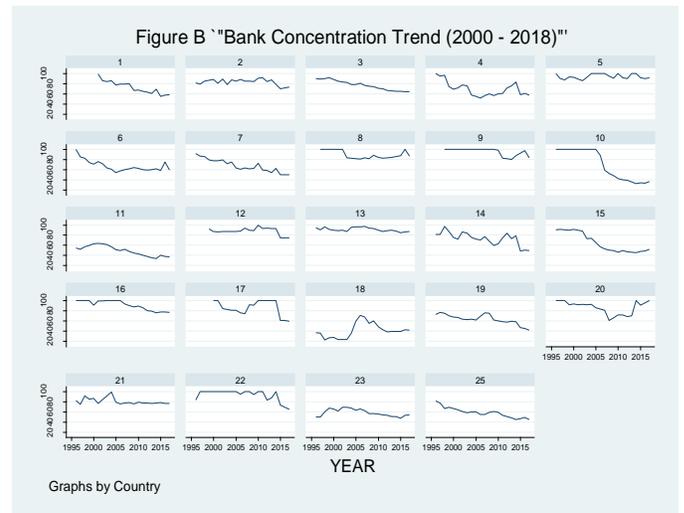
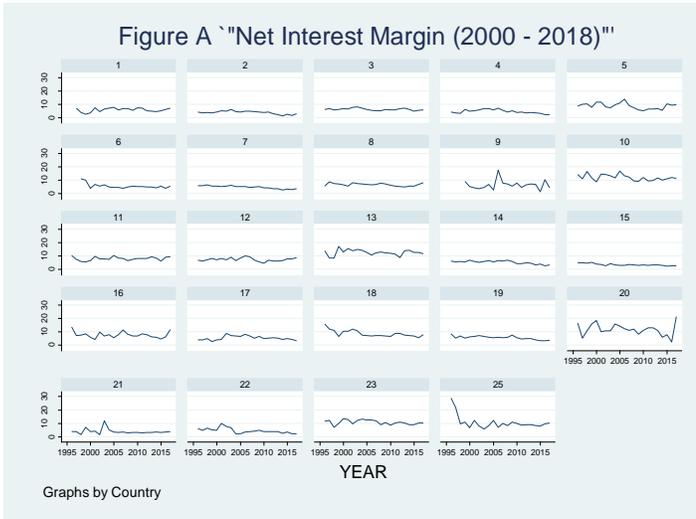
## RESULTS AND DISCUSSION

The version of the stochastic model used for this article is

the true fixed effect. The Wald Chi<sup>2</sup> of the whole model was 21.3 with probability Chi<sup>2</sup> of 0.000 with a log likelihood of -298.3405. This is indicative of the fact that the model is well fitted.

With the frontier regression model all the interaction variables and the squared variables were dropped because of multicollinearity problem with the exception of the product of technology and other variables. The variable Credit (C) and Deposit (D) and overhead cost were all significant at different significant levels in explaining stochastic production frontier for determining the efficiency scores. The trend variable (T) which proxy for technology was positive and significant at 1% shown in Table 2. The signs of the other variables conform to theory.

The second part of Table 2 is the regression of



**Figure 1.** The trend net interest margin, bank concentration, liquid liability and technical efficiency over the period 2000 to 2020. Source: Author

**Table 3.** Summary statistic of technical efficiency.

Variable		Mean	Std. dev.	Min	Max	Observations
Technical efficiency	Overall		0.1817	0.0086	0.9630	N = 486
	Between	0.7181	0.0637	0.6305	0.9280	n = 24
	within		0.1703	0.0781	0.9798	T-bar = 20.25

Source: Author

technical efficiency on concentration, liquidity and interest margin. The variables for the second regression start with prefix "mu". The dependent variable in second regression is technical efficiency derived from the first regression. Interest margin is significant at 10% has positive effect on technical efficiency and the coefficient is negative 0.019. Put differently the negative effect here means that interest margin have negative effect on technical inefficiency. This implies that as interest margin improves or increases it improves the technical efficiency of financial sector on the continent Africa.

In the case of market concentration is also significant at 5% and coefficient of 0.001 implies that improvement or increase in market concentration affects technical efficiency of financial sector on the continent. These also conform to theory.

To validate whether the stochastic model is relevant to the article conducts a number of diagnostic checks. From the regression output the article computes the ratio of variance of the technical inefficiency to the total variance of the error term gives a statistic that accounts for the variations in output accounted for by technical inefficiency and this statistic should range between zero and one. If the statistic is close to one (1) then it means that much of the variations in output are accounted for by technical inefficiency implying the stochastic model is the appropriate one. From the regression output for Table 2 the article have standard error of  $U_{\sigma}$  to be 0.2518312 with a variation of 0.063419 and  $V_{\sigma}$  is 0.1247323 with a variance of 0.015558 giving a total variance of the model to be 0.078977.

So the proportion of variation to technical inefficiency to total variance gives us 0.803. Since this statistic is closer to one (1) it is an indicative that the stochastic model is relevant. In other words technical inefficiency accounts for about 80% of the variations in the model.

The article again conducts the likelihood ratio statistic recommended by Kumbhakar et al. (2015) which is in this case is 1370.376. To validate whether the stochastic frontier model is relevant, the article computes the statistic recommended by Kumbhakar, Wang and Homcastle and compare it with the critical values that are reported in Kodde and Palm (1986). From the unrestricted and restricted regressions the maximum likelihood ratios are -290.4436 and -505.95362, respectively and this gives the statistic 431.02. Comparing the statistic 431.02 with critical values of the

mixed Chi-square distribution it is realized that at one degree of freedom under 2.5% significance level the statistic is greater than the critical value of 3.841; hence the article can reject the null hypothesis which says that the stochastic frontier model is not appropriate. In other words the article strongly rejects the null hypothesis of no technical efficiencies.

Since the stochastic model is relevant the article predicts technical efficiency from the model. The average technical efficiency for the period 2000 to 2018 is 0.718. Within variations dominate the variations in the technical efficiency. The minimum and maximum within variations are 0.0781 and 0.9798, respectively as depicted in Table 3. The average technical efficiency of 0.718 is an indicative that about 72% of emerging economies are well positioned to help economies to bounce back from the smother of COVID-19 as at 2018. In the case of the readiness of the continent the 72% gives a readiness of 42% to the consequences of COVID-19 to economic activities. This implies that policy makers will have work hard to improve net interest margin, liquid assets and market concentration of financial sector on the continent if the sector can really help economic activities to bounce back. In other words, the continent faces a probability of 42% to prevent economic depression.

Figure 2 shows the trend for the predicted technical efficiency for the continent Africa sampled for this article. From the trend it can be deduced that most of the countries sampled had technical efficiency below 0.5 and after 2006 most countries had technical efficiency above 0.5. The bar graph of Figure 3 confirms that for the period under study, all countries sampled on the African continent have technical efficiency greater than 0.5 which is indicative that the financial sectors in these countries were all technically efficient on the average.

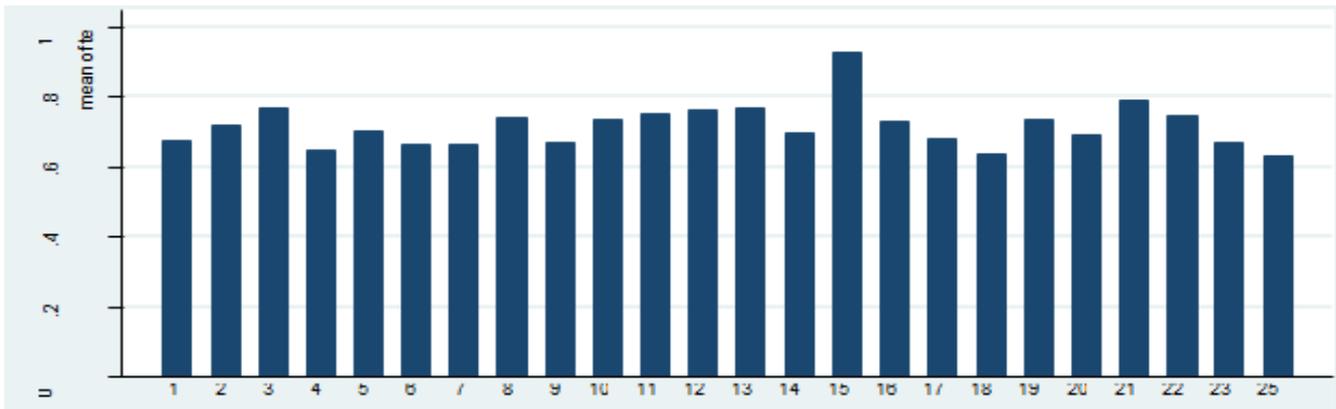
Appendix B depicts the rankings of the countries sampled in terms of technical efficiency. The first six (6) countries are Mauritius, South Africa, Botswana, Malawi, Madagascar and Kenya.

Countries on the continent that are likely to have challenges in the area of technical efficient in the financial sector are Zambia, Nigeria, Burkina Faso, Côte d'Ivoire, Cameroon and Gabon with Zambia being the worse country in terms of technical efficiency.

This article ranks South African financial sector among the best performing on the continent. However, according to S&P Global Ratings South African banks are unlikely



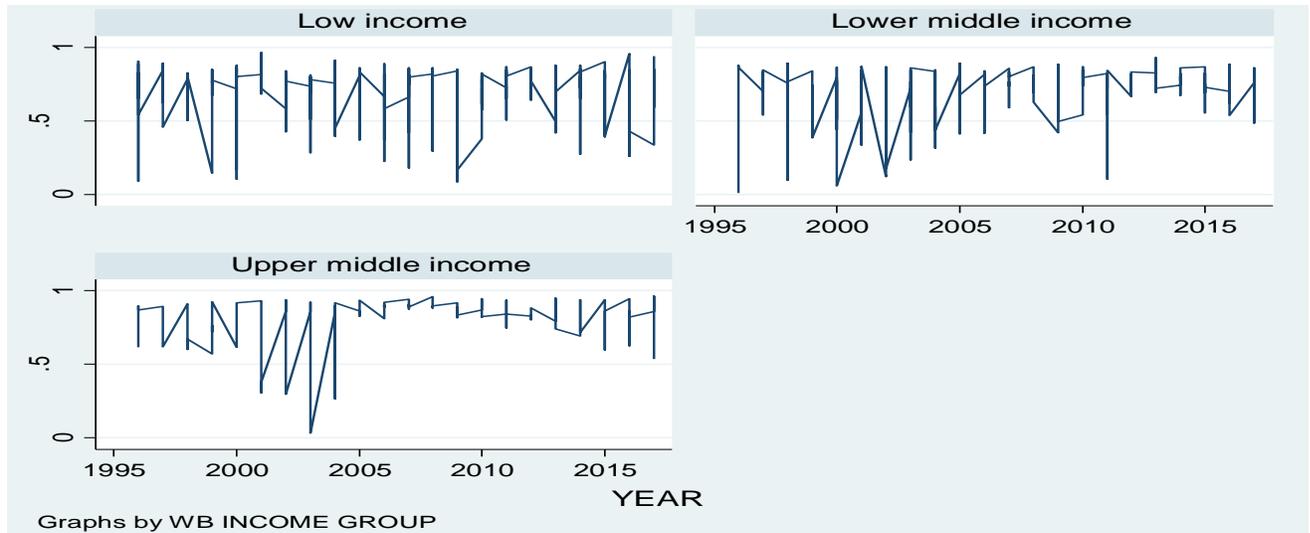
**Figure 2.** Trend of technical efficiency by countries.  
Source: Author



**Figure 3.** Mean efficiency by countries (2000 - 2018).  
Source: Author

to boost lending in 2020 amid economic uncertainty. This is because real GDP growth is expected to average 1.6% in 2020-2021 and also the fact the credit losses is expected to increase by 1.2% in 2020 hence banks extend credit slowly. For this reason, ratings for all top-tier banks in South Africa were assigned negative outlooks. This is an indication that as leaders in the continent fight COVID-19 pragmatic solutions should be also tailored to address the financial sector to ensure the necessary support for the economy. The continuous efficient operation of a financial sector in an economy is necessary if an economy is saving enough the unforeseen contingency. Botswana on the other hand

was ranked 3rd on the continent. This is not surprising since there has been series of projects intended to position the country to serve international financial sector. In relation to readiness of Botswana to support the shock of the pandemic our results put the country at 54% ready. In the work of Antwi-Asare and Addison (2000) they concluded that Ghana's banks have performed poorly in the past, offering but a narrow range and inefficient delivery of financial instruments, being strongly biased in their reach to the urban formal sector and, in particular, to the holding of low-risk government paper, and being largely non-competitive in structure. These results are indicative that banks in Ghana pass on their inefficiencies



**Figure 4.** Technical efficiency variation by income group (2000 to 2018).  
Source: Author

to their customers by raising their lending rates and lowering their deposit rates.

### Technical efficiency of financial sector by income grouping

Taking into consideration World Bank (WB) income groupings of countries, this article has considered low income, lower middle income and upper middle income countries. The mean technical efficiency for upper middle income (0.7934) and low income (0.7113) were as expected according to theory. However, mean technical efficiency for lower middle income of (0.6898) is not expected as shown in Appendix A. The implication here is that upper middle income and low income countries are more technically efficient than lower middle income countries. That means they are more resilient relatively when it comes to withstanding the economic shock as a result of COVID-19. The variations in technical efficiency for various income groups are more prominent in between countries for each group than within countries. However, Figure 4 shows that technical efficiency over the period improved significantly for upper income countries in 2005 and since then financial sectors have been doing very well.

This is also the case for lower middle income countries. The difference is that financial sectors were really not doing very well from 2000 to 2005. Afterwards there has been some appreciable improvement in the sector which gives the net effect performance in terms of technical efficiency behind the other groupings of low income and upper middle income countries. The implication is that lower middle income economies are more at risk to COVID-19 than low income and upper

middle income countries on the African continent.

### Conclusion

Organizational readiness for change is considered a critical precursor to the successful implementation of complex changes. Failure to establish sufficient readiness accounts for one-half of all unsuccessful, large-scale organizational change efforts. The readiness of an economy to withstand the economic depression of COVID-19 depends on how efficient that economy has been performed over the years. An economy that has been operating on the efficient frontier is likely to be in a better position to give up some relief packages for social interventions and also to oil the economic engine of the country to bounce back. Countries have to shut down their economic activities in attempt to fight this pandemic. Countries that have been efficient over the years are likely to manage post COVID-19 crisis better. This is because to efficiently operate for some years they are likely to have more reserves to rely on in times of need. In the light of this the financial sector of Africa is about 72% ready to support the economy due to the efficiency level of the financial sector of the continent. In other words, there is the probability of 0.42 that economy of the African continent will not plunge into economic depression. This is far below average and by implication Africa should be bracing itself for severe economic shock if proper effective relief programs are not put in place. It is recommended that policies to address interest rate margin, liquidity and market concentration should be managed properly to improve technical efficiency of the financial sectors on the continent. In terms of income groupings on the continent the lower middle income

countries are relatively challenged by technical efficiency to impact positively on economic development. In the light of this it is proposed as IMF and other international monetary fund plans to support economies, the continent Africa should be considered.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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*Full Length Research*

# **Assessment on the roles of information technology in improving the customer satisfaction and employee performance of commercial banks: The case of Dashen and United Bank Branches in Mizan-Aman, Southwestern Ethiopia**

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Received 18 August, 2020; Accepted 9 September, 2020

The study was conducted with the major objective of assessing the impact of IT on the performance of commercial banks in Ethiopia. In order to accomplish its general objective, the study attempted to evaluate the effects of IT on customer satisfaction, employee performance as well as bank revenue. The three dimensions were used as crucial indicators of the impact of IT on overall bank performance. Two cross-sectional surveys were conducted to gather the necessary data from the 372 customers and 24 employees of the Mizan-Aman branches of Dashen and United Banks in Southwestern Ethiopia. In addition, the annual performance reports of both banks, particularly the ones for 2015 and 2016 fiscal years, were reanalyzed as data sets for assessing the impact of IT on bank revenue. The findings of the study clearly indicated that IT indeed has an impact on the performance of commercial banks. It was found that the IT based services provided by the two bank branches were found to be convenient and user-friendly to customers. The study has also indicated that customers have found both banks to be efficient not only in terms of service delivery but also in terms of their ability to maintain their IT products. IT also positively affected the job performance of bank employees by reducing their workload and improving their accuracy. Meanwhile, broadband and electric power fluctuations were found to have a significant negative impact on both customer satisfaction and employee performance. Finally, an exploratory overview of the financial performance of the two banks has indicated that IT based services constituted a significant percent of the banks' gross profit for both 2015 and 2016 fiscal years.

**Key words:** Customer satisfaction, commercial banking, Dashen Bank, employee performance, information technology, United Bank.

## **INTRODUCTION**

The establishment of Bank of Abyssinia on February 16, 1906 marked the beginning of modern banking in Ethiopia. The bank was opened as a result of a 1905

agreement between Emperor Minilik II and Mr. Ma Gillivray, representative of the British owned National Bank of Egypt. A year after its inauguration the bank

started selling its shares at Addis Ababa, New York, London, Paris and Vienna, and opened branches in Harar, Dembidolo, Gore, Dire Dawa as well as an agency office at Gambella and a transit office in Djibouti (NBE, 2010).

In 1932, Emperor Haileselassie, in agreement with National Bank of Egypt, liquidated the Bank of Abyssinia by paying compensation to shareholders and established Bank of Ethiopia with Ethiopian shareholders with a capital of 750,000 pound sterling. At the time, the major shareholders were the Emperor and the then political elites. The bank was functional until the Italian invasion in 1935 which latter follows with the entrance of Italian Banks. The National Bank of Ethiopia was established in 1963 by proclamation 206/1963 and began operation in January 1964 (NBE, 2007).

After the 1974 revolution, all private banks and insurance companies merged and nationalized under supervision and control of National Bank of Ethiopia starting from January 1, 1975 (NBE, 2010). Later, when EPRDF controlled the country in 1991, it decreed a new banking law in January 1994 titled Proclamation No. 84/1994 which allowed the establishment of private commercial banks in the country. And sixteen private commercial banks have been established since then.

When it comes to Information Technology (IT), it refers to the application of computers and internet to store, retrieve, transmit and manipulate data, or information, often in the context of a business or other enterprises. Banks like other enterprises use IT as their computing tool to excel the service they render. Most researchers conclude that IT has two positive effects on bank's performance. First, IT can assist banks in reducing the operational and human resource costs. Like for instance, IT can minimize the paper works which can be utilized to transact money transfers, and can be easily applied by internet banking or mobile banking with no paper. IT can increase the efficient of the banks by reducing landline telephone costs by using online transactions. Also, an individual can perform various transactions through IT that would be performed by various employees (Farrell and Saloner, 1985).

Second, IT can facilitate transactions among customers with in the same network. Since customers come from different socio-economic backgrounds banks could provide a wide variety of first-rate services to their more distinguished customers who will not settle for mediocre services. As a result, the banking sector has shown a tremendous expansion in almost all societies. This is partly due to the fact that banking services have touched most aspects of contemporary society's life and activities (Farrell and Saloner, 1985).

This article is an output of a research done on the

impact of information technology on the performance of commercial banks in Ethiopia. The research was conducted by taking the Mizan-Aman branches of Dashen and United Banks as particular cases of reference.

### Statement of the problem

Financial industries, especially commercial banks, are currently becoming highly competitive and the computation is becoming so tough through service differentiation, easiness of service availability, culture and religion based product services and information technology application. Growing profitability by adopting innovative technology that would enhance customers' satisfaction is becoming the core of any banks' strategies. The challenges related to IT in Ethiopian commercial banking industry shall be classified in four major categories.

Security concerns associated with IT such as, Malware, Viruses, Trojans, Worms, Phishing spam and Spoofing, etc. including acts of intruders and hackers are becoming major challenge in the world. Security will always remain high on the IT agenda simply because cyber criminals know that a successful attack can be very profitable. This means they will always strive to find new ways to circumvent IT security, and users will consequently need to be continually vigilant.

Currently, banks are becoming more and more dependent on the use of IT for their day to day banking operations. Cyber-attacks on information system are often aggressive, well organized and very sophisticated (United Bank, 2012).

Since these technologies for the industry are at the infant stage, the problem remains at its high risk currently. For instance, Chris (2016) reported some pretty strong attack on banks' cyber-defenses in the past year, 2015. Three major incidents in the swift network, 50 at the Federal Reserve, problems at the bank of England and many other central banks, a major Incident at the Danish payment processor Nets, and big banks such as HSBC and JPMorgan have all been affected.

Seamless Information Technology supportive banking makes banking convenient for customers as it allows them to transact from anywhere, at any time 24/7 (United Bank, 2012). But this might not always hold true as Agbada (2008) claims that some consumers might be impaired as a result of age, or might have learning impairment and other might be physically disabled. Multi-channel delivery products like Mobile banking, Internet banking, ATM banking and Fund transfer through IT are operated by the customer itself. Customers with hearing

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problem may require visual representation of auditory information that a web site may provide in order to understand such information, particularly now that the use of multimedia such as video streaming on websites have increased. Besides, consumers with hearing impairments cannot locate or identify command or control that require listening to menu items before pressing the button as we have in voice-based interactive mobile phones. In addition to this, in developing countries like Ethiopia, majority of bank customers are not literate enough to handle the multi-channel transactions accordingly, and this in return led them to lose confidence on their bank financial accounts.

The major problem to apply an IT based banking structure in developing countries like Ethiopia is the problem of infrastructures like electricity and telecommunication, both of which are controlled by a monopoly. As can be witnessed by anyone who stayed in Ethiopia, the electric power usually cannot consistently be kept active the whole working day, which definitely affects the operation of E-banking like ATM and POS services. In other words, the interruption of broadband networks by the monopolized telecom supplier, Ethio telecom, affects the IT dependent services in general.

Unpredictable and stringent NBE directives have been issued from time to time which have a significant impact in the performance of commercial Banks in Ethiopia. For instance, currently, NBE banned one of the services, which United Bank Ethiopia used to render, prepaid mobile top up. These kinds of unpredicted directives are challenges for the commercial banks of Ethiopia. Though many researches have been conducted on the impact of Information Technology on commercial banks' performance over the globe, still a limited number of studies have been conducted on Ethiopian commercial banks. Therefore, the study tried to investigate the impact of IT on the performance of commercial banks in Ethiopia by adopting the following objectives:

1. To examine the impact of IT on customers' satisfaction.
2. To identify the influence of IT on the job performance of commercial bank employees.
3. To offer valuable suggestions that could help improve the provision of IT based services by commercial banks in Ethiopia.

## RESEARCH METHODS

The study can generally be considered as a cross-sectional survey on the impact of IT on the performance of two commercial banks in Ethiopia. Two cross-sectional surveys were conducted to examine the views of both customers and employees of the banks regarding the way in which IT has affected their satisfaction and performance respectively. Moreover, for the purpose of providing an adequate depiction of links and processes that surround the subject matter, the data from the survey were triangulated with data collected using the other basically qualitative methods of data collection like in-

depth interviews and documentary analysis. Figure 1 summarizes the conceptual framework behind the survey design.

## Study area

The study was conducted on Bench Maji Zone, Mizan-Aman town. Bench Maji Zone is found in Southern Nations, Nationalities and Peoples Region (SNNPR), Southwestern Ethiopia. It is found at a distance of about 561 km from Addis Ababa and 842 km from the regional capital Hawassa.

Dashen Bank is a private commercial bank established in 1995. Headquartered in Addis Ababa, the Bank is the biggest private Bank in Ethiopia and operates through a network of 196 branches, nine dedicated Forex Bureaus, 220 ATMs and 958 plus Point-of-Sale (POS) terminals spread across the nation. It has established correspondent banking relationship with 464 banks covering 71 countries and 175 cities across the world. The Bank also works in partnership with leading brands in the electronic payments industry (American Express, VISA, MasterCard and UnionPay cards) and prominent money transfer (Dashen Bank, 2016).

United Bank, on the other hand, was incorporated as a Share Company on 10 September, 1998 in accordance with the Commercial Code of Ethiopia of 1960 and the Licensing and Supervision of Banking Business Proclamation No. 84/1994. The Bank obtained a banking services license from the National Bank of Ethiopia and is registered with the Trade, Industry and Tourism Bureau of the Addis Ababa City Administration. Over the years, United Bank built itself into a progressive and modern banking institution. Today, United Bank is a full service Bank that offers its customers a wide range of commercial banking services with a network of 161 branches and 25 sub-branches, and a number of additional outlets on the pipeline (United Bank, 2015).

## Study population

According to data obtained from the Mizan-Aman branches of Dashen and United Banks, the two banks have 7050 and 4396 customers respectively. The total number of employees was also reported to be 21 for Dashen Bank and 25 for United Bank. Of the 21 employees in Dashen Bank, 6 are window clerks, 4 are manager/supervisors and 11 are manual workers. Similarly, of the 25 employees in United Bank, 8 are window clerks, 6 are managers/supervisors and 11 are manual workers.

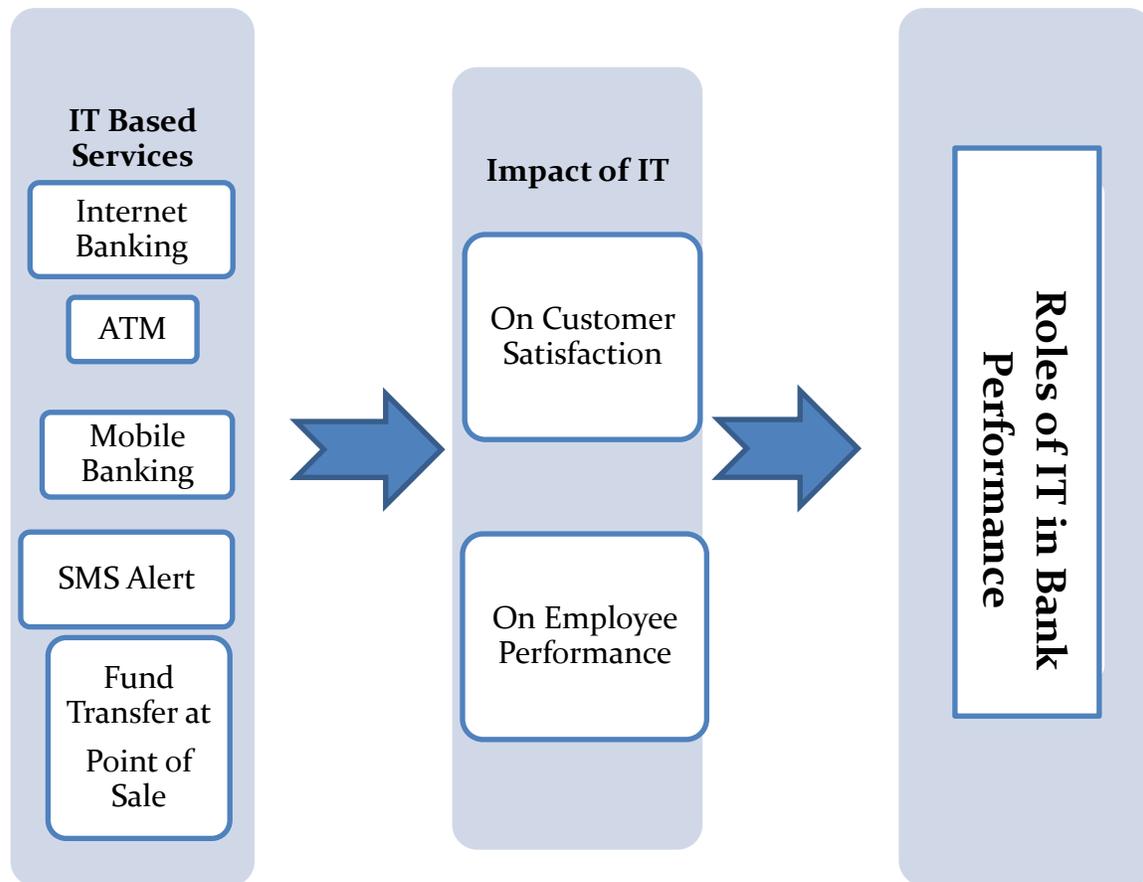
## Sampling techniques

In principle, accurate information about a given population could be obtained only from a census study. However, due to financial and time constraints, in many cases a complete coverage of a population is not possible. Thus, sampling is one of the methods, which allows the researcher to study a relatively smaller number of units representing the whole population (Sarantakos, 1998). Accordingly, the study employed simple random sampling technique to select its respondents. It used the following formula to calculate the sample size for bank customers who participated in the investigation.

$$n = \frac{Z_{\alpha/2}^2 [p(1-p)]}{e^2 + \frac{Z_{\alpha/2}^2 [p(1-p)]}{N}}$$

Where, n = Sample size;

Z $\alpha$ /2 = Critical value from the normal distribution with level of



**Figure 1.** Conceptual framework.  
Source: Developed by the researchers (2017).

significance equal to  $\alpha$   
 $e^2$  = Margin of error at 5%  $(0.05)^2$   
 N = Total number of customers;  
 p = Proportion of customers who use IT based services.

Therefore, the total sample size for customers will be:  $n = 372$ .

#### Methods of data collection

##### Primary data collection methods

**Survey:** Most of the primary data for the study was collected using the survey method. The method employed two structured questionnaires containing close-ended questions and was used to gather responses from both the customers and employees of the two banks. The questionnaires were designed in such a way that they enable the researchers to assess the impact of IT on customer satisfaction, employee performance and bank revenue.

**In-depth interviews:** In-depth interviews were conducted with key informants who were capable of providing richer and detailed information about the impact of IT on the performance of the two selected banks. Moreover, in-depth interviews were also conducted with bank officials including bank managers and system administrators. The results of the in-depth interviews were used to

weigh responses gathered from the survey.

**Observation:** This involves information canvassed through the personal observation of the researchers on situations related to the topic at hand.

##### Secondary data collection methods

**Data sets:** Secondary materials containing data on IT investment, bank profitability and annual performance were reviewed.

**Works of others:** In addition to reanalyzing data sets, the researchers also made use of published or unpublished reports and statistics found in different organizations. Major among such documents were studies conducted by various individuals at different periods in time.

## RESULTS

In terms of their socio-demographic background, the majority of customers who participated in the study were males [251(67.5%)], married [215(57.8%)], were between the ages of 18 and 29 [206(55.4%)], on average earn

**Table 1.** Sampling design.

S/N	Name of banks	Name of branches	Total no. of customers	Sample size	Total no. of employees	Sample size
1	Dashen Bank	Mizan-Aman	7050	231	21	10
2	United Bank	Mizan-Aman	4396	141	25	14
Total			<b>11446</b>	<b>372</b>	<b>46</b>	<b>24</b>

**Table 2.** Reliability and scale statistics.

<b>Reliability statistics</b>			
<i>Cronbach's alpha</i>	<i>Cronbach's alpha based on standardized items</i>	<i>No. of items</i>	
0.743	0.766	20	
<b>Scale statistics</b>			
<i>Mean</i>	<i>Variance</i>	<i>Standard deviation</i>	<i>No. of items</i>
70.64	102.685	10.133	20

more than 3999 ETB per month [80%], have a bachelor degree [206(55.4%)] and were civil servants [112(30.1%)]. Whereas the majority of employee respondents for the study were males [16(66.7%)], single [13(54.2%)], were between 18 and 29 years old [16(66.7%)], have a bachelor degree [24(100%)] and earn an average monthly income which is greater than 5999 ETB [62.50%] (Table 1).

### Impact of IT on customer satisfaction

In addition to the need to establish an efficient and sustainable business management system, another major reason for why firms adopt IT is to enhance the quality of the services they provide to their customers. As a result, nowadays the primary force behind the penetration of IT into the banking industry is the question of customer satisfaction. It was also for this reason that the study attempted to investigate the impact of IT on the performance of commercial banks in Ethiopia through an assessment on customer satisfaction.

To do so, the study used a self-filled structured questionnaire that contains a scale with 22 items intended to measure customer satisfaction. Respondents were asked to express their degree of agreement or disagreement with the idea contained within each item on the scale. The items contained a series of statements concerning IT based services and the responses ranged from strongly disagree to strongly agree with disagree, neutral and agree as the three intermediate responses. The scores for the responses were 1 strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree (Tables 3 to 5). Reverse scoring was used for items that contained unfavorable statements.

Moreover, the reliability of the scale was tested using Cronbach's test of reliability. The test indicated that, if two of the items on the scale concerning the fairness of service charges and legal agreements are removed, 74.3% of the variance in the scores for the remaining 20 items is reliable variance. Consequently, the Cronbach's alpha based on the scores for 20 standardized items was found to be 0.766, which is commonly assumed to be an acceptable degree of reliability by most researchers. Table 2 above summarizes the output from the reliability test done on the scale.

Although respondents were allowed to provide multiple responses to the question none of them reported to have used more than one IT based service. Consequently, the least used IT based service was found to be electronic fund transfer (4(1.1%)) [3(0.8%) DB and 1(0.3%) UB]. This could be because of the fact that the service by nature requires the existence of two or more agents who conduct their transactions electronically. One major conclusion that could be made from the findings presented in the table is that IT based services are often used by respondents mainly for the purpose of accessing and monitoring their own bank accounts. Another finding of the study in this regard is that internet banking has become a common service utilized by bank customers. It was found to be a service utilized by 21(5.6%) [13(3.5%) DB and 8(2.2%) UB] of the respondents. Although the proportion of its users is smaller by comparison, the finding appears to be interesting given the newness of the service in the Ethiopian banking industry. Moreover, the data show that SMS alerts, although not as new as internet banking, are becoming one of the basic mechanisms through which banks provide notifications to their customers. According to the data, 31(8.3%) [15(4.0%) DB and 16(4.3%) UB] of the respondents

**Table 3.** Respondent's confidence in using IT based services by banks.

<b>Bank name x respondents confidence in using IT based services</b>			<b>Respondents confidence in using IT based services</b>					<b>Total</b>
<b>I feel confident to use technology based products of the bank</b>			<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly agree</b>	
Bank Name	Dashen Bank	Count	21	40	26	50	94	231
		% of Total	5.6	10.8	7.0	13.4	25.3	62.1%
Bank Name	United Bank	Count	8	18	14	47	54	141
		% of Total	2.2	4.8	3.8	12.6	14.5	37.9%
Total		Count	29	58	40	97	148	372
		% of Total	7.8%	15.6	10.8	26.1	39.8	100.0

Source: Survey (2017).

**Table 4.** Impact of IT on workload, speed of service delivery and decision making by banks.

			<b>Impact of IT on workload</b>				<b>Total</b>
			<b>Strongly disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly agree</b>	
Bank Name	Dashen Bank	Count	0	0	7	3	10
		of total	0.0	0.0	29.2	12.5	41.7
Bank Name	United Bank	Count	1	0	2	11	14
		of Total	4.2	0.0	8.3	45.8	58.3%
Total		Count	1	0	9	14	24
		% of Total	4.2	0.0	37.5	58.3	100.0
			<b>Impact of IT on speed of service delivery</b>				<b>Total</b>
			<b>Strongly disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly agree</b>	
Bank Name	Dashen Bank	Count	0	1	7	2	10
		% of Total	0.0	4.2	29.2	8.3	41.7%
Bank Name	United Bank	Count	1	0	6	7	14
		% of Total	4.2	0.0	25.0	29.2	58.3%
Total		Count	1	1	13	9	24
		% of Total	4.2%	4.2	54.2	37.5	100.0
			<b>Impact of IT on decision making</b>				<b>Total</b>
			<b>Strongly disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly agree</b>	
Bank Name	Dashen Bank	Count	0	0	9	1	10
		% of Total	0.0	0.0	37.5	4.2	41.7%
Bank Name	United Bank	Count	1	0	6	7	14
		% of Total	4.2	0.0	25.0	29.2	58.3%
Total		Count	1	0	15	8	24
		% of Total	4.2	0.0	62.5	33.3	100.0

Source: Survey (2017).

reported to have used SMS alert as a means of obtaining updates from their respective banks.

United Bank was the first private commercial bank in the area and Dashen Bank is relatively new to the Mizan-Aman market. However, despite its late arrival in the area, Dashen Bank has grown to be a formidable

competitor since it has now surpassed United Bank in its number of customers. As can be seen from a description of the study population, United Bank which was a pioneer of private banking in the area, currently has only 4396 customers while Dashen Bank has 7050. This could be mainly because of Dashen Bank's effective marketing

**Table 5.** Impact of IT on service accuracy and quality of work by banks.

			The Impact of IT on service accuracy					Total
			Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
Bank name	Dashen Bank	Count	0	2	1	6	1	10
		% of Total	0.0	8.3	4.2	25.0	4.2	41.7%
Bank name	United Bank	Count	1	0	1	8	4	14
		% of Total	4.2	0.0	4.2	33.3	16.7	58.3%
Total		Count	1	2	2	14	5	24
		% of Total	4.2%	8.3	8.3	58.3	20.8	100.0
			Impact of IT on the quality of work					Total
			Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
Bank name	Dashen Bank	Count	0	0	0	7	3	10
		% of Total	0.0	0.0	0.0	29.2	12.5	41.7%
Bank name	United Bank	Count	1	0	0	7	6	14
		% of Total	4.2	0.0	0.0	29.2	25.0	58.3%
Total		Count	1	0	0	14	9	24
		% of Total	4.2%	0.0	0.0	58.3	37.5	100.0

Source: Survey (2017).

strategies and innovative use of IT.

### Accessibility and convenience of IT based services

As far as customer satisfaction is concerned, the basic installation of IT into the structure of a banking institution is only half the required task. The institution also has to make its IT based services accessible and convenient to its customers. Unless this is done, the introduction of IT could do more harm to the overall operation of the bank than good. Inaccessible and inconvenient IT based services could potentially push customers away from a bank than attract more customers or increase the satisfaction of steady customers. Therefore, the question is not simply about whether or not a bank has integrated IT into its system but whether or not it has made its IT based services accessible and convenient to its customers.

Accordingly, the majority (145(39.0%)) [78(21.0%) DB and 67(18.0%) UB] agreed to the statement "The bank's technology based services are always available" followed by 108(29.0%) [84(22.6%) DB and 24(6.5%) UB] respondents who reported to strongly agree with the same item. Meanwhile, 74(19.9%) [41(11.0%) DB and 33(8.9%) UB] said they disagreed, 29(7.8%) [18(4.8%) DB and 11(3.0%) UB] said they strongly disagreed and the rest 16(4.3%) [10(2.7%) DB and 6(1.6%) UB] preferred to be neutral on the subject. In addition, the median score and the mode for the item was found to be 4.00, further suggesting a general agreement on the regular availability of IT based services by the banks.

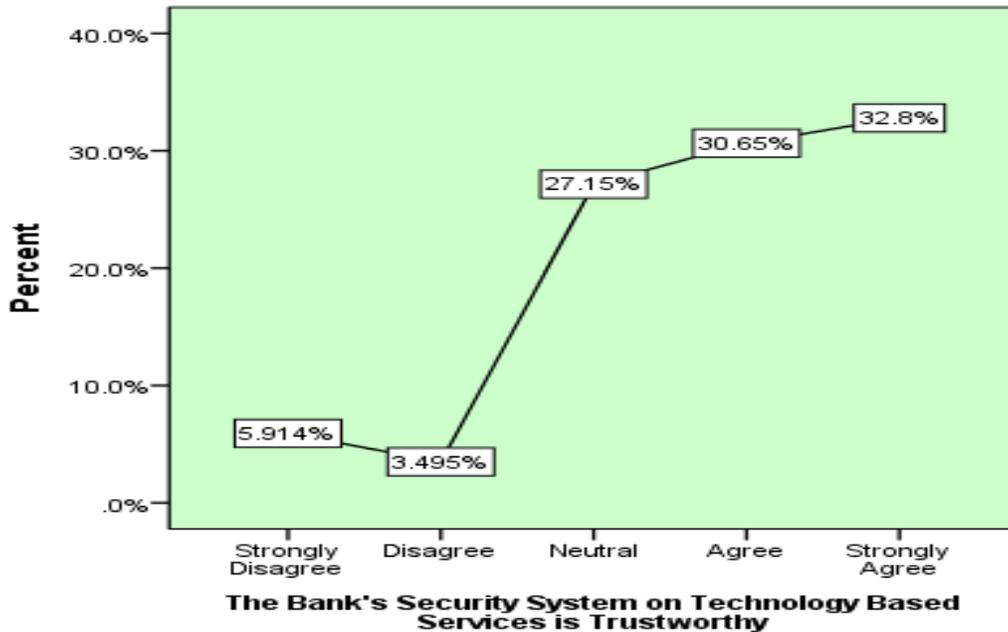
Moreover, there is also ample evidence in the data to

suggest that most of the respondents who found the IT based services user friendly do so because the services allow them to transfer money to and from other commercial banks. According to the data, there is a statistically significant correlation between the overall user-friendliness of IT based services and their capability to transfer money to and from other commercial banks. The scores for the two items reveal that they have a Kendall's tau\_b correlation coefficient of 0.165 which is significant at  $\alpha = 0.001$ .

### Reliability of IT based services

As part of its attempt to evaluate the impact of IT on customer satisfaction, the study also tried to measure to what extent customers find the IT based services of the two banks reliable. It strived to do so by assessing how confident customers felt in using IT based services, how trustworthy customers found the IT based services, the impact of network and power fluctuations on IT based services, the guarantee provided by banks in case of losses from IT related transactions, IT security and secrecy of user passwords and the accuracy and timeliness of information obtained from IT based services.

Consequently, 148(39.8%) [94(25.3%) DB and 54(14.5%) UB] reported that they feel highly confident in using IT based services while the second majority of the respondents (97(26.1)) [50(13.4%) DB and 47(12.6%) UB] felt sufficiently confident to use the services. Although these groups of respondents represent a significant majority, it also seems important to mention that 87(23.4%)



**Figure 2.** Trustworthiness of IT based services.  
Source: Survey (2017).

customers in fact felt either unconfident or strongly unconfident about using IT based services. This is hard to overlook because confidence in services is a very crucial component of customer satisfaction.

The data also show that network and power fluctuations negatively affect the reliability of IT based services. This is so not only for the reliability of the services but also their convenience. According to the data, 123(33.1%) of the respondents thought that power fluctuations greatly affected the banks' IT based services while 129(34.7%) of them thought that they are highly affected by broadband network fluctuations. In addition, 140(37.6%) respondents basically agreed that the banks' IT based services are mostly affected by power fluctuations whereas 118(31.7%) agreed that it was broadband network instability that mostly affected the services. This shows that of the 372 respondents sampled for the study, a total of 263(70.7%) of them reported that electric power fluxes had a negative impact on IT based services while a total of 247(66.4%) respondents stated that broadband network variations do have a negative effect on the services. This indicates that power and broadband network fluctuations stand at the top of all the factors that could negatively affect IT based services. However, this could be partially attributed to the fact that the study was conducted in Mizan-Aman town which is known to suffer from unusually recurrent power shortages and network cuts.

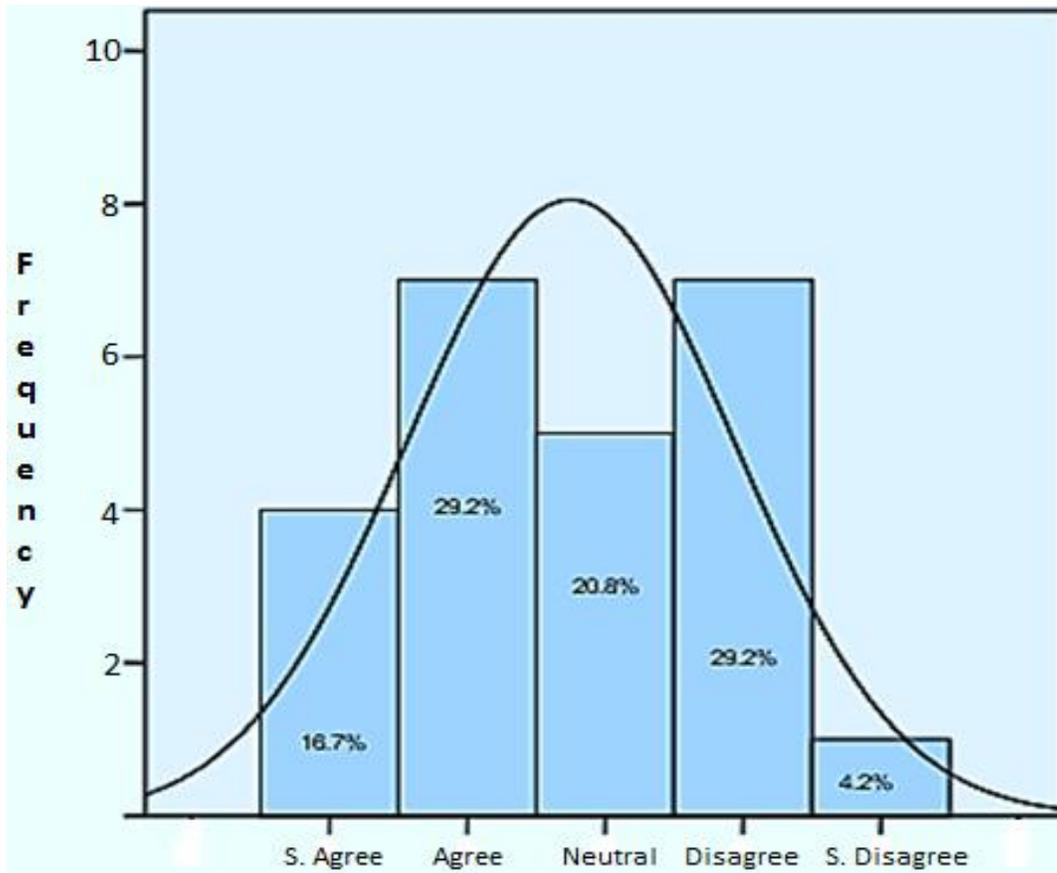
In relation to reliability, as regards the statement "The bank's security system on technology based services is trustworthy", the majority of the respondents (122(32.8%))

[82(22.0%) DB and 40(10.8%) UB] strongly agreed that the services are in fact trustworthy whereas 144(30.6%) [64(17.2%) DB and 50(13.4%) UB] simply agreed to the statement. The mode for this particular variable was 5.00 again indicating a strong agreement while the median is 4.00 also implying a general agreement on the trustworthiness of IT based services (Figure 2) provided by the banks.

### IT maintenance efficiency

Despite its complex algorithms and procedures, malfunction is a common feature of IT products. Similarly, the IT based services provided by the banking industry also face glitches that range from minor to systemic. As a result, the study attempted to investigate the impact of IT malfunction on customer satisfaction as well as the IT maintenance efficiency of the selected banks starting with the operational competence of the banks' IT products.

First among these products are ATMs which provide direct services to customers. According to the data, the majority of the respondents (98(26.3%) [60(16.1%) DB and 38(10.2%) UB]) disagreed that the ATMs of the two banks are always functional while 37(9.9%) [19(5.1%) DB and 18(4.8%) UB] strongly disagreed to the fact (Figure 3). This shows that the two banks suffer from a strong efficiency problem in relation to their ATM operations. Although this is the case with the efficiency of ATMs, the larger majority of the customers (152(40.9%) [102(27.4%)



**Figure 3.** IT and its likelihood to create a culture of dependency among employees.  
Source: Survey (2017).

DB and 50(13.4%) UB]) strongly agreed that the accuracy of the banks' technology based services is always flawless whereas another significant segment of the customers (101(27.2%) [68(18.3%) DB and 33(8.9%) UB]) agreed to the statement.

From the two findings presented above, it is possible to conclude that even if the banks' IT based services have an efficiency problem they do have a notable level of accuracy which could considerably increase their reliability. In fact a correlation test between the scores for the accuracy of IT based services and respondents' level of confidence in using the services indicates that there is actually a statistically significant correlation. The accuracy of IT based services and respondents' confidence in using them have a positive correlation of 0.541 which is statistically significant at  $\alpha = 0.01$ .

In addition, the accuracy of IT based services and the efficiency of ATMs also have a significant correlation with the banks' quickness in solving IT related problems and ATM malfunctions respectively. According to the data, the accuracy of IT based services has a positive correlation with quickness of response to fixing IT products by a correlation coefficient of 0.570 which is statistically

significant at  $\alpha = 0.01$ . Likewise, the efficiency of ATMs has a positive correlation with quickness of responses to solve ATM malfunctions by a correlation coefficient 0.170 which is also statistically significant at  $\alpha = 0.01$ . This indicates that both the accuracy of the banks' IT based services and the efficiency of their ATMs have a lot to do with their swiftness in resolving IT related malfunctions.

### Impact of IT on employee performance

Prior the tuning of IT for the purpose of improving customer satisfaction, the central reason behind the introduction of IT into business world is to enhance the competitiveness of firms through upgrading work flow and employee performance. IT has proved to have a substantial impact on the smoothness of company operations as well as the workload and accuracy of employees. To assess whether this is the case in the two banks selected for the study, the research endeavored to examine the impact of IT on the load and accuracy of work among bank employees. The study also attempted to see if there are any drawbacks associated with the

introduction of IT into the two banks.

### Impact of IT on workload

The findings of the study indicate that of the 24 employees working in the two banks, 14(58.3%) [3(12.5%) DB and 11(45.8%) UB] strongly agreed, 9(37.5%) [7(29.2%) DB and 2(8.3%) UB] simply agreed while only 1(4.2%) employee of UB strongly disagreed that IT has minimized their workload. This is not surprising because instead of being overwhelmed by a lot of paperwork, the institution of IT into the banks has enabled the employees to perform most of their work digitally using comprehensive banking software. Deposits and withdrawals only involve a few clicks on the computer and periodic transactions are updated automatically. Employees are no longer required to manually count the paper money they transact with customers and the genuineness of foreign money notes could be checked using an easy-to-use electronic device. All of this of course takes a great weight off the workload of bank employees.

Moreover, IT has also improved the speed of service delivery by the banks. Based on the data, more than half of the employees (13(54.2%) [7(29.2%) DB and 6(25.0%) UB]) agreed that IT has enabled them to serve their customers quickly and without any delay while 9(37.5%) [2(8.3%) DB and 7(29.2%) UB] agreed to the fact. This is also something related to what has been already stated above. The promptness of computer software and other IT products in processing information undeniably reduces the amount of time required to serve customers. Correspondingly, IT has not only reduced the workload of employees and improved the speed of their service delivery, but it also has a positive impact on the decision making capacity of bank officials. A significant majority of the respondents (15(62.5%) [9(37.5%) DB and 6(25.0%) UB]) strongly agreed that they believe IT positively helps their managers to make better decisions. As for the rest of the employees 8(33.3%) [1(4.2%) DB and 7(29.2%) UB] strongly agreed, whereas only 1(4.2%) employee of United Bank strongly disagreed. This is so because IT allows bank managers to screen information quickly and search the proper course of action. They could easily check the transaction records of tellers, review their financial history and pinpoint the sources of faulty transactions if any.

In addition, differences in the impact of IT on the workload and speed of service delivery of separate gender and age groups have also been observed. A Kendall's tau<sub>b</sub> correlation points out that the gender and ages of respondents are negatively correlated with the impact of IT on workload. The test shows that both variables are negatively correlated with the impact of IT on workload with a correlation coefficient of -0.492 which is statistically significant at  $\alpha = 0.05$ . From this finding it is possible to say that IT has a more substantial impact on

the workload of men and employees between the ages of 18 and 29 than on that of women and employees between the ages of 30 and 39.

### Impact of IT on work accuracy

Studies over the years have shown that IT not only reduces the workload of employees but also highly increases their accuracy. Since most of the information is processed electronically, the only sectors often prone for user errors are data entry and output interpretation. Consequently, more than half (14(58.3%) [6(25.0%) DB and 8(33.3%) UB]) of the employees included in the study agreed and another 5(20.8%) [1(4.2%) DB and 4(16.7%) UB] strongly agreed that IT has in fact improved their work accuracy. Observation also shows that compared to the way bank operations would have been conducted without it, there is no question that IT has a paramount positive impact on service accuracy.

While the findings presented above were tabulated from responses to the statement "Information Technology increases employees' accuracy," as a way of cross checking the validity of the responses employees were asked to respond to the statement "Working with technology based products makes employees commit much more mistakes than manual work." Results indicate that 14(58.3%) [6(25.0%) DB and 8(33.3%) UB] employees disagreed and another 5(20.8%) [1(4.2%) DB and 4(16.7%) UB] strongly disagreed that IT products make employees commit much more mistakes than manual work. Since the same number of respondents affirmed the positive impact of IT on work accuracy, it is possible to conclude that the responses obtained for the two items on work accuracy were genuine.

Moreover, in relation to the impact of IT on the quality of work respondents were asked to express their stand to the statement "Information Technology helps employees to deliver their job according to the bank's standard" to which the majority (14(58.3%) [7(29.2%) DB and 7(29.2%) UB]) agreed while (9(37.5%) [3(12.5%) DB and 6(25.0%) UB]) strongly agreed. Only 1(4.2%) employee from united bank disagreed.

This point out that IT has not only enabled employees to improve their work accuracy but also has allowed them to work up to the standard of their organization. This might be because of the fact that the standard of work in the banks is closely tied more to the system software than to employees' individual capacity. It could be said that the major difference in the quality of work performed by the employees emanates from the speed of service delivery than from the actual precision with which they accomplish their tasks.

### Drawbacks associated with IT based services

Although it has fetched a lot of positive results for the

banking world, IT has also brought with it a number of problems. Unexpected glitches in system software, dependency on broadband networks, faulty digital transactions, hacking, etc. are among the many problems that have surfaced alongside the institution of IT based banking services. For the purpose of examining possible drawbacks associated with the introduction of IT into Dashen and United banks, the study attempted to explore the fact in relation to IT adoption difficulties among employees, the direct relationship between IT and electric power/broadband network as well as the likelihood of IT to create a culture of technology dependency among employees.

To begin with, the data showed that a larger portion of the employees who participated in the study have found new technology based products difficult to adopt. To the statement "New technology based products are difficult to adapt with", 7(29.2%) [4(16.7%) DB and 3(12.5%) UB] of the respondents answered "agree" while 3(12.5%) [1(4.2%) DB and 2(8.3%) UB] strongly agreed. Additionally, 6(25.0%) of the respondents disagreed to the same statement, another 6(25.0%) respondents remained neutral, whereas the rest 2(8.3%) [1(4.2%) DB and 1(4.2%) UB] strongly disagreed. This finding indicates that one potential problem associated with the introduction of IT into commercial banks is the issue of technology adoption. With all the compounded tasks they are expected to perform, recent IT based banking products tend to have complex command procedures which are not so easy to learn. This in turn could possibly present a great deal of disarray to the periodic flow of work in the banks.

Furthermore, as with the greater part of customers surveyed for the study, the majority of employees in the two selected banks strongly agreed that power and network fluctuations negatively affect IT based services, thus their job performance as employees. According to the data, of the 24 employee respondents of the study, 13(54.2%) [6(25.0%) DB and 7(29.2%) UB] strongly agreed that electric power and broadband network disruptions negatively affect technology based products of the banks, which in return affects the performance of employees. 4(16.7%) [2(8.3%) DB and 2(8.3%) UB] agreed, 3(12.5%) all from United Bank disagreed, 2(8.3%), one from each bank strongly disagreed while the same percentage of employees from both banks preferred to stay neutral on the matter. This stands to show that power and network fluctuations are among the most critical problems that adversely impact the job performance of employees in the selected commercial banks. Besides, as earlier discussed in this paper, the same problem also significantly affects the convenience as well as reliability of the IT based services provided by the two banks.

Although tasks performed through IT products appears to be simple and monotonous, bank employees are required to be qualified experts in banking and finance.

They need to constantly upgrade their expert knowledge by drawing on their practical experiences on the job. To assess whether IT based service delivery hampers employees from upgrading their banking knowledge, respondents of the study were asked to state their stance on the statement "Information Technology does not let employees to upgrade their banking knowledge, since they are dependent on the system."

As depicted in the histogram above, although the size of respondents who agreed and disagreed with the given statement is equal at 7(29.2%), the overall response tally leans towards the agree side. This is so because 4(16.7%) [1(4.2%) DB and 3(12.5%) UB] have strongly agreed while only 1(4.2%) respondent from United Bank strongly disagreed with the fact and 5(20.8%) all of them again from United Bank remained neutral. From this, it is possible to deduce that although the introduction of IT based service delivery initially exposes employees to a new way of performing financial dealings, once that happens they have little chance of upgrading their banking knowledge. This could be because being perpetually preoccupied with utilizing the same system software for a lengthy period of time discourages employees from seeking further professional development.

## Summary

As have been presented, the study on the impact of IT on the performance of commercial banks was done based on empirical analyses of both primary and secondary data. Subsequently, the analysis and interpretation of the data has conveyed the following major findings:

1. It is possible to conclude with a 99% level of confidence that customers who were satisfied with the availability of IT based services also found the IT based services of the banks to be convenient, speedy, user-friendly and efficient in update notifications.
2. There is a statistically significant positive correlation (0.673 significant at  $\alpha = 0.01$ ) between the accessibility of IT based services and their convenience to customers.
3. There is a statistically significant positive correlation (0.393 significant at  $\alpha = 0.01$ ) between the speed of IT based services and their convenience to customers.
4. There is a statistically significant positive correlation (0.185 significant at  $\alpha = 0.01$ ) between overall user-friendliness of IT based services and user-friendliness of services in terms of language options.
5. There is a statistically significant positive correlation (0.165 significant at  $\alpha = 0.01$ ) between the overall user-friendliness of IT based services and their capability to transfer money to and from other commercial banks.
6. Electric power and broadband network fluctuations stand at the top of all the factors that negatively affect IT based services.

7. The accuracy of IT based services and customers' confidence in using them have a positive correlation of 0.541 which is statistically significant at  $\alpha = 0.01$ .

8. The accuracy of IT based services has a positive correlation with quickness of response to fixing IT products by a correlation coefficient 0.570 which is statistically significant at  $\alpha = 0.01$ .

9. The efficiency of ATMs has a positive correlation with quickness of responses to solve ATM malfunctions by a correlation coefficient 0.170 which is also statistically significant at  $\alpha = 0.01$ .

10. Differences in the impact of IT on the workload and speed of service delivery of separate gender and age groups have also been observed. IT has a more substantial impact on the workload of men and employees between the ages of 18 and 29 than on that of women and employees between the ages of 30 and 39.

11. IT has not only enabled employees improve their work accuracy but also has allowed them to work up to the standard of their organization.

12. One eventual problem associated with the introduction of IT into commercial banks is the issue of technology adoption. Complex software command procedures which are not so easy to learn present a great deal of disarray to the smooth flow of work in the banks.

13. Electric power and broadband network fluctuations are among the most critical problems that adversely impact the job performance of employees in the selected commercial banks.

14. The introduction of IT could create a culture of technology dependency among employees.

15. IT based services constituted a significant percent of the banks' gross profit for both 2015 and 2016 fiscal years. They comprised 25.10% of the banks' gross annual profit in 2015 while they accounted for 26.07% of the combined annual profit in 2016.

## Conclusion

IT is among the central features of modern society and has become an unavoidable element of living in the modern world. Education, politics as well as the market in contemporary society all involve a certain degree of dependence on IT. The market in particular is becoming highly reliant on the use of IT. Electronic trading is currently a necessary part of international business transaction and the banking industry in almost all countries is now IT dependent. This is also the case when it comes to countries like Ethiopia. Both public and private banks in the country are regularly using IT to carry out their financial dealings. The current study attempted to investigate the impact of IT on the performance of private commercial banks in Ethiopia through an analysis of facts pertaining to the Mizan-Aman branches of Dashen and United Banks.

Consequently, an overview of the mission and values of the two banks indicates that the mission statements of both banks acknowledge the undeniable usefulness of IT for banking success and their values reflect the need to constantly improve customer satisfaction in order to secure continued institutional survival. Although both banks aim to use 'appropriate' or 'state-of-the-art' technology, Dashen Bank clearly appears to be determined to excel in the provision of not only domestic but also international banking services. While Dashen Bank appears to have a more determined focus on efficiency and excellence, United Bank seems to aim at enhancing the value of shareholders and the wellbeing of its employees. Dashen Bank also appears to be more business oriented and strongly geared towards long term institutional stability and growth while United Bank seems to focus more on its social and corporate responsibilities towards its employees and the country at large. However, aside from the above mentioned differences, the two banks indeed provide due attention to both IT and customer satisfaction.

Additionally, a quantitative analysis of data obtained from customer of the two banks have indicated that customers generally found the IT based services of both banks to be convenient, reliable, speedy, as well as user-friendly. However, electric power and broadband network fluctuations were identified as the primary factors that significantly affect IT based services of both banks. The negative impact of these factors was found to be particularly severe because the study was conducted in Mizan-Aman town which is known to suffer from unusually recurrent power shortages and network cuts. Nevertheless, even if the banks' IT based services have an efficiency problem that has largely attributed to the aforementioned factors, they do have a notable level of accuracy which noticeably increases their reliability.

The study has also revealed that IT has a positive impact on job performance by reducing the workload of bank employees. This is not surprising because of the fact that instead of being overwhelmed by a lot of paperwork the institution of IT into the banks has enabled the employees to perform most of their work digitally using comprehensive banking software. Deposits and withdrawals only involve a few clicks on the computer and periodic transactions are updated automatically. Employees are no longer required to manually count the paper money they transact with customers and the genuineness of foreign money notes could be checked using an easy-to-use electronic device. All of this, of course, takes a great weight off the workload of bank employees.

In addition, IT has not only enabled employees improve their work accuracy but has also allowed them to work up to the standard of their organization. This might be because of the fact that the standard of work in the banks is closely tied to the system software than to employees' individual capacity. It could be said that the major

difference in the quality of work performed by the employees emanates from the speed of service delivery than from the actual precision with which they accomplish their tasks. Moreover, the findings of the study indicate that one potential problem associated with the introduction of IT into commercial banks is the issue of technology adoption. With all the compounded tasks they are expected to perform, recent IT based banking products tend to have complex command procedures which are not so easy to learn. This in turn could possibly present a great deal of disarray to the periodic flow of work in the banks.

Furthermore, the study has shown that the introduction of IT into commercial banks tends to create a culture of dependency among bank employees. Although the introduction of IT based service delivery initially exposes employees to a new way of performing financial dealings, after that happens they have little chance of upgrading their banking knowledge. This is so because being perpetually preoccupied with utilizing the same system software for a lengthy period of time discourages employees from gaining professional development. Finally, a brief analysis of the financial impact of IT on the two banks has shown that IT based services constituted a significant percent of the banks' gross profit for 2015 and 2016 fiscal years.

Generally, the study has shown that IT indeed has a positive impact on the performance of private commercial banks. It has revealed that if utilized properly, IT could significantly enhance overall bank performance by way of improving customer satisfaction, reducing workload, increasing work accuracy as well as by availing new sources of bank revenue.

## ABBREVIATIONS

**ATM**, Automated Teller Machines; **CSA**, Central Statistical Agency; **DB**, Dashen Bank; **EPRDF**, Ethiopian People Revolutionary Democratic Front; **ETB**, Ethiopian Birr; **FY**, Fiscal Year; **ICT**, Information Communication Technology; **IT**, Information Technology; **NBE**, National Bank of Ethiopia; **PIN**, Personal Identification Number; **POS**, Point of Sales; **SMS**, Short Messaging Service; **SNNPR**, Southern Nations, Nationalities and Peoples Region; **UB**, United Bank.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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*Full Length Research Paper*

# **Corporate governance and its effects on financial performance of banks evidence from selected private commercial banks in Ethiopia**

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Received 28 January, 2020; Accepted 4 March, 2020

**Corporate governance is not an abstract goal but exists to serve corporate purposes by providing a structure within which stockholders, directors, and management can pursue most effectively the objectives of the corporation and thereby it maximize the financial performance of the company for its shareholders. This paper investigates and examines the corporate governance and its effects on financial performance from the evidenced data gathered from selected privately owned commercial banks in Ethiopia. By adopting panel data, Purposive sampling technique has been utilized to select the respondents from the existing target population. This paper will include independent corporate governance variables such as Board size, Meeting frequency of board, Audit Committee Size, Liquidity Ratio, Existence of outside director, Board Educational Qualification, Board Gender Diversity, chief executive compensation and controlling variable of bank age and bank growth. Random Effect Model GLS regressions analysis was adopted to analyze the annual data generated from the annual statements of the selected private commercial banks of Ethiopia and annual reports of National Bank of Ethiopia covering a period from 2010 to 2018G.C. In addition, primary data of structured open ended questionnaires used to support the finding of secondary data. The presence female director, chief compensation, audit committee size, Educational Qualification, meeting frequency of board, liquidity ratio was found to be a positive and significant relationship with return on asset. In the other side, board size has a negative and insignificant association with return on asset. As a recommendation, Private commercial banks have to have a moderate number of board size and they have to hold meeting and discussion for the future fate of banks. Audit committee in private commercial banks should be given as a major determinant. As much as possible, banks have to hire and train female board and it is better in that banks should encourage and motivate executive with compensation.**

**Key words:** Corporate governance, financial performance, privately owned commercial bank.

## **INTRODUCTION**

Corporate governance refers to the way in which a corporation is directed, administered, and controlled; it concerns mainly the relationships among the various internal and external stakeholders involved as well as the governance processes designed to help a corporation

achieve its goals. Of prime importance are those mechanisms and controls that are designed to reduce or eliminate the principal-agent problem (Aldamen et al., 2003). Corporate governance is a means used to maximize the financial performance of banks and

concerned stakeholders such as employees, shareholders, the board of directors and executive management (Ashenafi and Kelifa, 2013). Many researchers have worked on this area (Brooks, 2008; Creswell, 2009; Freeman et al., 2004; Imam and Malik, 2007). Even though all these studies were on the effects of Corporate Governance on banks' performance most of the researchers found a mixed and contradicted result for measuring financial performance. Effective corporate governance is mandatory to enhance financial performance, that is financial institution generally and banking sector particularly. This would ensure the management (the agent) runs the firm for the benefit of one or several stakeholders (principals). According to Imam and Malik (2007); Kelifa (2012); Kyereboah-Coleman (2007); Khatib et al. (2011); Kim and Rasiah (2010) and Kothari (2004), there is a key regulatory framework for the financial institution as well for banks such as interest rate regulation, minimum capital requirement, foreign exchange currency controls, inflation which are the concern of government. Malik (2007); Kelifa (2012); Kyereboah-Coleman (2007); Khatib et al. (2011); Kim and Rasiah (2010) and Kothari (2004) stated governance issue ensures performance in banks; and maintaining the government requirement has different problems such as non-existence of organized stock exchange, high government intervention and control, absence of national standards of corporate governance, absence of effective accounting and auditing and lack of educational qualification of board. Maintaining, ensuring directing and supervision of good corporate governance for financial institution specifically for banks is the responsibilities of the National Bank of Ethiopia because it controls all aspect in relation to money supply and other financial issues. In developing countries especially in Ethiopia, corporate governance issues need critical concentration so as to maintain financial performance as different studies conducted in Ethiopia provided. Mohammed et al. (2014); Melvin and Hirt (2005); Naser (2012); Olajide (2013); O'Connell and Cramer (2010) and Rose (2007) focused on corporate governance effects on microfinance institution located in Ethiopia from 2005 to 2014 by using the Corporate governance variable such as educational qualification, board gender diversity, business management experience of board member, board size and by quantitative research approach by multiple linear regression model with proxy of financial performance of banks return on equity. They concluded gender diversity, board educational qualification, business management experience were negatively related to banks' financial performance of return on equity. Even though research was performed on this area corporate governance on the financial performance of micro

finance institution was not fully assessed as the preliminary objective was stated and the result or findings were very contradictable. The reason for indicating that the finding is contradictable is first its real board educational qualification and the expertise they invest on the company depends and has positive effects on financial performance MFI of developing economies than developed countries. The second reason is that individual feeling or attitude towards corporate governance may not be only concluded by quantitative approach rather it was more advanced and the researcher may acquire as well may be saved from contradictable findings, if descriptive study with qualitative study approach were employed. The other study was (Rose, 2007; Vafeas, 1999) conducted on the areas of ownership structure and corporate governance effects on financial institution especially on microfinance institutions. Behind these studies, there are many limitations that the variables used to show corporate governance were opposite. From them almost all the studies show ownership structure, management capability and board structure on financial performance as determining variables for corporate governance. The second limitation is that only MFIs were assessed without corporate governance on banks using quantitative study data from 2004-2010; 6 year data were used and qualitative study is not included. Still additional variable should be considered to show corporate governance effects on financial performance of banks (Vafeas, 1999; Wooldridge, 2006). For the sake of current study, corporate governance variables such as board size, meeting frequency of board, existence of audit committee, liquidity ratio, existence of outside director performing internally, board gender diversity, executive compensation, and other effects towards financial performance of selected private commercial bank by using return on asset were proxy variables, dependent variable. The control variables were bank growth or net asset and bank size or the number of private banks branches.

## LITERATURE REVIEW

### Theoretical literature review

Corporate governance is the manner in which the power of a corporation is exercised in the stewardship of the corporation's total portfolio of assets and resources with the objective of maintaining and increasing shareholders' value and satisfaction of other stakeholders in the context of its corporate mission (O'Connell and Cramer, 2010). In this regard, there are a number of theoretical perspectives which are used in explaining the impact of corporate

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governance mechanisms on firms' financial performance. The challenges of corporate governance could help to align the interests of individuals, corporation, and society through a fundamental ethical basis and fulfill the long term strategic goal of the owners (Mohammed et al., 2014).

### Agency theory

Agency theory was proposed by Imam and Malik (2007); Khatab et al., (2011) and Rose (2007); in field of Economics, directed at the agency relationship, in which one party (principal) delegates work to another (agent) who performs that work. Its focus is on shareholders' interests that necessitates security by split-up incumbency of the role of board; the segregation of management role and ownership lead to a serious matter of control over the risk attitude. This theory is on mechanism where the board of directors and owners act as the monitoring authority whereas agents are the managers (Wooldridge, 2006).

In order to prevent the managers to abuse their position and protect their interests, the stockholders may use several different mechanisms. Another way to overcome this problem is rewarding managers financially. The best way is to calculate their bonuses as a percentage of the realized profit of the company (Soludo, 2004).

### Empirical review

The study conducted in developing economies (Melvin and Hirt, 2005). examined the relationship between corporate governance practices and performance of commercial banks in Kenya. The population of the study was the 45 banks licensed by the Central Bank of Kenya as at the end of 2010. The study adopted a census study approach because of the small population and the banks are easily accessible. Two methods of data analysis were employed, the description analysis which provides some average of relevant variables and regression analysis to establish the relationship between the corporate governance variable (explanatory variable) and firms' performance/dependent variable/ over the period of study. The research concluded that corporate governance practices, directors' effectiveness, management effectiveness have a positive relationship with banks' performance. The study investigated the effect of corporate governance on the performance of commercial banks in Kenya; 37 commercial banks were studied in Kenya over a period of 2005-2009. The finding is not compatible with the objective; all the variables were negatively related and the objective was not accomplished in that corporate governance has no relations with board size, CEO duality, and directors' independence as well on ROE and ROA.

From this study, the limitation is that the variables

adopted such as board size, board independence and ownership concentration have a contradictable result on financial performance proxy of return on equity significantly and the opposite on return on asset, which is unthinkable (Olajide, 2013). The researchers used lodgit model analysis with a sample of 120 firms listed on the S&P300 during the period of 2008 and 2009. The study revealed that smaller audit committees with more experience and financial expertise are more likely to be associated with positive firm performance in the market. It is also found that longer serving chairs of audit committees negatively impact accounting performance. In addition to the above review conducted by different study on different time, the other study conducted in emerging countries (Naser, 2012; Soludo, 2004) and other study was done on developing countries on corporate governance and most of them found contradicting result with the stated objective.

Even if there is limited number of research work on the evaluation of the effect of corporate governance on private commercial banks' financial performance, there were mixed results from previous studies pertaining to the relationship between corporate governance mechanisms and financial performance; some of the reviewed papers were on the existing regulation and study conducted as follows.

O'Connell and Cramer (2010) and Rose (2007) argue that the regulation of NBE is non-sufficient to protect minority rights because the main objective of NBE is financial regulation and which is just one aspect of governance.

In Ethiopia also most of the study was done on microfinance institution and from them the study conducted by Olajide (2013); O'Connell and Cramer (2010); Rose (2007) and Soludo (2004) as well as other adequately performed on corporate governance effects on profitability of insurance companies for different time span and almost they used the variable such as board size, CEO duality, meeting frequency, and board independence as well as capital structure as Explanatory variable of corporate governance and almost all have reached on the same result in which the variable stated affect corporate governance positively.

### Existing literature summary, limitations and identification of gaps

From the study conducted there almost all have performed on focused on the level of compliance with national codes of corporate governance and international principles, has examined the level of corporate governance disclosure in companies and has analyzed the state of the implementation of systems of regulation in developing nations while Some studies have investigated the difficulties that affect the improvement of corporate governance, and recommendations have been made to solve these problems. In addition to above, most

of the literature that has examined the relationship between corporate governance and firm performance has utilized a few elements of corporate governance as well as the major point in all research conducted on different time is that investigation of the relationship between corporate governance and firm performance shows a significant concentration on developed countries, but this issue has attracted only limited research on developing countries especially in Ethiopia.

### Literature driven hypothesis

#### ***Board size and financial performance***

Some of the studies, such as (Olajide, 2013) and others, state that the size of the board in bank operations affects the performance of bank positively and significantly. In consideration of this, some other such as (Vafeas, 1999) found that the larger board size will reduce the performance and results in easier CEO control.

**Ha<sub>1</sub>:** Board size has negative effects on banks Return on Asset.

#### ***Meeting frequency of board and financial performance***

The empirical study conducted a different individual such as (Vafeas, 1999; Wooldridge, 2006) and other concluded that the minutes and meeting frequency that the board waste is negatively related to the financial performance of banks as well most of the study is contradictable and resulted in inconclusive findings.

**Ha<sub>2</sub>:** Meeting frequency of board has negative effects on banks Return on Asset.

#### ***Audit committee size on financial performance***

The existence of an audit committee composed of external board members in the firm will create a transparent and credible environment between management, external auditors and the board members.

**Ha<sub>3</sub>:** Existence of a large number of the audit committee has negative effects on banks Return on Asset.

#### ***Liquidity ratio and financial performance***

Most of the empirical study conducted by Kyereboah-Coleman (2007) and Yenesew (2012) found that the liquidity ratio requirement from NBE to private commercial banks in Ethiopia have a negative effect on their profitability while some other study by Olajide (2013) and

Rose (2007) was found positive relationship thereof.

**Ha<sub>4</sub>:** Regulation of Liquidity requirement has negative effects on banks Return on Asset.

#### ***Board composition (outside board member) and financial performance***

According to agency theory, advocates, outside directors are more likely to show objectivity in their deliberations and are willing to consider diverse groups in making their decisions. Contrary to this, there is some other study which defends this that the existence of outside director does not influence the operation at all and there is no consensus behind the existing literature.

**Ha<sub>5</sub>:** Proportion of outside director on the board has negative effects on banks Return on Asset.

#### ***Board of educational qualification and financial performance***

The most study conducted by different researcher support this and finds a positive relation thereof. Creswell (2009) and Kelifa (2012) suggested in the study that directors educational qualification has the power to make banks operations more effective than that which have not and he found that positive and significant effects thereof.

**Ha<sub>6</sub>:** Board member educational qualifications have positive effects on banks Return on Asset.

#### ***Board gender diversity and financial performance***

Empirical studies such as Brooks (2008) and Yenesew (2012) support this, in that the existence of female director in board positively affects the profitability because controlling function and could be one of several tools used to minimize potential agency issues; while some other study (Brooks, 2008) found the opposite, that the presence of board diversity influence none on profitability.

**Ha<sub>7</sub>:** Board gender diversity measured by the presence of female director in the board has positive effects on banks Return on Asset.

#### ***Director or chief executive compensation and financial performance***

The agency-based theory generally supports that there is a positive relationship between executive compensation and firm performance (Naser, 2012; Soludo, 2004;

**Table 1.** Descriptive statistics summary of variables.

Variable	Obs	Mean	St. Dev	Min	Max
ROA	108	3.195	1.129795	-3.2	6.7
Bsze	108	10.24074	1.45891	7	2
MfrB	108	24.85185	11.32429	2	2
ACsZ	108	2.101852	0.8531395	1	3
Rglq	108	0.4912037	0.4572055	23	0.1
ExoudD	108	8.916667	2.782203	3	12
BedQ	108	5.185185	2.010013	1	9
Bged	108	1.833333	1.072163	0	5
Cexcop	108	1.574074	.6442224	1	3

Source: Stata version 13 output.

Freeman et al., 2004). Only a few of the study concluded that the presence of compensation for chief executives and director motivate as well as encourage them for better performance and it has a positive relationship with profitability (Khatab et al., 2011; Melvin and Hirt, 2005) and while most defend this. While in emerging countries, this was not given concern. This study considers this variable of corporate governance mechanisms.

**Ha<sub>8</sub>:** Chief executive Compensation has negative effects on banks Return on Asset.

## METHODOLOGY

In order to achieve the objective of this research, the study adapts Explanatory Research Design. The rationale for choosing explanatory research design is; it used to examine the cause and effect relation between dependent and independent variable. The required data to analyze the effects of Corporate Governance on Financial Performance was Mixed Approach in nature. In addition, Primary data was qualitatively adopted. The primary and secondary data for this study (the financial statements) was collected from private commercial banks head office majorly from Board, Board secretary and delegated staff. The target population of the study was from Private Commercial Banks in Ethiopia totaled 18. Among them, 12 banks were selected as respondents. Judgmental or Purposive sampling technique was adopted to select Twelve banks by making criteria and purpose (based on the age and availability data for the study period), which fitted as well make the study effective from objective perspective. Panel data comprising both Cross-sectional and time series data were chosen over the unbalanced one, thus periods covering Nine Years from 2010-2018 of 12 sampled banks were taken as respondents for the study.

### Model specification

In examining the effects of corporate governance on financial performance from the evidence of selected commercial banks in Ethiopia, the econometric model developed from ground and gap in the existing literature is as follows:

$$ROA = \alpha + \beta_1 Bszeit + \beta_2 MfreBit + \beta_3 ACsZit + \beta_4 Rglqit + \beta_5 ExouDit + \beta_6 BedQit + \beta_7 BgedVit + \beta_8 CexcoPit + LnBgrz + LnBasZ + \epsilon_{it}$$

## RESULTS AND DISCUSSION

As above revealed that, regarding dependent variable, Return on asset mean value is 3.19 and with 6.7 and -3.2 maximum and minimum value respectively. Board Size in which the maximum number of board size in private commercial banks is 12 and the minimum Board size is 7. The meeting frequency held in commercial banks has a maximum of 60 and above times and the minimum meeting held was 10-20 times. As far as audit committee size is concerned, the results show above those banks have a maximum of 3 audit committee and a minimum of 1 audit committee for the past nine consecutive years. As far as board gender diversity, measured by the female directorate in the board, is concerned, the Commercial Banks have 5 female board maximum and there are also the banks having without the female board in the banks. Chief executive Compensation for the board was given a maximum of 3 times and a minimum of 1 time in a year for past nine consecutive years (Table 1).

### Violation of classical linear regression model

**Assumption: The average value of error term is zero ( $E(u_t) = 0$ )**

According to (9 and 15), the existence of the constant term in the regression equation will prevent the violation of the assumption the average value of errors is zero. Multiple regression model developed in this study included the constant term the assumption of the mean value the error term is zero was not violated.

**Assumption: Test for normality assumption**

For checking the presence of normality the following hypothesis is developed to support the null hypothesis in that there is normality at 5% significance level and the P

**Table 2.** Shapiro Wilk test results of normality.

Variable	Obs	W	V	Z	Prob>z
Bsze	108	0.96934	2.700	2.212	0.09347
MfrB	108	0.85624	12.659	5.655	0.07000
ACsZ	108	0.99866	0.118	-4.760	1.00000
Rglq	108	0.20327	70.158	9.469	0.50000
ExoudD	108	0.92142	6.920	4.309	0.30001
BedQ	108	0.97601	2.112	1.666	0.09787
Bged	108	0.98344	1.459	0.841	0.20022
Cexcop	108	0.96266	3.288	2.651	0.08401

Source: Stata version 13 output result.

**Table 3.** DW test result of autocorrelation.

Test	DW test statistics
DW result	1.709884

Source: Stata version 13 output result.

value resulted from normality test Shapiro Wilk test must be 0.05 to show data are normally distributed and the non-violation of this assumption is proved as follows:

Ho: Residuals are normally distributed  
Ha: Residuals are not normally distributed

From Table 2, it was concluded that violation of the normality assumption of CLRM does not occurred in all residuals Shapiro wilk test P value is above 0.05 (P value from the output of this tests ranges between (0.07-1.00).

### Assumption: Test of autocorrelation

The Durbin-Watson test examines the hypothesis that  $H_0: \rho = 0$  (implying that the error terms are not auto-correlated with a first-order scheme) against the alternate, according to Soludo (2004) and Wooldridge (2006) (Table 3).

Ho: Residuals are not linearly auto-correlated  
Ha: Residuals are not linearly auto-correlated

The DW test statistic value was 1.709884 a total observation of 108 (9\*12) were used in the model also 8 Variables and an intercept term were modeled. So, the null hypothesis of no autocorrelation is within the inconclusive region. Therefore, the study can now conduct model selection for further regression. The rule of thumb provided by Creswell (2009); Kelifa (2012) and Rose (2007) revealed that the P-value from the Hausman test is statistically significant (less than five percent) the

fixed-effect model is preferred in favor of random effect, otherwise the random effect model is selected.

Ho: Random Effect Model is appropriate  
Ha: Fixed Effect Model is appropriate

In this case, random effect model is appropriate because the p-value is above five percent (0.05) which is 0.3986 as shown on appendix part four in that Hausman specification test of random effect model is the best estimator of outcomes.

### Random effect model regression results

In this study Adjusted R square value more than 50% which is 0.7734 to mean that, 77% of the explanatory variable of corporate governance stated on the model determines the financial performance of private commercial banks in Ethiopia while the other determining factor out of this model scores 23%. The null hypothesis of F-statistic (the overall test of significance), which states the Adjusted R-squared is equal to zero was rejected at a 5% significance level (Table 4). The model of explanatory and controlling variable determining the return of asset the regression results of coefficient and standard error were entered on the equation depending on the results and it is the model is hereunder;

$$ROA = 1.06817 + 0.0193914Bszeit + 0.0156882MfreBit + 0.1641561ACsZit + 0.0197362Rglqit + 0.0724136ExouDit + 0.1402747BedQit + 0.1736035BgedVit + 0.2354656CexcoPit + 0.4067403LnBgrz + 0.3631693LnBasZ + \epsilon it$$

### Board size and return on asset

From the regression results revealed on the above Table 4, the coefficients of a board size-0.0193914 and the P value is 0.721 which is negatively and insignificantly related with banks financial performance. This means that

**Table 4.** Random Effect model Regression result of the variable.

(ROA)	Coef.	Std. Err.	[95% Conf. Interval]	
Bsize	0.019	0.054	-0.087	0.125
MfrB	0.015	0.005	0.004	0.027
AcSZ	0.164	0.070	0.026	0.301
Rglq	0.019	0.147	-0.268	0.308
ExouD	0.072	0.029	0.014	0.129
BedQ	0.140	0.038	-0.216	-0.063
Bged	0.173	0.067	0.042	0.304
Cexop	0.235	0.098	0.042	0.428
LnBgrz	0.406	0.076	0.256	0.055
lnBasZ	0.363	0.113	0.584	0.141
Cons	1.068	0.691	-0.286	2.422
sigma_u	0			
sigma_e	0.64071574			
rho	0 (fraction of variance due to u_i)			

Source: Stata version 13 Random effect regression result.

the larger number of board size has lower financial performance and vice versa.

Not only the negative relationship between Board size and return on an asset but also the relationship is insignificant. Most of the study conducted previously such as (Kim and Rasiah, 2010; Melvin and Hirt, 2005; Rose, 2007) found in their studies that the Board size is negatively and insignificant relationship with the financial performance of the banks. These findings are also consistent with the corporate governance theory in that it paves the way for reducing the agency cost.

#### Meeting frequency of board and return on asset

The meeting frequency has a positive and significant relationship with banks financial performance because as the meeting frequency increase, board exerts much time with the board resulted in an increment in the performance of operational activities of the management. So, in the regression and questionnaires result, the results of the alternative hypothesis ( $H_{a2}$ ) stating that Meeting

frequency of board has a negative impact on banks return on asset is rejected and the null hypothesis stating Board Meeting frequency is positively and significantly related with return on asset is accepted at 5% of the significance level.

#### Audit committee size and return on asset

As per the respondents, the existence of audit committee have a direct positive relationship with financial performance in that the level of fraud and misstated value on the financial statements will be assessed and resulted to minimize the level of non-corrective activities on the banks as well as the segregation of duties rested on financial statement understatement and overstatement. The hypothesis ( $H_{a3}$ ) states that Existence of a large number of the audit committee has a negative impact on banks Return on Asset is rejected from this study and the null hypothesis stating there is the positive and significant relationship among audit committee size and return on an asset will be accepted at 5% significance level.

### Liquidity ratio and return on asset

The random effects regression results from Table 4 shows that the correlation coefficient and P value between liquidity ratio and banks return on asset is 0.0197362 and 0.893 respectively. This implies that as the liquidity ratio and financial performance are positively and insignificantly related. According to the respondent's reflection on primary data, liquidity ratio has a direct relationship with the financial performance of banks because the banks having the liquid asset in their banks results to opportunity to mature their liability. This resulted in better performance and growth of the banks because the liquidity ratio must be kept so as to cope up with current liability. At 5% level of significance, the null hypothesis is failed to reject in that liquidity ratio and return on asset is positively and insignificantly related to the regression and questionnaires result reflects.

### Existence of outside director performing internal task and return on asset

As the respondents view, existence of outside board member but performing internally have a positive effects on financial performance of private commercial bank measured by return on asset in that, the task that they take as concerned body in each of the decision boosts or enhance the value of banks and thus results in increment of return on asset in best achieving the goal. The null hypothesis accepted indicates that the existence of outside board performing an internal task in the bank has a positive and significant correlation with return on asset.

### Board educational qualification and return on asset

Table 4 random effect model showed that the board educational qualification and banks return on the asset are having the correlation coefficient and P value of 0.1402747 and 0.00 respectively. In addition, above 70% of the respondents answered that the level of education is determining issues because the board experience, know-how and transparency matters the corporate governance in enhancing financial performance. Depending on the regression results, discussion and questionnaires analysis conducted, the alternative hypothesis ( $H_{a6}$ ) indicating that Board education qualification has positive effects on return on asset is accepted.

### Presence of female board in the bank and return on asset

The regression model showed on the Table 4 of board gender diversity measured by the female board in the

bank and private commercial banks financial performance proxy of return on asset is conducted. The correlation coefficient and table value of P is 0.1736035 and 0.010 respectively. As revealed by the 75% respondents, the presence of female board in the banks increases financial performance because banks with diversified board gender composition, especially the existence of female board members, enable to see at the operations of the banks from different perspective. Accordingly, the alternative hypothesis ( $H_{a7}$ ) indicating that Board gender diversity measured by the presence of female director in the board has positive effects on banks return on asset is accepted at 5% of significance level

### Executive compensation and return on asset

The correlation coefficient of 0.2354656 shows that there is a positive relationship between executive compensation and return on asset of the banks. In relation to this, the P-value results 0.017 indicate that there is a significant relationship between them. These findings really support theory of corporate governance which is agency theory in that, manager who has direct responsibility must be compensated in order to reduce the principal-agent problem; thus, to come up with better financial performance. From the above results of the analysis, the null hypothesis indicating chief executive compensation has positive effects on return on banks is accepted

## CONCLUSION AND RECOMMENDATIONS

Moderate Board Size can enable them make adequate and quick decision to be forwarded. Accordingly, they minimize the number of Board Size in that the cost incurred for each will be decreased and results in high profitability. Banks' Board should meet and deal with future fates and growth of the banks at least three and above times in a month since they have positively and significantly related statistically. This study advice the banks to encompass different audit committee as much as possible since it is positively and significantly related to banks financial performance. Also, independent auditor needs too. Banks should also encourage board members to participate in the tasks of banks internally as revealed from the findings. This study recommends banks to train and hire more qualified board that have the knowledge of banking sector, management capability as far as Board Educational Qualification of CG is concerned. This study advice the bank should hire, train, and participate Female Board as much as possible so as to have high financial performance and then enhance CG. This study recommends that banks should maintain the Liquidity position and make cash ready to recover the liability and escape from the relevant mandatory cost of borrowing. It is good that banks encourage and motivate managers by

providing them remuneration, incentive, allowance, and bonus to keep the financial viability and future growth. Banks should also expand Branches to gain Economies of scale since LnBasz is positive with ROA.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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*Full Length Research Paper*

# **Stability of money demand function in emerging Countries: Static and dynamic panel approaches**

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Received 12 January, 2020; Accepted 2 July, 2020

The purpose of this study is to investigate the stability of money demand function in emerging countries using the annual data over the period 1987 to 2018. The panel data was analyzed applying both static and dynamic panel models. With the static panel analysis, the random effect method is found to be an appropriate model to determine the factors that affect money demand in emerging countries. The findings of random effect method reveal real income affect money demand positively while exchange rate and real interest rate influence money demand negatively. The results of dynamic panel approach show that real income has positive impact on broad money demand while exchange rate, real interest rate and inflation negatively influence broad money demand in the long-run. The dynamic panel approach confirms that inflation has a significant impact on money demand in addition to the variables found to significantly influence money demand with the random effect method of static panel approach. This implies that dynamic panel model better estimates the determinants of money demand function as compared to static panel model. The stability analysis of each country confirms stable money demand function. The error correction model reveals any deviation from the equilibrium is corrected each year in the selected emerging countries. Therefore, the monetary policy makers can incorporate the outcome of this study as additional input for the implementation of effective monetary policy in the selected countries of emerging economies.

**Key words:** Autoregressive Distributed Lag (ARDL) model, BRICS, dynamic panel model, money demand, pooled mean group, random effect method.

## **INTRODUCTION**

Money provides a trade-off between the liquidity benefit of holding money and the interest advantage of holding working and fixed assets. The demand for money is a

desire and ability to decide in which way people can accumulate their wealth. Economists explain the money demand as the choice of keeping the financial assets in

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the form of money; either as cash or bank demand deposits. Money is demanded not for its own sake, but for all the functions that it can perform. Money demand theory seeks the reasons for why both individuals and institutions would like to keep a part of their income on hand and how much of it, and the reflections of this behavior on the economy. The stability of money demand ensures predictability of the variables, and therefore reduces the possibility of an inflation bias. That means a stable money demand articulates that the changes in the elements of money demand equation can be predicted. The stability of money demand function reveals the variables that determine the quantity of demanded money remain consistent over time period. Stable money demand exists if the demand for money has a long-run cointegrating association with its determinants without any systematic changes in the regression coefficients.

The determinants and stability of money demand are two crucial concepts in the theory of money demand. While the classic quantity theory of Fisher underlines income as the only determinant of the money demand function, Keynes and Friedman consider the variables such as interest rates, bond and equity returns, and the return on physical goods in addition to output (Diu and Donald, 2010). Kjosevski (2013) explains a stable money demand function as the quantity of money is predictably associated to a set of key variables connecting money to the economic real sector. Understanding the stability of money demand and its determinants is the key functions in formulating appropriate monetary policy for countries considering a monetary targeting framework. In other words, discussing the money demand function is the main target for monetary policy makers since the combination of money supply and money demand decides the interest rate, and hence influences the aims of monetary policy (Oscalik, 2014).

In case that the money demand function is stable, the authorities can change the money supply in order to eliminate economic stagnation or fight against inflation. In the case of achieving a stable money demand function which can be explained by variables such as income, interest rate, inflation expectation; it is possible that the increase in the money supply may affect those variables in the expected way, the money demand could reach the new level of money supply and the money market could find the balance again (Rao and Kumar, 2008). The determinants and the stability of money demand play a crucial role in constructing efficient monetary policies for the market. Effective monetary policies can be made with the help of a stable and predictable money demand. With the expectation of stable money demand function, the policy makers considered monetary targeting as a successful strategy to attain price stability. However, the experiences of developed countries that pursued monetary targeting policy reveal the money demand function is not as stable as expected. Particularly, diversifying the financial instruments, increasing financial

liberalization, regulatory changes in the banking sector and technological innovations related to the electronic payments required to reconsider the stability of money demand after the end of 1980s (Tumturk, 2017). In some countries the fundamental changes occurred in financial markets have affected the existence of stable relationship between the goal variables and targeted aggregate. Hence, the monetary authorities have reviewed the money demand function as “unstable” in the corresponding countries.

Emerging countries are not independent from the countries in which all these fundamental changes occurred in the financial markets. As Li (2014) states before the 1978 economic reform in China nearly all financial institutions combined into the People’s Bank of China (PBC), which served as the administration headquarter as well as the business center of China’s financial and banking system. PBC had exclusively controlled the money supply and also served as government treasury. However, in 1978 Chinese Communist Party reformed the structure focusing on a shift from “class struggle” to “economic development.” In the second half of 1980s, the PBC was transformed into the Central Bank of China to carry out monetary policy independently. The exclusive functions of the banking system as both administrative and commercial were finally separated. In the 1990s, the reform focused on creating an efficient banking system to formulate and implement monetary policy and issue loans being free from the control of the political orders.

Financial reforms have been implemented globally from the early 1980s although it is not able to state that all countries implemented these reforms with the same speed and at the same time (Rao and Kumar, 2008). India also implemented financial reforms in 1980s (Rao and Kumar, 2008; Singh and Pandey, 2009) where income elasticity has declined from 1.29 to 1.02 and the coefficient of interest rate, which was insignificant during 1970-1985 has become significant during 1985 – 2005 (Rao and Kumar, 2008). In 1990s Turkish financial markets also practiced deregulation and financial liberalization (Tumturk, 2017).

South Africa adopted the money market-oriented monetary policy measures in 1980s (Nell, 1999). In 2000 the country adopted an official inflation-targeting framework eliminating the monetary policy framework of setting predetermined targets for broad money (M3). However, this official monetary framework does not necessarily understate the significance of money in the formulation of an effective policy strategy, as long as stable money demand function exists and also the appropriate monetary aggregate (M3) comprises information about the future price changes (Nell, 2003). Stability of money demand function is a fundamental concept in macroeconomics as the appropriate design of the monetary policy is contingent upon the presence of stable money demand function (Tumturk, 2017). An

important question to be raised is “Have the money demands been stable in the emerging countries?”

Several empirical researches have been carried out on money demand function in emerging countries based on the country specific data over the past few decades using various approaches. According to Hurn and Muscatelli (1992), some previous studies on money demand function using different approaches show that the function was stable over time. However, these studies fail to appropriately describe the existence of long-run relationship between money demand and its determinants. As Diu and Donald (2010) explain the estimates of money demand functions with various specifications fail to reveal a stable money demand function in several countries due to the structural changes like deregulation and financial innovations. The purpose of this study is therefore to address the question of which form of money demand function is appropriate for empirical work in emerging countries, and to determine whether or not the long-run cointegration exists between money demand and its determinants. Estimation of the appropriate functional form is crucial since the stability of money demand is contingent upon the established functional form.

This study contributes to the literature in determining the appropriate money demand function for emerging countries using both static and dynamic panel models. In addition, with time series analysis this study examines the stability of money demand function for group-specific countries using cumulative sum (CUSUM) and cumulative sum of square (CUSUMSQ) tests for the specified money demand function. The aim of CUSUM and CUSUMSQ tests is to find out whether the fundamental changes in financial market structure have compromised the stability of money demand function and changed the consistency of estimated coefficients. Hence, this study contributes to the literature on the determination of the stability of money demand function in emerging countries: Brazil, China, India, Indonesia, South Africa and Turkey using time series and panel approaches. The remaining part of the article is organized as follows. Section two presents some reviews of theoretical and empirical literature on the stability of money demand function. With the aim of determining stable money demand, this section reviews the empirical literature on most widely used models (cointegration and error correction modeling) and the application of CUSUM and CUSUMSQ tests. Section three elaborates the methodology followed in the investigation of the stability of money demand function. This section briefly describes the error correction model and cumulative sum test. Section four analyses the results of static panel approach with random effect method and dynamic panels with pooled mean group on the determinants of money demand function. This section also investigates the cointegration and stability of money demand function across countries: Brazil, China, India, Indonesia, South Africa and Turkey using the error

correction models and stability diagnostic tests: CUSUM and CUSUMSQ tests. Finally, conclusions are provided based on the results of this specific study.

## LITERATURE REVIEW

Demand for money has become temporarily unstable in developed countries after the financial reforms (Rao and Kumar, 2008). This is attributed to the effects of deregulation of the financial markets which has increased competition in the financial markets, created additional money substitutes, increased use of credit cards and electronic money transfers, increased liquidity of the fixed deposits and induced higher international capital mobility (Rao and Kumar, 2008; Diu and Donald, 2010). On monetary policy aspect, it forced many industrial countries to shift from the monetary aggregate targeting to inflation targeting policy framework. However, recently this view has changed as many empirical findings with various data definitions and econometric methodology have confirmed stable money demand function. According to Bahmani-Oskooee and Rehman (2005), money demand function in many Asian countries of developing economies is stable, in which case Central Banks target on money supply. It is necessary to investigate whether money demand function is stable or not since targeting on the interest-rate is inappropriate in the existence of stable demand for money (Rao and Kumar, 2008). This implies that stability of money demand function has implication on the choice of monetary policy instruments.

### The stability of money demand function

Estimating a stable money demand function is essential for the Central Banks with respect to their targets on sustainable growth and price stability. Using panel data, Rao and Kumar (2008) find long-run relationship between money demand and the determinants: GDP and interest-rate for the selected Asian countries. In the study of comparing backward and forward looking approaches to modeling money demand in Turkey, the analysis of M2 broad money demand for the period 1980:Q1-1991:Q2 with quarterly data confirms that inflationary expectation is the most dominant factor affecting money demand. This implies that the expectations of economic agents adjust the inflation rate extensively, which allows them to put away inflation tax by reducing their monetary holdings (Saatcioglu and Korap, 2005).

Tumturk (2017) states that provided the average economic growth rate and nominal interest rate, monetary growth rate can be adjusted conformable with the price stability. Such adjustment is possible on condition of strong and stable relationship between inflation and targeted monetary aggregate. However, in the absence of

strong and stable association between inflation and the targeted monetary aggregates, targeting on monetary aggregate is not applicable as experienced by a number of industrial countries. In other words, the weak and unstable relationship fails to give the anticipated outcome on inflation, and no longer will the targeted monetary aggregate provide a reasonable indication about the viewpoint of monetary policy (Mishkin, 1998). In Vietnam the empirical studies were carried out on the determinants of demand for money within the context of dollarization and underdeveloped financial markets, where the US dollar provides a substitute for the local currency. The findings reveal the cointegrating relationships among the variables: money-demand, output, real price stock and foreign interest rate. In addition, real money demand is sensitive to inflation. In this country the demand for real money was found to be stable over the period 1999 – 2009, and this is a vital foundation for the implementation of the appropriate monetary policy (Diu and Donald, 2010).

In Turkey, the bound test is applied in combination with CUSUMSQ test to analyze the stability of broad money demand with quarterly data over the period 1985:Q4-2006:Q4. The findings indicate the existence of stable association between money demand (M2) and the determinants: real-income, interest-rate and exchange-rate (Tumturk, 2017). Investigating the money demand function over the period 1989:Q1-2010:Q4, Gencer and Arisoy (2013) reveal the existence of long-run relationship between real-money demand and the determinants: real-income, exchange-rate, inflation and interest-rate in the Turkish economy. The findings show positive effect of real-income and exchange-rate on real-money demand while interest-rate and inflation negatively influence the real-money demand.

In the investigation of a stable long-run equilibrium association between money demand (M2) and the determinants: real-income, interest-rate, exchange-rate and inflation, Niyimbanira (2013) finds stable money demand function, and concludes effective monetary policy in South Africa based on results of the Error Correction model (ECM). In the determination of the stability of M3 money demand in South Africa, Nell (2003) finds stable money demand function over the period 1968 – 1997. In the analysis of the stability of the money demand function with a VAR-based approach in South Africa, Kapingura (2014) reveals the existence of cointegration between money-demand function and its determinants over the period 1994-2012 with quarterly data.

### **Cumulative sum and cumulative sum of square tests for stability**

Many studies interpret the cointegration of monetary aggregate with income and interest-rate as a sign of stable demand for money. However, cointegration does

not necessarily imply reliability of estimated coefficients. According to Bahman-Oskooee and Wang (2007), there are cases where the variables included in money demand function become cointegrated while the estimated money demand function remains unstable. This implies that cointegration is not sufficient for stability, and therefore it is necessary to test the stability of the specified money demand function using cumulative sum (CUSUM) of recursive residuals and cumulative sum of squares of recursive residuals (CUSUMSQ) tests to effectively determine whether or not the long-run and short-run estimated elasticities are stable over the specified time period.

The CUSUM test determines whether the coefficients of the money demand function are changing systematically while CUSUMSQ investigates the presence of abrupt change with the null hypothesis of parameters are stable. The CUSUM can also reveal structural changes. If the CUSUM crosses the red line, this is evidence against structural stability of the specified model. That means if the blue line crosses the red lines of 5% significance level, the null hypothesis of stable parameters is rejected. A test with a 5% significance level rejects the stability of the parameters if  $CUSUM_{\tau}$  crosses the lines  $\pm 0.948 \left[ \sqrt{T-K} + \frac{2(\tau-K)}{\sqrt{T-K}} \right]$ , where K is the number of explanatory variables in the restricted, stable model,  $\tau$  runs from some small value  $T_1$  to T, and T is sample size (Granger and Terasvirta, 1993). This test is designed to detect a nonzero mean of the recursive residuals due to shifts in the model parameters. The test may not have much power if there are various shifts that may compensate their impacts on the means of the recursive residuals. In that case, the CUSUMSQ may be more informative. If  $CUSUMSQ_{\tau}$  crosses the lines given by  $\pm c + (\tau - K)/(T - K)$ , a structural instability is diagnosed, where the constant c depends on the desired significance level, the sample size T, and the number of regressors in the model (Lutkepohl and Kratzig, 2004). Suitable values of c are described in table form in Johnston (1984).

Kjosevski (2013) states that the CUSUM test is applied to perceive the existence of systematic changes in the coefficients, while the CUSUMSQ test detects the deviation from the steadiness of the parameters is sudden and unexpected. This implies that the cumulative sum of square provides a useful complement to the cumulative sum test, particularly when the departure from constancy of  $\beta_i^s$  is random rather than systematic. Since a well-defined and stable money demand function helps central banks to achieve their objectives with a money targeting or an interest rate targeting mechanism, the researchers commonly apply the CUSUM and CUSUMSQ tests to examine the stability of money demand function (Diu and Donald, 2010).

Nduka et al. (2013) apply CUSUM and CUSUMSQ tests to investigate the existence of stable demand for money in Nigeria. The cointegration and stability findings

confirm the existence of stable and long-run association between money demand and its determinants. The empirical findings reveal income and foreign-interest-rate influence the money demand positively while domestic-real-interest-rate, inflation-rate, and exchange-rate affect the money demand negatively. Okonkwo et al. (2014) explain that money demand function in Nigeria is stable as confirmed by CUSUM and CUSUMSQ tests. The coefficient of error correction term is negative and significant confirming the deviation from the equilibrium is adjusted towards the equilibrium.

## METHODOLOGY

Money demand functions of the emerging countries were investigated using both time series and panel data. The advantage of using time series over cross section data can be explained as the ability of investigating the dynamic relationships of the variables where the time series provide sufficient information about the earlier time period (Abonazel, 2016). The advantage of panel datasets over the individual time series includes the capability of controlling the unobserved heterogeneity in individuals/countries and increasing the degree of freedom for stable parameter estimation (Mitic et al., 2017). In other words, panel data do not only increase the total number of observations and their variation but also reduce the noise coming from the individual time series. Hence, heteroscedasticity is not an issue in panel data analysis.

In panel data analysis both the static panel and dynamic panel variants were considered for the investigation of the stability of money demand function. Static panel considers only exogenous variables as explanatory variables, while the dynamic panel variations include the lagged dependent variables as additional explanatory variables.

### Static panel data model

For static panel analysis, there are three types of models: pooled model, fixed effect model, and random effect model. The pooled model specifies constant coefficients, which is the usual assumption for cross sectional analysis. Since the pooled model is the most restrictive static panel data model, it is not widely used in the literature. We assume that there is unobserved heterogeneity across countries captured by  $\alpha_i$ . The main question is whether the country-specific effects,  $\alpha_i$ , are correlated with the regressors. The fixed effect model allows the country-specific effects,  $\alpha_i$ , to be correlated with the regressors. Whereas, the random effect model assumes that the country-specific effects,  $\alpha_i$ , are distributed independently of the regressors. In such case  $\alpha_i$  are included in the error term,  $\varepsilon_{it}$ . To determine the appropriate model for this static panel analysis, pFtest and the Hausman test were applied. The pFtest was performed to select the appropriate estimate between pooled model and fixed effect model. The hypothesis of pFtest can be stated as:

$H_0$ : Pooled OLS method is consistent  
 $H_1$ : Fixed effect model is consistent

This test confirmed that fixed effect method was the appropriate model over the pooled OLS estimate. Then, fixed effect model and random effect model were compared using the Hausman test statistic, which is described as:

$$H = (\hat{\beta}_{RE} - \hat{\beta}_{FE})' (var(\hat{\beta}_{RE}) - var(\hat{\beta}_{FE}))^{-1} (\hat{\beta}_{RE} - \hat{\beta}_{FE}) \quad (1)$$

The hypothesis of the Hausman test can be described as:

$H_0$ : Random effect model is consistent  
 $H_1$ : Fixed effect model is consistent

The Hausman test statistic follows a chi-squared distribution with degrees of freedom equal to the number of parameters for time-varying explanatory variables in the model. Since the Hausman test was insignificant, i.e. p-value = 0.9938, which was greater than 5%, the random effect method was chosen as the consistent model for the static panel analysis of money demand function. Random effect model is an OLS estimation of the transformed model. The model can be stated as:

$$y_{it} - \hat{\lambda}\bar{y}_i = (1 - \hat{\lambda})\mu + (x_{it} - \hat{\lambda}\bar{x}_i)' \beta + v_{it} \quad (2)$$

Where,

$$v_{it} = (1 - \hat{\lambda})\alpha_{it} + (e_{it} - \hat{\lambda}\bar{e}_i); \lambda = 1 - \frac{\delta_e}{\sqrt{T\delta_\alpha^2 + \delta_e^2}}$$

$$i = 1, \dots, N; t = 1, 2, \dots, T$$

The number of observations is NT, where N = number of countries under the study, which is 6; and T = time series from 1987 to 2018, which is 32. So, NT = 6×32= 192.  $\hat{\lambda} = 0$  corresponds to pooled OLS and  $\hat{\lambda} = 1$  corresponds to the within (fixed effects) estimates. The random effect estimate is a weighted average of the between and within estimates.

### Durbin-Watson test for serial correlation

To detect the existence of serial correlation in the panel model, Durbin-Watson test was applied with the hypothesis:

$H_0$ : there is no serial correlation in the residual generated from random effect method  
 $H_1$ : there is serial correlation in the residual.

### Breusch-pagan test for homoscedasticity

Breusch-Pagan test was employed to examine whether the data set was homoscedastic or heteroscedastic, the hypothesis of which can be described as:

$H_0$ : there is homoscedasticity in the data set  
 $H_1$ : there is heteroscedasticity in the data set

### Controlling heteroscedasticity and autocorrelation of panel data

Since both Durbin-Watson test and Breusch-Pagan test confirmed the serial correlation and heteroscedasticity in the data set, the heteroscedasticity and autocorrelation were controlled using "arellano" method, which is used to make the standard-error robust in the presence of heteroscedasticity and autocorrelation problem.

### Cross sectional dependence in panels

According to Baltagi (2001), cross-sectional dependence is a problem of macro panel with long time series. To detect the cross sectional dependence in the panel data set, Breusch-Pagan LM test was used with the hypothesis:

$H_0$ : there is no cross sectional dependence  
 $H_1$ : there is cross sectional dependence in panels

Since the Breusch-Pagan LM test revealed the cross sectional dependence in the panel data set, Feasible Generalized Least Square (FGLS) was applied for controlling the cross sectional dependence. FGLS is sometimes called Estimated Generalized Least Square (EGLS). Panel EGLS (cross-section random effects), (Appendix A) is better estimates than Panel Corrected Standard Error (PCSE) in controlling cross sectional dependence when the time series (T) is greater than number of cross section (N). Whereas, PCSE is applied when  $N > T$  to control the cross sectional dependence.

## DYNAMIC PANEL DATA MODEL

### Specification of the panel ARDL model

The generalized panel ARDL (p,q,q,...,q) model can be specified as:

$$y_{it} = \sum_{j=1}^p \delta_i y_{i,t-j} + \sum_{j=1}^q \beta'_{ij} X_{i,t-j} + \varphi_i + e_{it} \quad (3)$$

Where  $y_{it}$  is the dependent variable,  $(X'_{it})'$  is a  $K \times 1$  vector that are allowed to be purely  $I(0)$  or  $I(1)$  or cointegrated;  $\delta_i$  is the coefficient of the lagged dependent variable called scalars;  $\beta_{ij}$  are  $K \times 1$  coefficient vectors;  $\varphi_i$  is the unit-specified fixed effects;  $i = 1, \dots, N$ ;  $t = 1, 2, \dots, T$ ;  $p, q$  are optimal lag orders;  $e_{it}$  is the error term.

The re-parameterized ARDL (p, q, q, ..., q) error correction model is specified as:

$$\Delta y_{it} = \theta_i [y_{i,t-1} - \lambda'_i X_{i,t}] + \sum_{j=1}^{p-1} \xi_{ij} \Delta y_{i,t-j} + \sum_{j=1}^{q-1} \beta'_{ij} \Delta X_{i,t-j} + \varphi_i + e_{it} \quad (4)$$

Notes:

$\theta_i = -(1 - \delta_i)$ , group-specific speed of adjustment coefficient (expected that  $\theta_i < 0$ )

$\lambda'_i$  = vector of long-run relationships

ECT =  $[y_{i,t-1} - \lambda'_i X_{i,t}]$ , the error correction term

$\xi_{ij}, \beta'_{ij}$  are the short-run dynamic coefficients.

The panel ARDL (p, q, q, q, q) with the variables: Broad-money, GDP, Exchange-rate, Real-interest-rate, and Inflation can be specified as:

$$\begin{aligned} Moneydemand_{it} = & \sum_{j=1}^p \delta_i Moneydemand_{i,t-j} + \sum_{j=1}^q \beta_{1ij} GDP_{i,t-j} + \\ & \sum_{j=1}^q \beta_{2ij} Exchange_{i,t-j} + \sum_{j=1}^q \beta_{3ij} Real_{i,t-j} + \sum_{j=1}^q \beta_{4ij} Inflation_{i,t-j} + \varphi + e_{it} \end{aligned} \quad (5)$$

### Panel unit root test

Panel unit root tests can be categorized as "first generation" or "second generation". The most notable tests of the first generation unit root tests are the Levin-Lin-Chu test (LLC) and the Im-Pesaran-Shin test (IPS). The assumption for using Im-Pesaran-Shin (IPS) in Panel Unit Root testing is Heterogeneous slopes; whereas, for using Levin-Li-Chu (LLC) is homogenous slopes. Basically, these tests are extensions of the traditional augmented Dickey-Fuller (ADF) unit root test for univariate time series modelling, under the very restrictive assumption of individual cross-sectional independency (Mitic et al., 2017). The LLC test estimates ADF regression on the pooled panel data by the OLS, assuming the

same auto-regressive process across individuals, which is an additional restriction. Under the assumption of common unit root, the LLC test is testing the null  $H_0: \rho_i = \rho = 0$  for all  $i$ , against the alternative  $H_1: \rho_i = \rho < 0$  for all  $i$ . The IPS test relaxes the latter assumption, allowing the possibility of varying autoregressive processes across individuals, and therefore uses the group-mean of individual t-statistics in statistical inference.

$$\bar{t}_{NT} = \frac{\sum_i^N t_{iT} (P_i, \varphi_{i1}, \dots, \varphi_{iP_i})}{N} \quad (6)$$

Where  $\bar{t}_{NT} (P_i, \varphi_{i1}, \dots, \varphi_{iP_i})$  denotes the t-statistic for testing the unit root in the  $i^{\text{th}}$  individual process (lag order  $P_i$  is typically selected according to some info criterion). Accordingly,  $\bar{t}_{NT}$  is used to test null  $H_0: \rho_i = 0 \forall i$  against the alternative  $H_1: \exists i \in \{1, \dots, N\}, \rho_i < 0$ .

### Hausman (1978) test for selection of the appropriate estimator

For the analysis of money demand function using dynamic panel data model, the Hausman test was performed to identify the efficient estimator among the estimators: Pooled Mean Group (PMG), Mean Group (MG), and Dynamic Fixed Effect (DFE). The hypothesis of the Hausman test can be described as follows.

(i) To determine the appropriate estimator between Mean Group (MG) and Pooled Mean Group (PMG), the null hypothesis of homogeneity can be described as:

$H_0$ : PMG is the most efficient estimate

$H_1$ : MG is the most efficient estimate

The p-value (0.2100) is greater than 5%, and we fail to reject the null hypothesis. Hence, the model supports the PMG estimator.

(ii) After finding that PMG was the appropriate estimator in comparison to MG, Hausman test was again performed to identify a suitable estimator comparing PMG with DFE. The hypothesis of Hausman test can be stated as:

$H_0$ : PMG is the most efficient estimate

$H_1$ : DFE is the most efficient estimate

The p-value (0.9986) is greater than 5%. So, we fail to reject the null hypothesis. Since the Hausman test confirmed the PMG as the most efficient estimate compared to MG and DFE, the dynamic panel analysis of money demand function was based on the PMG estimator, which was proposed by Pesaran et al. (1999). PMG is an intermediate estimator between MG and DFE. It allows the intercepts, short-run coefficients, and error variances to differ freely across groups, i.e. all these are heterogeneous. The PMG estimators are consistent and efficient under the assumption of long-run slope homogeneity. That means long-run coefficients are homogenous. In other words, PMG constrains the long-run coefficients to be identical, but allows the short-run coefficients and error variances to differ across groups. PMG generates consistent estimates of the mean of short-run coefficients by taking the sample average of individual unit coefficients.

### Autoregressive Distributed Lag (ARDL) model for time series analysis

To investigate the stability of money demand function in each country of the panel members, the ARDL model was employed based on the results of the unit root test where some variables were integrated of order one,  $I(1)$ , while some other variables were

stationary at level, that is,  $I(0)$ . The ARDL model can be specified as:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^n \beta_i \Delta y_{t-i} + \sum_{i=0}^n \delta_i \Delta x_{t-i} + \varphi_1 y_{t-1} + \varphi_2 x_{t-1} + \mu_t \quad (7)$$

Where,  $\sum_{i=1}^n \beta_i \Delta y_{t-i} + \sum_{i=0}^n \delta_i \Delta x_{t-i}$  is short-run, and  $\varphi_1 y_{t-1} + \varphi_2 x_{t-1}$  is long-run;  $\beta_i$  &  $\delta_i$  are short-run coefficients;  $\varphi_1$  &  $\varphi_2$  are ARDL long-run coefficients;  $\mu_t$  is disturbance (white noise) term.

### Cumulative sum (CUSUM) test

The familiar Brown-Durbin-Evans (1975) CUSUM test for structural change in the linear regression model can be explained as:

$$y_t = x_t' \beta + u_t \quad t = 1, \dots, T$$

where  $y_t$  is the dependent variable,  $x_t = (1, x_{t2}, \dots, x_{tk})'$  is a  $K \times 1$  vector of independent variables (including a constant), such that  $\text{plim}_{T \rightarrow \infty} \frac{1}{T} \sum_{t=1}^T x_t x_t' = R$

For some finite and nonsingular  $K \times K$  matrix  $R$ , the  $u_t$ 's are *i. i. d.*  $(0, \sigma^2)$  disturbances (not necessarily normal), and  $\beta$  is a  $K \times 1$  vector of regression coefficients. The null hypothesis under this test is that this vector remains constant over time. The standard CUSUM test is based on recursive residuals (standardized forecast errors)

$$\tilde{u}_t = (y_t - x_t' \hat{\beta}^{(t-1)}) / f_t$$

where

$$\hat{\beta}^{(t-1)} = \left( \sum_{i=1}^{t-1} x_i x_i' \right)^{-1} \sum_{i=1}^{t-1} x_i y_i'$$

is the OLS estimate for  $\beta$  from the first  $t-1$  observation ( $t = K + 1, \dots, T$ ); which is tacitly assumed that  $\sum_{i=1}^K x_i x_i'$  has rank  $K$ ) and where

$$f_t = \left[ 1 + x_t' \left( \sum_{i=1}^{t-1} x_i x_i' \right)^{-1} x_t \right]^{1/2}$$

It rejects the null hypothesis of parameter constancy for large value of

$$\sup_{0 \leq z \leq 1} \left| \frac{W^{(T)}(z)}{1 + 2z} \right|$$

where  $W^{(T)}(z) = \frac{1}{\sqrt{T-K}} \sum_{t=K+1}^{K+z(T-K)} \tilde{u}_t$ ,  $0 \leq z \leq 1$ , is the cumulative sum of the first  $z(T-K)$  recursive residuals, and where

$$\hat{\sigma} = \sqrt{\frac{1}{T} \sum_{t=K+1}^T \tilde{u}_t^2}$$

### Source of data and description of variables

The study of money demand function was based on the annual data of period 1987 to 2018. The data were obtained from World Bank except the interest-rate data for Turkey which was obtained from Federal Reserve Economic Data (FRED). The classical quantity theory of Fisher describes income as the only determinant of money demand while other economists including Keynes, Tobin and Friedman explain the money demand function considering additional determinants: interest-rates, the return on physical goods, and bond and equity returns (Diu and Donald, 2010). Sichei and Kamau (2012) state that money demand functions can be effectively determined by including more determinants into the specification rather than the traditional specification. Hence, many variables were considered for efficient specification of money demand function for the emerging countries. The data for Money-demand and GDP were in natural logarithmic form; whereas, real interest rate, exchange rate and inflation were in percentages.

### Money demand

it stands for broad money demand. Broad money was chosen to be dependent variable. It was measured in constant US dollar. The term broad money is used to describe M2, M3 or M4, depending on the local practice. The exact definitions of the three measures depend on the country. In China broad money M2 refers to the entire stock of liquid assets in an economy, such as cash and current account deposits, as well as "near money" indicators that are less liquid, such as savings deposits. According to Hurn and Muscatelli (1992), M3 is the highest money balance in South African monetary policy targets. M3 includes M2 plus longer-term time deposits and money market funds with more than 24-hour maturity. M4 includes M3 plus other deposits. Broad money is superior to narrow money in macroeconomic analysis. M0 and M1, also called narrow money, normally include coins and notes in circulation and other money equivalents that are easily convertible into cash.

### Gross domestic product (GDP)

It stands for real income which was measured as GDP at constant prices. As Turturk (2017) explains theoretically the sign of the income elasticity of money demand is expected to be positive. Hurn and Muscatelli (1992) also found positive relationship between GDP and real M3. Therefore, the sign for real GDP was expected to be positive.

### Exchange

It stands for exchange rate. According to Kjosovski and Petkovski (2017), exchange rate plays a vital role in explaining money demand. Namely, during periods of high inflation, countries might experience a partial replacement of domestic with foreign currencies, either as a store of value or as a medium of exchange. According to Bitrus (2011), the return on the holdings of foreign assets is influenced by the expectation of exchange rate movements. That means depreciation of the domestic currency relative to foreign currencies would lead to a rise in the return on foreign assets to domestic holders and vice versa. Some findings state that when the exchange rate increases, the demand for money decreases. In such a case the exchange rate is inversely related to the demand for money while others including Gencer and Arisoy (2013) and Diu and Donald (2010) attach positive sign for exchange rate in relation to money demand. Hence, the sign for this variable was indeterminate a priori.

**Table 1.** pF test for individual effects.

---

H <sub>0</sub> : Pooled OLS method is consistent
H <sub>1</sub> : Fixed effect model is consistent
pF test (Fixed method, pooled method)
data: Money demand ~ GDP + Exchange + Real + inflation
F = 74.441, df1 = 5, df2 = 182, p-value < 2.2e-16
alternative hypothesis: significant effects

---

**Table 2.** Hausman test between fixed method and random method.

---

H <sub>0</sub> : Random effect model is consistent
H <sub>1</sub> : Fixed effect model is consistent
Ph test (Fixedmethod,Random)
Hausman Test
data: Moneydemand ~ GDP + Exchange + Real + Inflation
chisq = 0.23072, df = 4, p-value = 0.9938
alternative hypothesis: one model is inconsistent

---

### Real

It stands for real interest rate. Keynesians highlight the negative sign of interest rates with the significant effect on money demand (Diu and Donald, 2010). Zuo and Park (2011) also find negative effect of real interest rate on money demand in China. The sign for this variable was therefore expected to be negative.

### Inflation

A priori expectation for the coefficient of inflation was negative. Diu and Donald (2010) find inflation to be negative in determining the demand for money in Vietnam. Niyimbanira (2013) states that many empirical findings in South Africa reveal negative effect of inflation on real money demand.

## RESULTS AND DISCUSSION

This study investigates the determinants and stability of money demand in emerging countries with the annual data of period 1987 to 2018. The random effect model was employed to determine the factors that affect money demand in emerging countries with the static panel analysis. The ARDL models were applied to investigate money demand function with dynamic panel approach and time series analysis. The stability test was performed for each country using cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) tests.

### Static panel analysis

For static panel analysis, random effect model was found to be an appropriate model compared to pooled model

and Fixed effect model based on the pFtest and Hausman test. The null hypothesis of “pooled OLS method is consistent” was rejected following the p-value (0.0000), which is less than 5% (Table 1). This test supports the Fixed effect model rejecting the pooled model.

Once the pFtest confirmed the fixed effect method as an appropriate model, this method was again compared with the random effect method using the Hausman test to investigate whether fixed effect method would be preferred to random effect method. However, the Hausman test supported the random effect as a consistent method since the p-value (0.9938) was greater than 5% (Table 2). So, the null hypothesis of “random effect model is consistent” was not rejected by the Hausman test. With static panel approach, money demand of emerging countries was, therefore, analyzed using the random effect method. The findings reflect that money demand in emerging countries is positively influenced by real income while exchange rate and real interest rate affect money demand negatively (Equation 8).

$$\text{Moneydemand} = -12.664 + 1.4443\text{GDP} - 0.00004\text{Exchange} - 0.00214\text{Real} + 0.000047\text{inflation}$$

$$(0.7861)^{***} \quad (0.0279)^{***} \quad (0.00001)^{***} \quad (0.0011)^{**} \quad (0.000048)$$

(8)

Real-income and exchange-rate are significant at 1% significance level while real-interest-rate is significant at 5% significance level. The findings reflect that a 1% increase in real income results in 1.44% increase in money demand in emerging countries. The exchange-rate and real-interest-rate negatively affect the money demand but the magnitudes are small, which are 0.00004%

**Table 3.** Durbin-Watson test for serial correlation in static panel model.

---

$H_0$ : There is no serial correlation in the residual (generated from "random effect method").  
 Command: pdw test (Moneydemand ~ GDP + Exchange + Real + Inflation,  
 data = Panel\_Data, model = "random")  
 Durbin-Watson test for serial correlation in panel models  
 data: Moneydemand ~ GDP + Exchange + Real + Inflation  
 DW = 0.98322, p-value = 1.369e-13  
 alternative hypothesis: serial correlation in idiosyncratic errors

---

**Table 4.** Homoscedasticity test using Breusch-Pagan test.

---

$H_0$ : there is homoscedasticity  
 bptest(Moneydemand ~ GDP + Exchange + Real + Inflation,  
 data = pdata\_bptest, studentize = F)  
 Breusch-Pagan test  
 data: Moneydemand ~ GDP + Exchange + Real + Inflation  
 BP = 26.127, df = 4, p-value = 2.983e-05

---

**Table 5.** Arellano method for controlling autocorrelation and heteroscedasticity.

---

Random\_method = plm(Moneydemand ~ GDP + Exchange + Real + Inflation, data = pdata, model = "random")  
 coefest (Random\_method,vcovHC (Random\_method, method = "arellano"))

t test of coefficients:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	-1.2664e+01	1.3043e+00	-9.7092	<2e-16 ***
GDP	1.4443e+00	4.5251e-02	31.9163	<2e-16 ***
Exchange	-4.0277e-05	4.1232e-06	-9.7684	<2e-16 ***
Real	-2.1384e-03	3.1487e-03	-0.6791	0.4979
Inflation	4.7067e-05	4.6688e-05	1.0081	0.3147

---

Signif. codes: '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

and 0.00213% change on money demand for 1% changes in exchange-rate and real-interest-rate, respectively.

Most of the time in static panel data model the serial correlation problem is experienced due to misspecification by including only exogenous variables as the explanatory variables in money demand function. The serial correlation problem was checked by Durbin-Watson (DW) test. The null hypothesis of DW test is no serial correlation in the residual generated from random effect method. Since the p-value (0.0000) is less than 5%, we reject the null hypothesis of no serial correlation in favor of the alternative hypothesis that the model specification is serially correlated (Table 3). The random effect method was also checked for the heteroscedasticity of the data set using Breusch-Pagan test. The null hypothesis of the Breusch-Pagan test is that there is

homoscedasticity in the data set. Since the p-value (0.0000) of the test is less than 5%, the null hypothesis of homoscedasticity is rejected in favor of the alternative hypothesis of heteroscedasticity in the data set (Table 4).

Durbin-Watson test for serial correlation and Breusch-Pagan test for heteroscedasticity confirmed that the static panel data model was suffering from both serial correlation and heteroscedasticity problem. To control the autocorrelation and heteroscedasticity of panel data, Arellano method was applied to make the standard error robust (Table 5). The results of Arellano method reflect that GDP and exchange rate are significant at 1%. However, real interest rate is found to be insignificant after controlling the heteroscedasticity and autocorrelation of the panel data. Similar to serial correlation in time series, cross-sectional dependence reduces the efficiency of least squares estimators, and invalidates conventional

**Table 6.** Breusch-Pagan LM test for cross-sectional dependence in panels.

---

H<sub>0</sub>: there is no cross sectional dependence  
pcdtest(Random\_method, test = c("lm"))

Breusch-Pagan LM test for cross-sectional dependence in panels  
data: Moneydemand ~ GDP + Exchange + Real + Inflation  
chisq = 62.125, df = 15, p-value = 1.083e-07  
alternative hypothesis: cross-sectional dependence

---

t-tests and F-tests which use standard variance-covariance (Baltagi et al., 2012; Kao and Liu, 2014). To detect the cross sectional dependence, the standard Breusch-Pagan LM test is applied when the number of cross-section (N) is less than the number of time periods (T) (Baltagi et al., 2012). The null hypothesis of the Breusch-Pagan LM test for cross-sectional dependence in panels can be stated as there is no cross-sectional dependence in the panels. The p-value (0.0000) of the test indicates the presence of the cross-sectional dependence (Table 6).

Cross sectional dependence can be corrected using Feasible Generalized Least Square (FGLS) and Panel Corrected Standard Error (PCSE). FGLS is preferred to PCSE when the time period (T) is greater than the cross section (N) in correcting the problem of cross sectional dependence. Whereas, PCSE is used when the cross section (N) is greater than the number of time series (T). Since the number of time series (T) of this study was greater than the number of cross section (Appendix B), the cross sectional dependence was corrected using the FGLS. FGLS is sometimes called Estimated Generalized Least Square (EGLS). Equation 9, in which cross section dependence is controlled by using FGLS, reflects that GDP influences money demand positively while exchange rate and real interest rate possess negative impact on money demand in emerging countries.

$$\text{Moneydemand} = -12.6642 + 1.4443\text{GDP} - 0.00004\text{Exchange} - 0.00214\text{Real} + 0.000047\text{Inflation}$$

$$(0.5413)^{***} \quad (0.0188)^{***} \quad (0.00001)^{***} \quad (0.0012)^{**} \quad (0.000086)$$

(9)

\*\*\* significant at 1%, \*\* significant at 5%.

### Dynamic panel analysis for money demand function

Most of static panel models in applied econometrics literatures are likely to be misspecified since the within-group error terms are serially correlated, which invalidate both point estimates and statistical inferences. That means some relevant information is left in the error term that would have been part of the model. In such case, the solution might not be to fix the problem by estimating with

robust standard error rather specifying and estimating a dynamic model. The dynamic models tend to be correctly specified as the dynamics are in the estimated part of the model removing the relevant information from the error terms, which invalidate the static fixed effect/random effect estimation. Dynamic models provide more economic information by virtue of being able to distinguish short-run and long-run effects of independent variables on the dependent variable through error correction modelling. The core point of a dynamic panel is including lagged dependent variable, which introduces the history into the model by encompassing the effects of the entire time path of the independent variable(s). To explain more intuitively, consider simple dynamic model:

$$y_t = \beta_0 + \alpha y_{t-1} + \beta X_t + e_t \quad (10)$$

Substitute for  $y_{t-1} = \beta_0 + \alpha y_{t-2} + \beta X_{t-1} + e_{t-1}$  in equation (10). Again substitute for  $y_{t-2} = \beta_0 + \alpha y_{t-3} + \beta X_{t-2} + e_{t-2}$ , and so on. In doing so, it can be realized that the influence of the lagged dependent variable tends towards zero while the influence of the independent variable increases by way of increasingly complex compound coefficient. The economic intuition to the algebra is that "history matters", i.e. the dependent variable (Y) is influenced not only by the current value of the independent variable ( $X_t$ ) but also by values of the independent variable in the past ( $X_{t-1}, X_{t-2}$ , and so on). Consequently, in a dynamic model, the estimated coefficient on the current value of the independent variable ( $X_t$ ) measures only the short-run effect of X on Y. The long-run effect is larger as it considers both the current and the lagged effects of X on Y.

Dynamic panels can be analyzed using Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), Pooled Mean Group (PMG), Mean Group (MG), and Dynamic Fixed Effect (DFE) models. FMOLS and DOLS are used when all the variables are integrated of order one, I(1); whereas, PMG, MG, and DFE models are used when the variables are integrated of combination of I(1) and I(0), that is, some variables are stationary at level while some other variables are integrated of order one, I(1). The panel unit

**Table 7.** Hausman test for appropriate model selection between MG and PMG.

hausman mg pmg, sigmamore				
	---- Coefficients ----			
	(b)	(B)	(b-B)	qrt(diag(V_b-V_B))
	mg	pmg	Difference	S.E.
gdp	1.970665	1.336776	0.6338891	0.4694726
exchange	-0.00638532	-0.0000844	-0.0637688	0.0415364
real	0.0351415	0.0350145	0.000127	0.0332878
inflation	0.0321437	-0.0013673	0.033511	0.0316511

b = consistent under Ho and Ha; obtained from xtpmg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtpmg  
 Test: H<sub>0</sub>: difference in coefficients not systematic

$$\text{chi2}(4) = (b-B)[(V_b-V_B)^{-1}](b-B)$$

$$= 5.86$$

$$\text{Prob}>\text{chi2} = 0.2100$$
**Table 8.** Hausman Test for the appropriate model selection between PMG and DFE.

hausman pmg DFE, sigmamore				
	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	pmg	DFE	Difference	S.E.
gdp	1.336776	1.388191	-0.0514144	0.4543827
exchange	-0.0000844	-0.0000526	-0.0000318	0.0001962
real	0.0350145	0.0029139	0.0321005	0.1080982
inflation	-0.0013673	-0.0003957	-0.0009716	0.0059829

b = consistent under Ho and Ha; obtained from xtpmg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtpmg  
 Test: H<sub>0</sub>: difference in coefficients not systematic

$$\text{chi2}(4) = (b-B)[(V_b-V_B)^{-1}](b-B)$$

$$= 0.11$$

$$\text{Prob}>\text{chi2} = 0.9986$$

root test confirmed that money-demand and real-interest-rate were stationary at level while GDP, Exchange-rate and Inflation were non-stationary, I(1). Hence, Hausman test was applied to select the best model out of PMG, MG and DFE. That means to decide the appropriate model between MG and PMG, the Hausman test was applied with the null hypothesis of "PMG is the most efficient estimate". In Table 7, in which the Hausman test between MG and PMG is reported, p-value (0.2100) is greater than 5%. This finding confirms that Pooled Mean Group

(PMG) model is an appropriate for the determination of money demand function.

Hausman test was again applied to decide the best model between PMG and DFE with the null hypothesis that PMG was the most efficient estimate. The p-value (0.9986), which was greater than 5%, supported the PMG model as the efficient estimate (Table 8). That means the Hausman test confirmed Pooled Mean Group (PMG) as an appropriate model to investigate money demand function in emerging countries based on the balanced

**Table 9.** Model selection criteria table.

Model	LogL	AIC*	BIC	HQ	Specification
6	323.212159	<b>-2.841519</b>	-1.461702	-2.281780	<b>ARDL(3, 2, 2, 2, 2)</b>
5	299.014616	-2.839248	-1.895163	-2.456269	ARDL(3, 1, 1, 1, 1)
1	276.247550	-2.715489	-1.989269	-2.420890	ARDL(1, 1, 1, 1, 1)
3	281.436142	-2.706163	-1.871010	-2.367373	ARDL(2, 1, 1, 1, 1)
4	304.380448	-2.694028	-1.423144	-2.178479	ARDL(2, 2, 2, 2, 2)
2	296.271181	-2.669784	-1.507832	-2.198425	ARDL(1, 2, 2, 2, 2)

Source: the model selection summary of own balanced panel data.

**Table 10.** Long run coefficients and cointegration term of the PMG model.

Dependent Variable: D(Moneydemand)				
Dynamic regressors (2 lags, automatic): GDP EXCHANGE REAL INFLATION				
Selected Model: ARDL(3, 2, 2, 2, 2)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP	1.223746	0.025380	48.21620	0.0000
EXCHANGE	-0.000108	1.54E-05	-6.988782	0.0000
REAL	-0.022639	0.009727	-2.327512	0.0217
INFLATION	-0.035719	0.007152	-4.994269	0.0000
COINTEQ01	-0.154774	0.070913	-2.182590	0.0311

Source: the panel ARDL log-run coefficients and error correction term (ECT) of the PMG model.

annual panel data over the period 1987 to 2018. PMG takes the cointegration form of a simple ARDL model and adopted for panel setting by allowing the intercepts, short-run coefficients and cointegrated terms differ across cross-sections. That means PMG allows intercepts, short-run coefficients and error variances to differ across groups while long-run coefficients are the same for all panel members. Pesaran et al. (1999) explain the long-run coefficients being the same across groups as common technologies influence all groups in a similar way. For example, Solow growth model often assumes the same technology across countries and hence long-run production function parameters would be the same though the speed of convergence to the steady state might vary based on different population growth rates across countries.

The panel model selection summary revealed ARDL (3, 2, 2, 2, 2) was the best lag structure, which had the lowest value (-2.841519) of Akaike Information Criteria (AIC) (Table 9). The dynamic panel analysis was therefore based on ARDL (3, 2, 2, 2, 2). The panel ARDL (3, 2, 2, 2, 2) model reflects that the long-run coefficients of each of the regressors are significant (Table 10; Appendix C). The elasticity of GDP is 1.22 and significant at 1% significance level. Exchange rate and inflation are also significant at 1% significance level and their elasticities are -0.0001 and -0.0357, respectively. The elasticity of real-interest-rate is -0.0226 and significant at

5% significance level. In the long-run, real income has positive impact on broad money demand while exchange-rate, real-interest-rate and inflation negatively influence broad money demand in the long-run. The negative effect of inflation rate on broad money supports the theoretical expectation that as the inflation rate rises, the demand for money falls. This indicates that people prefer to substitute physical assets for money balances. Rao and Kumar (2008) find that income elasticity of demand is about unity, and demand for money responds negatively to variations in the short term interest rate. Cointegration equation coefficient (-0.1548) is significant at 5% of significance level (Table 10), which confirms the existence of long-run relationship among the variables in the panel. This implies that any deviation from the long-run equilibrium is corrected at the speed of 15.5%.

The long-run coefficients are the same (homogenous) for all countries under the panel while their respective short-run coefficients differ across countries in the panel. This is because the assumption of Pooled Mean Group (PMG) is that only the long-run coefficients are the same for all the groups that make up the panel while each country (group member) has its respective error variances and short-run coefficients. The error correction term for Brazil reveals the deviation from the long-run equilibrium is corrected at the speed of 0.36%. Similarly, the deviations from the long-run equilibrium are corrected at the speed of 47.4, 8.2, 16.8, 1.4, and 18.7% for China,

**Table 11.** Group-specific error variances (error correction term).

Country	ECT	Std. Error	t-Statistic	Prob. *
Brazil	-0.003633	2.30E-06	-1579.799	0.0000
China	-0.473808	0.006010	-78.83702	0.0000
India	-0.081973	0.001771	-46.29902	0.0000
Indonesia	-0.168071	0.009814	-17.12626	0.0004
South Africa	-0.014316	0.000486	-29.46759	0.0001
Turkey	-0.186846	0.003371	-55.43048	0.0000

Source: Extracted from the results of cointegration equation (ECT) and short-run coefficients of PMG model of respective countries that make up the panel (Appendix-D).

**Table 12.** ARDL Error correction regression.

ECM Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.81946	0.768802	-4.96807	0.0001
D(GDP)	2.181554	1.720723	1.267812	0.2187
D(GDP(-1))	-4.80122	1.701065	-2.82248	0.0102
D(INFLATION)	-5.87E-05	6.44E-05	-0.9124	0.3719
CointEq(-1)*	-0.47834	0.095134	-5.02806	0.0001
R-squared	0.561791	Akaike info criterion	0.109193	
Adjusted R-squared	0.491678	Schwarz criterion	0.342726	
F-statistic	8.012601	Hannan-Quinn criter.	0.183902	
Prob(F-statistic)	0.000266	Durbin-Watson stat	2.126036	

India, Indonesia, South Africa, and Turkey, respectively (Table 11).

### Time series analysis for stability of money demand function

The diagnostic tests for stability, serial correlation and residual distribution were performed considering the group-specific regressions, which assume all coefficients and variances differ. With the specification of ARDL (3, 2, 2, 2, 2), the residuals were not normally distributed in time series of Brazil, and serial correlation was detected with such specification of time series in India, Indonesia and South Africa (Appendix D).

Pesaran et al. (1999) explain that the group-specific estimates are biased because of sample-specific omitted variables or measurement errors that are correlated with the regressors. Rao and Kumar (2008) state that it is difficult to introduce country-specific special factors in the

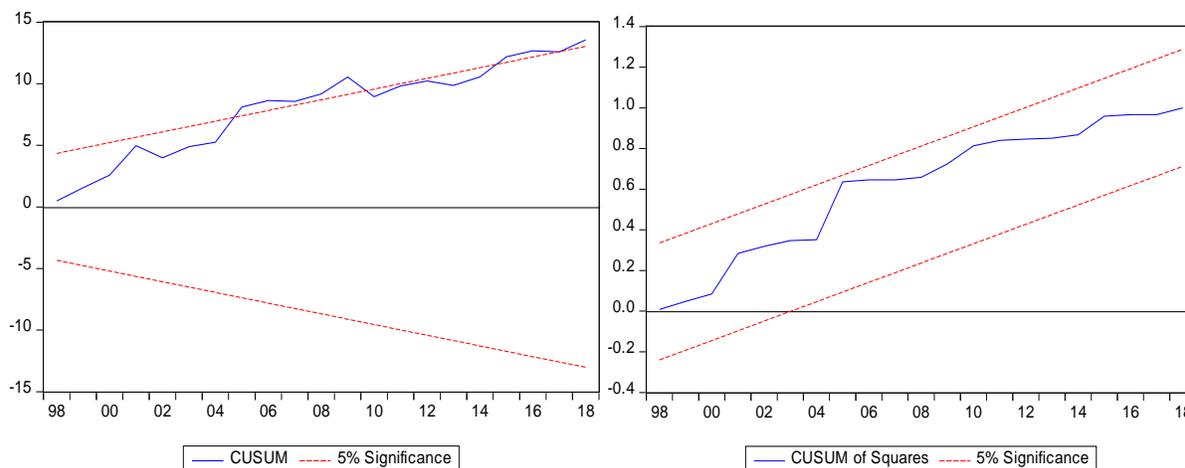
panel data methods. In this study, such bias was corrected by experimenting with different specification of the model as ARDL (1, 2, 0, 0, 1) for Brazil; ARDL (3, 0, 0, 0, 0) for India; ARDL (2, 2, 2, 2, 2) for Indonesia; and ARDL (1, 2, 0, 0, 0) for South Africa. Whereas, in China and Turkey the group-specific estimates with ARDL (3, 2, 2, 2, 2) model reflected that the residuals were normally distributed, and no evidences of serial correlations were found in the model.

This confirmed the reasonable estimates with the model ARDL (3, 2, 2, 2, 2) for China and Turkey.

### Stability of money demand function in Brazil

Money demand function in Brazil reveals the existence of cointegration between money demand and the determinants: GDP, Exchange rate, Real interest rate and Inflation (Table 12).

The Error Correction Model (ECM) can be specified as:



**Figure 1.** CUSUM and CUSUMSQ test for dynamically stability of the model.

$$\Delta(\text{Moneydemand})_t = \beta_0 + \sum_{i=1}^p \beta_i \Delta(\text{Moneydemand})_{t-i} + \sum_{i=0}^{q_1} \delta_{1i} \Delta(\text{GDP})_{t-i} + \sum_{i=0}^{q_2} \delta_{2i} \Delta(\text{Exchange})_{t-i} + \sum_{i=0}^{q_3} \delta_{3i} \Delta(\text{Real})_{t-i} + \sum_{i=0}^{q_4} \delta_{4i} \Delta(\text{Inflation})_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad (11)$$

$$\Delta(\text{Moneydemand})_t = -3.819 + 2.182\Delta(\text{GDP})_t - 4.801\Delta(\text{GDP})_{t-1} - 0.00006\Delta(\text{Inflation})_t - 0.4783ECT_{t-1}$$

The negative sign of the coefficient of cointegration equation (-0.478341) reflects that if there is departure in one direction, the correction would have to pull back to the other direction so as to ensure that equilibrium is retained. The findings can be interpreted as the previous years' deviation from the long-run equilibrium is corrected at the speed of 47.8%.

#### Diagnostic test for serial correlation and residual distribution

The result of Breusch-Godfrey serial correlation LM test reflects the higher *p-value* of chi-square (0.1722), which reveals no evidence for serial correlation of the model. Normality test for residual distribution also reflects that the *p-value* of Jarque-Bera is 0.4139, which is greater than 5%, and we cannot reject the null hypothesis that states the residuals are normally distributed. That means the normality test confirms that the residuals are normally distributed, and hence the model is correctly specified to determine money demand function in Brazil.

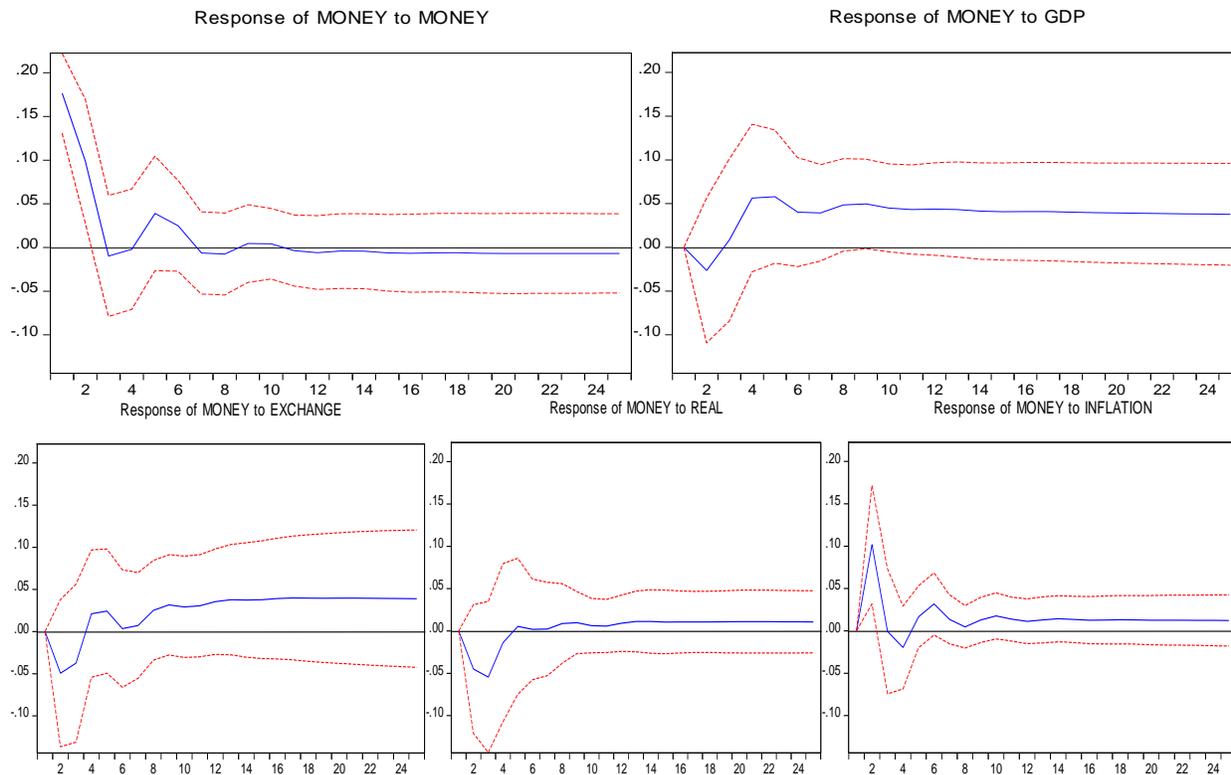
#### Test for dynamically stability of the model

The CUSUM test shows that the blue line is deviated from the 5% critical boundary between 2005 and 2010

(Figure 1). This structural break reflects that Brazil experienced challenges related to the slowdown in advanced economies following the global financial crisis and the falling of Chinese demand for Brazilian commodities (Costa, 2016). However, the CUSUM of squares test reflects that the blue trend line lies within the red lines, which confirms that the model is dynamically stable. This finding reveals Brazil has quickly recovered from the global financial crisis. Although the recursive error in the CUSUM test slightly crosses the 5% upper critical limit between 2005 and 2010, the CUSUMSQ test shows greater stability. This confirms that the demand for money in Brazil by and large is stable.

#### Impulse response functions and variance decomposition

Impulse response function is defined as the change in the current and expected values of a variable (or a vector of variables) conditional on the realization of a shock at a point in time. It shows the effects of shocks on the adjustment path of the variables. Impulse response function determines how long and to what degree a shock of a given equation has on all of the variables in the system. Impulse response functions are able to explain the sign of the relationships as well as how long these effects require to take place. A useful insight is that



**Figure 2.** Response to Cholesky one S.D. (d.f. adjusted) innovations  $\pm 2S.E.$

an impulse response function is essentially just a plot of the coefficients of the moving average representation of a time series. The analogy of the impulse response is like dropping a stone in a pond, in which at first ripples will be bigger but as time passes, the ripples get smaller and smaller until equilibrium is restored. That means when a dependent variable experiences a shock, it will return to equilibrium over a period of time. Figure 2 illustrates how money-demand reacts to a shock to the variables: money-demand, GDP, Exchange-rate, Real-interest-rate, and Inflation. The response of a shock to money-demand is a positive in money-demand but it turns to be negative after year three though it immediately turns back to positive after year four, and then decreases until it finally dies out over time. This is the response of money-demand to a shock of itself. The response of money-demand to a shock of GDP is negative but after year three it becomes positive where the effect remains positive and remains constant over time period. Similarly, response of money-demand to shocks of exchange-rate and real-interest-rate is that first it becomes negative and after year four the effect becomes positive and constant. Variance decomposition (forecast error variance decomposition) measures the contribution of each type of shock to the forecast error variance. It gives the proportion of the movement in the dependent variable that is due to its own shock versus shocks to the other

variables. In other words, variance decomposition informs what fraction of the forecast error variance of a variable is due to different shocks, potentially at different horizons. It gives information about the relative importance of its shock to the variables in the VAR. In money demand function of Brazil, the percent of broad-money variance due to broad-money decreases sharply in the first two years and after the second year, the effect decreases gently.

The proportion of the movements of the money-demand, that is, its own shock versus shocks to GDP and exchange-rate increases while it becomes constant to shocks to real-interest-rate and inflation after year two (Figure 3). Hence, variance decomposition and impulse response analysis help to check the impact of one variable on the other.

### Stability of money demand function in China

The bound test in money demand function of China reflects the existence of cointegration between money demand and its determinants. The error correction term (-0.07068) is negative and significant at 1% significance level, which can be interpreted as any deviation from the equilibrium is corrected at the speed of 7.1% each year (Table 13).

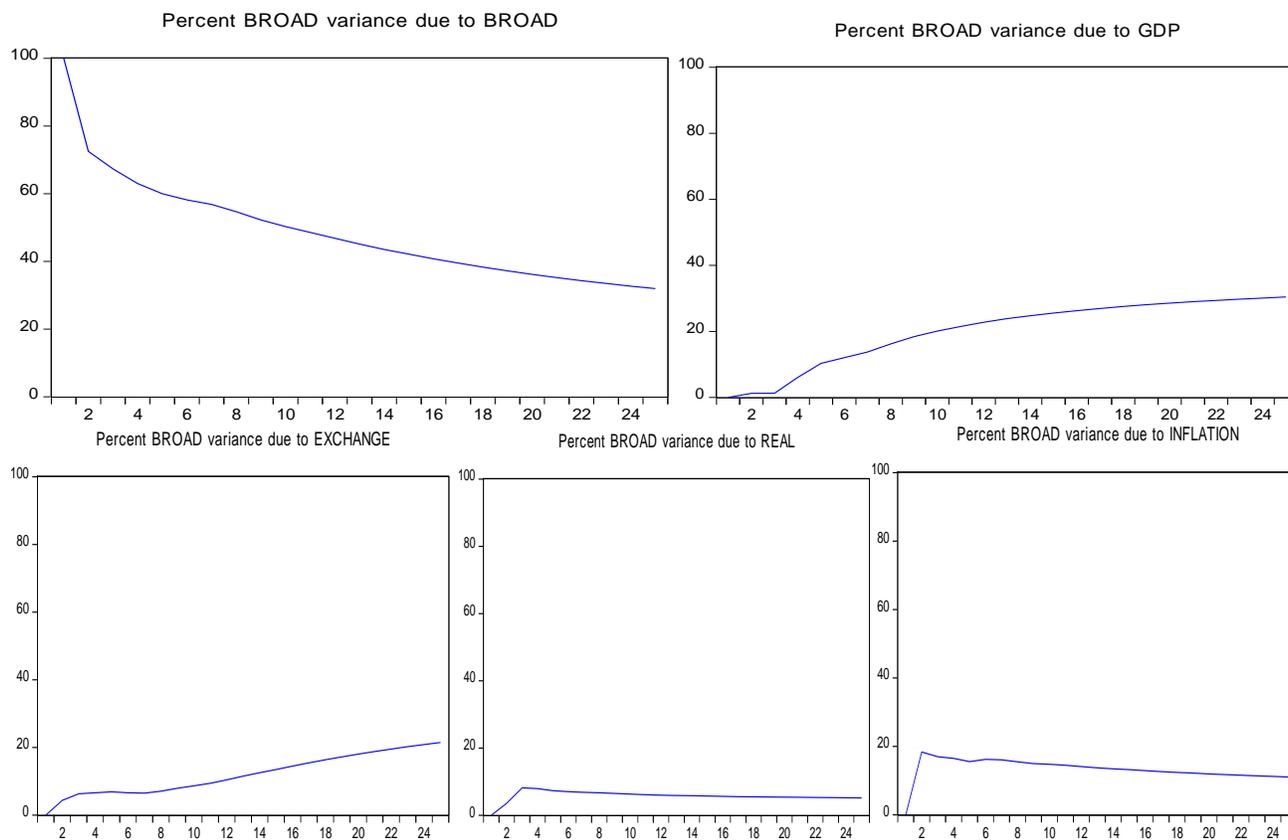
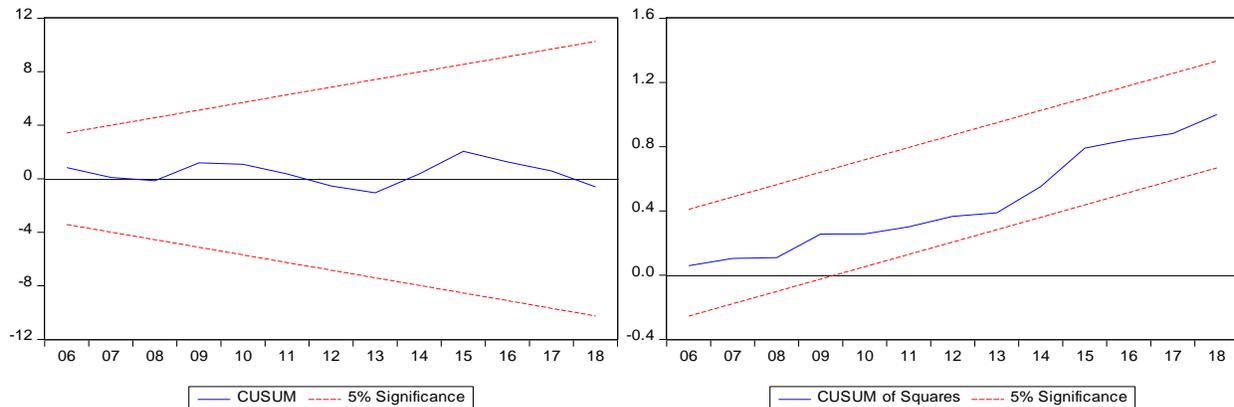


Figure 3. Variance decomposition of money demand function in Brazil.

Table 13. ARDL error correction regression.

Dependent Variable: D(Moneydemand)				
Selected Model: ARDL(3, 2, 2, 2, 2)				
Sample: 1987 2018				
Included observations: 29				
ECM Regression				
Variable	Coefficient	Std. error	t-Statistic	Prob.
C	2.258651	0.223777	10.09331	0.0000
D(Moneydemand(-1))	-0.066084	0.199984	-0.330444	0.7463
D(Moneydemand(-2))	0.084751	0.140423	0.603540	0.5565
D(GDP)	-0.745524	0.380154	-1.961110	0.0716
D(GDP(-1))	2.284400	0.407953	5.599661	0.0001
D(EXCHANGE)	0.012130	0.010672	1.136647	0.2762
D(EXCHANGE(-1))	0.010806	0.007725	1.398826	0.1853
D(REAL)	0.006667	0.005901	1.129754	0.2790
D(REAL(-1))	-0.010357	0.005352	-1.935241	0.0750
D(INFLATION)	-0.003274	0.005028	-0.651187	0.5263
D(INFLATION(-1))	-0.018296	0.005338	-3.427656	0.0045
CointEq(-1)*	-0.070678	0.007096	-9.959869	0.0000
R-squared	0.922776	Akaike info criterion	-4.844838	
Adjusted R-squared	0.872807	Schwarz criterion	-4.279060	
F-statistic	18.46715	Hannan-Quinn criter.	-4.667644	
Prob(F-statistic)	0.000000	Durbin-Watson stat	2.000726	



**Figure 4.** CUSUM and CUSUMSQ tests for stability of money demand function.

**Table 14.** ARDL error correction regression.

ECM Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.560713	0.241715	-2.319725	0.0305
D(Moneydemand(-1))	0.207952	0.174163	1.194012	0.2458
D(Moneydemand(-2))	0.347216	0.171050	2.029913	0.0552
CointEq(-1)*	-0.035208	0.014384	-2.447748	0.0233
R-squared	0.411856	Akaike info criterion	-4.480163	
Adjusted R-squared	0.341279	Schwarz criterion	-4.291571	
F-statistic	5.835539	Hannan-Quinn criterion	-4.421098	
Prob(F-statistic)	0.003639	Durbin-Watson stat	1.861890	

### Serial correlation and normality test

The serial correlation diagnostics was carried out with the null hypothesis of no serial correlation in the residuals. The p-value of chi-square (0.1437) is greater than 5%, which confirms no evidence for serial correlation in the model specification. The normality test confirms the residuals are normally distributed since the null hypothesis of “residuals are normally distributed” is not rejected due to higher p-value of Jarque-Bera (0.598935).

### Stability diagnostics

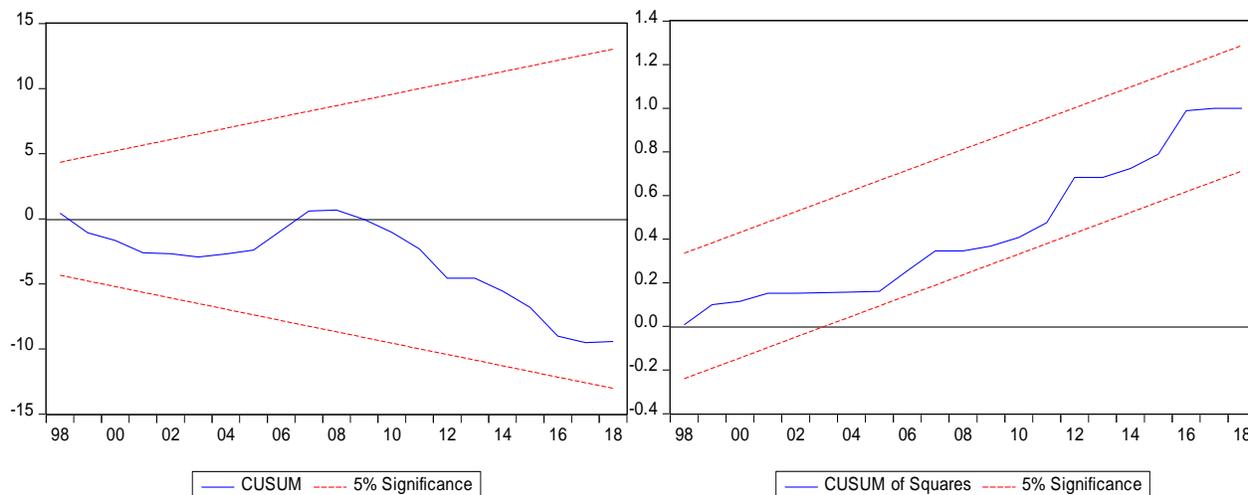
The stability diagnostics show that the blue lines are within the red lines boundaries for both CUSUM and CUSUMSQ tests, which confirm stable money demand in China (Figure 4). In the analysis of stability of money demand in China over the period 1983-2002 with the quarterly data, Bahman-Oskooee and Wang (2007) find

that only M1 is stable with CUSUM and CUSUMSQ tests though both M1 and M2 are cointegrated with their determinants. The instability of M2 can be explained as in the second half of 1980s the People’s Bank of China was transformed into the Central Bank of China to carry out monetary policy independently (Li, 2014), which might cause the structural break over the period 1983 - 1987.

After the financial reforms, CUSUM and CUSUMSQ tests confirm stable money demand in China over the period 1987 – 2018.

### Stability of money demand function in India

The negative sign of error correction term (ECT) reflects the convergence in the long-run if there is any deviation from the equilibrium. The coefficient of ECT (-0.035208) implies that the deviation from the equilibrium is corrected at the speed of 3.5% each year (Table 14). Money demand has cointegration with the determinants: GDP,



**Figure 5.** Stability test for money demand function in India.

exchange rate, real interest rate and inflation.

#### Diagnostics for serial correlation and normality test

Breusch-Godfrey serial correlation test was performed to detect serial correlation in the model with the hypothesis:

$H_0$ : there is no serial correlation

$H_1$ : the residuals are serially correlated

Since the p-value (0.7828) is greater than 5%, the null hypothesis is not rejected. This implies that there is no evidence for serial correlation in the model. The normality test for residual distribution determines whether the residuals are normally distributed or not. The null hypothesis of the normality test is that the residuals are normally distributed. Since the p-value of Jarque-Bera is greater than 5%, which is 0.335522, we failed to reject the null hypothesis. This implies that the residuals are normally distributed.

#### Stability test for money demand function in India

The CUSUM test determines whether the coefficients of the money demand function are changing systematically, while CUSUMSQ investigates the presence of abrupt change with the null hypothesis of parameters are stable. The CUSUM can also reveal structural changes. If the CUSUM crosses the red line, this is evidence against structural stability of the specified model. That means if the blue line crosses the red lines of 5% significance level, the null hypothesis of stable parameters is rejected. Since the blue line is within the red line boundaries (Figure 5), we fail to reject the null hypothesis. This implies that the money demand in India is stable. This

finding is consistent with that of Rao and Kumar (2008) who state that there is no evidence that the long-run relationship between money demand and its determinants is significantly affected over the period 1985 to 2005. Bahmani-Oskooee and Rehman (2005) also state that demand for money is fairly stable in many Asian countries including India. In the investigation of stable money demand function after reforms, Nitin and Asghar (2016) find stable money demand function in India with monthly data over the period 1991 – 2014 using the cointegration and error correction model.

#### Stability of money demand function in Indonesia

Money demand function in Indonesia reveals the existence of cointegration between money demand and the determinants: GDP, Exchange rate, Real interest rate and Inflation. In the analysis of the Indonesian influential factors of money demand, Prawoto (2010) also confirms the existence of long-run relationship between money demand and its determinants. The Error Correction Model (Table 15) can be specified as:

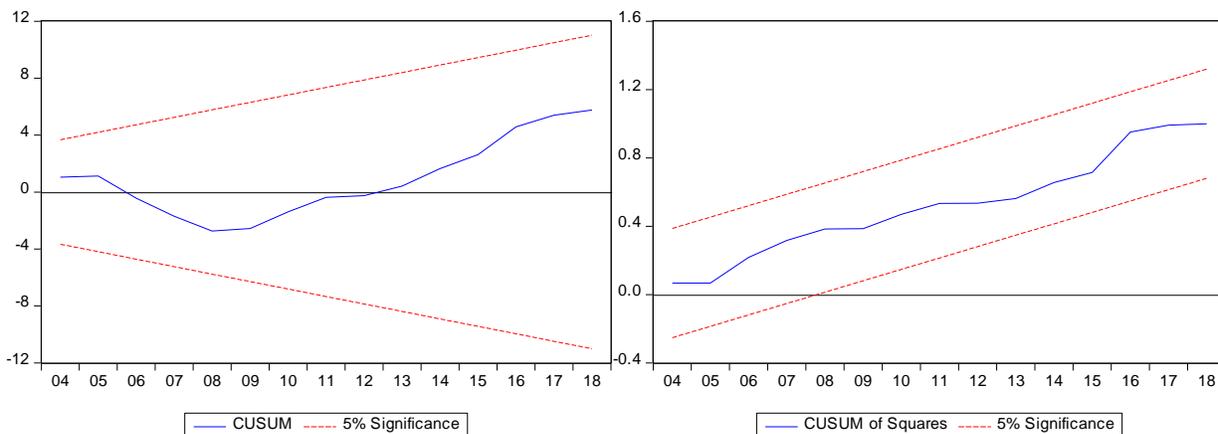
$$\Delta(\text{Moneydemand})_t = \beta_0 + \sum_{i=1}^p \beta_i \Delta(\text{Moneydemand})_{t-i} + \sum_{i=0}^{q_1} \delta_{1i} \Delta(\text{GDP})_{t-i} + \sum_{i=0}^{q_2} \delta_{2i} \Delta(\text{Exchange})_{t-i} + \sum_{i=0}^{q_3} \delta_{3i} \Delta(\text{Real})_{t-i} + \sum_{i=0}^{q_4} \delta_{4i} \Delta(\text{Inflation})_{t-i} + \lambda \text{ECT}_{t-1} + \varepsilon_t \quad (12)$$

$$\Rightarrow \Delta(\text{Moneydemand})_t = 1.1005 + 0.2367\Delta(\text{Moneydemand})_{t-1} - 2.0574(\text{GDP})_t + 0.3153\Delta(\text{GDP})_{t-1} + 0.0000001\Delta(\text{Exchange})_t + 0.0000035\Delta(\text{Exchange})_{t-1} - 0.00767\Delta(\text{Real})_t + 0.002\Delta(\text{Real})_{t-1} - 0.0125\Delta(\text{Inflation})_t + 0.0002\Delta(\text{Inflation})_{t-1} - 0.235\text{ECT}_{t-1}$$

The error correction term (-0.2351) implies that the deviation from the equilibrium is corrected at the speed of 23.5% each year.

**Table 15.** Results of ARDL error correction regression.

Dependent Variable: D(Moneydemand)				
Selected Model: ARDL(2, 2, 2, 2, 2)				
Sample: 1987 2018				
Included observations: 30				
<b>ECM Regression</b>				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.100494	0.253949	4.333530	0.0006
D(Moneydemand(-1))	0.236700	0.144504	1.638019	0.1222
D(GDP)	-2.057362	1.196520	-1.719456	0.1061
D(GDP(-1))	0.315276	1.028712	0.306476	0.7635
D(EXCHANGE)	7.07E-08	1.43E-05	0.004943	0.9961
D(EXCHANGE(-1))	3.45E-06	1.26E-05	0.274023	0.7878
D(REAL)	-0.007667	0.005707	-1.343386	0.1991
D(REAL(-1))	0.001972	0.003343	0.589861	0.5641
D(INFLATION)	-0.012477	0.005560	-2.243927	0.0404
D(INFLATION(-1))	0.000189	0.002554	0.073918	0.9421
CointEq(-1)*	-0.235135	0.052197	-4.504747	0.0004
R-squared	0.840115	Akaike info criterion	-3.407142	
Adjusted R-squared	0.755965	Schwarz criterion	-2.893369	
F-statistic	9.983555	Durbin-Watson stat	1.820626	
Prob(F-statistic)	0.000012			

**Figure 6.** Stability test for money demand function in Indonesia.

### Diagnostics for serial correlation and residual distribution

The result of Breusch-Godfrey LM test reflects the higher *p-value* of chi-square (0.5951). This supports the null hypothesis of no serial correlation in the model. This implies that there is no evidence of serial correlation in the model. The normality test determines whether the residuals are normally distributed or not with the null hypothesis of the residuals are normally distributed. The higher *p-value* of Jarque-Bera (0.9720), which is greater than 5%, supports the null hypothesis. This confirms that the residuals are normally distributed.

### Stability test for money demand function in Indonesia

The CUSUM and CUSUMSQ testes were applied to detect the coefficients of the money demand function were structurally stable with the null hypothesis of parameters are stable. Figure 6, in which the blue line lies within the red line boundaries, implies that the money demand function in Indonesia is stable. Lestano et al. (2011) investigate money demand stability for Indonesia using both broad and narrow money demand equation over the period, 1980Q1-2004Q4. The findings reflect the existence of long-run relationships between broad and narrow money demand and their determinants. However,

**Table 16.** ARDL error correction regression.

ECM Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.078188	1.713724	-2.963247	0.0072
D(GDP)	1.662906	0.348704	4.768811	0.0001
D(GDP(-1))	1.071063	0.348344	3.074730	0.0055
CointEq(-1)*	-0.205539	0.069778	-2.945629	0.0075
R-squared	0.750663	Akaike info criterion	-4.023744	
AdjustedR-squared	0.721893	Schwarz criterion	-3.836918	
F-statistic	26.09215	Hannan-Quinn criterion	-3.963977	
Prob(F-statistic)	0.000000	Durbin-Watson stat	2.196451	

the CUSUM and CUSUMSQ tests reveal only narrow money demand is stable in Indonesia. They justify why broad money was not stable over the period 1980 – 2004 as that period was influenced by many financial liberalization including the financial crisis of 1997-1998. In addition to this justification, in their analysis the inflation factor was not considered in the specification of broad money demand function. This might also reflect unreliable result in the stability tests due to misspecification of the determinants. In the analysis of stability of narrow money demand in Indonesia, Hossain (2011) states that the narrow money demand is stable irrespective of ongoing financial reforms in Indonesia since the late 1980s. The findings also reflect the existence of long-run relationships between narrow money demand and the determinants: real income and the deposit interest rate.

#### Stability of money demand function in South Africa

The bound test in money demand function of South Africa reveals the existence of long-run relationship between money demand and its determinants. The error correction term (-0.2055) is negative and significant at 1% significance level, which implies that any deviation from the equilibrium is corrected at the speed of 20.55% each year (Table 16).

#### Diagnostics for serial correlation and residual distribution

The Breusch-Godfrey LM test was performed with null hypothesis of no serial correlation. The higher *p-value* of chi-square (0.5033), which is greater than 5%, supports the null hypothesis. This implies that there is no evidence of serial correlation in the model. The normality test was performed to investigate whether the residuals were

normally distributed or not with the null hypothesis of “the residuals are normally distributed”. The higher *p-value* of Jarque-Bera (0.9588), which is greater than 5%, supports the null hypothesis. This implies that the residuals are normally distributed.

#### Stability test for money demand function

The CUSUM and CUSUMSQ tests were applied to investigate the stability of the coefficients of money demand function with the null hypothesis of stable parameters. Figure 7, in which the blue lines lie within the red line boundaries, implies that money demand function is stable in South Africa. This finding is similar to that of Dube (2013) in the analysis of broad money demand (M3) in South Africa, in which the demand for money is stable in both CUSUM and CUSUMSQ tests. In the empirical analysis of money demand stability in Nigeria, Okonkwo et al. (2014) find stable money demand function using CUSUM and CUSUMSQ tests. In the stability analysis of money demand in Nigeria, Nduka et al. (2013) also confirm stable and long-run relationship between demand for real broad money and the determinants: income, domestic real interest rate, expected rate of inflation, expected foreign exchange depreciation, and foreign interest rate as the trend lines are within the boundary lines in both CUSUM and CUSUMSQ tests.

#### The stability of money demand function in Turkey

Money demand function in Turkey reveals the presence of cointegration between money demand and its determinants. The error correction term (-0.5044) is negative and significant at 5% significance level, which

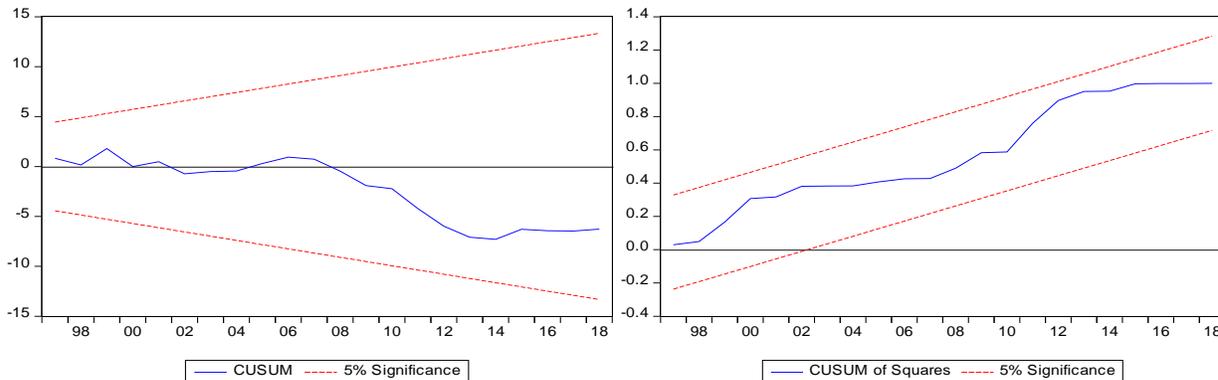


Figure 7. Stability test for the coefficients of money demand function.

Table 17. ARDL Error correction regression.

Dependent Variable: D(Moneydemand)  
 Selected Model: ARDL(3, 2, 2, 2, 2)  
 Sample: 1987 2018  
 Included observations: 29

ECM Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-18.70561	7.093137	-2.637142	0.0205
D(Moneydemand(-1))	-0.046435	0.188811	-0.245934	0.8096
D(Moneydemand(-2))	-0.034313	0.176109	-0.194841	0.8485
D(GDP)	-0.146105	0.477479	-0.305993	0.7645
D(GDP(-1))	-0.861542	0.583369	-1.476838	0.1635
D(EXCHANGE)	-0.012830	0.081577	-0.157269	0.8774
D(EXCHANGE(-1))	-0.043005	0.120551	-0.356734	0.7270
D(REAL)	-0.001482	0.000853	-1.736509	0.1061
D(REAL(-1))	-0.010727	0.003652	-2.937424	0.0115
D(INFLATION)	-0.008482	0.003418	-2.481822	0.0275
D(INFLATION(-1))	0.001854	0.000959	1.933582	0.0752
CointEq(-1)*	-0.504373	0.189999	-2.654614	0.0198
R-squared	0.701362	Akaike info criterion	-2.045959	
Adjusted R-squared	0.508126	Schwarz criterion	-1.480182	
F-statistic	3.629557	Hannan-Quinn criter.	-1.868765	
Prob(F-statistic)	0.008616	Durbin-Watson stat	2.183254	

implies that any deviation from the equilibrium is corrected at the speed of 50.4% in the long-run (Table 17).

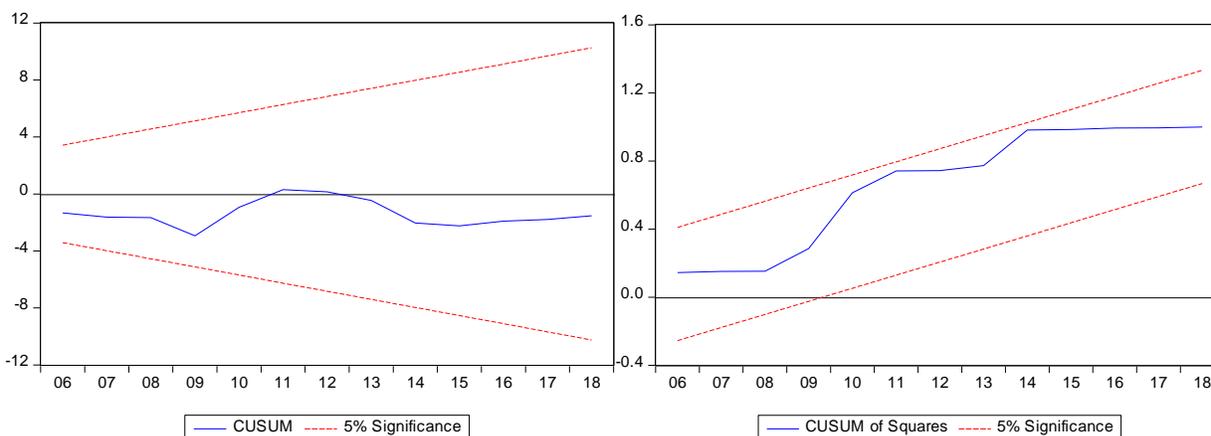
**Diagnostics for serial correlation and residual distribution**

The Breusch-Godfrey serial correlation LM test was performed with the null hypothesis of no serial correlation. The higher p-value of chi-square (0.1887), which is greater than 5%, supports the null hypothesis. This implies that there is no evidence of serial correlation

in the model. The normality test was also performed with the null hypothesis of normally-distributed residuals. The p-value of Jarque-Bera (0.614483) is greater than 5%, and hence the null hypothesis is not rejected. This implies that the residuals are normally distributed.

**Stability test for money demand function in Turkey**

The CUSUM and CUSUMSQ tests were performed to detect whether the coefficients of the money demand function were structurally stable with the null hypothesis of stable parameters. Figure 8, in which the blue lines are



**Figure 8.** CUSUM and CUSUMSQ tests for stability.

within the red line boundaries, implies that money demand function in Turkey is stable. This finding is similar to that of Saatcioglu and Korap (2005) in the study of Turkish broad money demand over the period 1987Q1 – 2004Q2 with quarterly data. However, in the analysis of money demand function in Turkey, Oscalik (2014) explains that while CUSUM test indicates stable money demand function, the CUSUMSQ test results in instability of money demand function. In the study conducted during the inflation target on money demand and its determinants in Turkey over the period 2002:Q1 – 2013:Q2, Tumturk (2017) also finds unstable relationship between money demand and its determinants with CUSUM test. The findings of their unstable money demand function might be attributed to the global financial crisis of 2008. However, the probability of this global-crisis impact is insignificant when a wide range of data period (1987 to 2018) is considered to investigate the stability of money demand function in Turkey.

## Conclusion

Real income influences money demand of the emerging countries positively; whereas, exchange rate, real interest rate and inflation possess negative impacts on money demand. Money demand function is better explained by using dynamic models rather than static panel analysis. The stability test confirms stable money demand function in China, India, Indonesia, South Africa and Turkey. However, the CUSUM test of money demand function in Brazil reflects the existence of structural breaks between 2005 and 2010, which might be due to the global financial crisis. The error-correction term is negative and significant in each of the group-specific countries. This confirms that any deviation from the equilibrium is corrected each year at the speed of 47.8% in Brazil, 7.1% in China, 3.5% in India, 23.5% in Indonesia, 20.55% in South Africa, and 50.4% in Turkey. The bound tests in the money demand

function of the emerging countries reveal the existence of long-run relationship between money demand and the determinants: GDP, exchange rate, real interest rate, and inflation. Therefore, the central banks should target on money supply as their monetary policy in the countries of the emerging economies.

## CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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## APPENDICES

**Appendix A. Results of Random Effects Model.**

Balanced Panel: n = 6, T = 32, N = 192

Effects:

	var	std. dev	share
idiosyncratic	0.03499	0.18705	0.145
individual	0.20666	0.45459	0.855
theta:	0.9275		

Residuals:

Min.	1st Qu.	Median	3rd Qu.	Max.
-0.898121	-0.084984	0.010268	0.084234	0.758812

**Coefficients:**

	Estimate	Std. Error	z-value	Pr(> z )
Intercept	-1.2664e+01	7.8614e-01	-16.1093	< 2.2e-16 ***
GDP	1.4443e+00	2.7880e-02	51.8034	< 2.2e-16 ***
Exchange	-4.0277e-05	8.2141e-06	-4.9034	9.417e-07 ***
Real	-2.1384e-03	1.0545e-03	-2.0278	0.04258 **
Inflation	4.7067e-05	4.8492e-05	0.9706	0.33175

Signif. codes: '\*\*\*' 0.01 '\*\*' 0.05 '\*' 0.1

Total Sum of Squares: 104.61      Adj. R-Squared: 0.93704  
 Residual Sum of Squares: 6.4479      Chisq: 2846.89 on 4 DF, p-value: < 2.22e-16  
 R-Squared: 0.93836

Source: own computation.

**Appendix B. Feasible Generalized Least Square (FGLS) for controlling cross sectional dependence.**

Dependent Variable: MONEYDEMAND

Method: Panel EGLS (Cross-section random effects)

Total panel (balanced) observations: 192

Swamy and Arora estimator of component variances

Cross-section SUR (PCSE) standard errors and covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	1.444255	0.018790	76.86433	0.0000
EXCHANGE	-4.03E-05	8.56E-06	-4.705828	0.0000
REAL	-0.002138	0.001194	-1.791571	0.0748
INFLATION	4.71E-05	8.60E-05	0.547078	0.5850
C	-12.66417	0.541272	-23.39708	0.0000

**Effects specification**

	S.D.	Rho
Cross-section random	0.454594	0.8552
Idiosyncratic random	0.187055	0.1448

**Appendix B Cont'd.** Feasible Generalized Least Square (FGLS) for controlling cross sectional dependence.

<b>Weighted statistics</b>			
R-squared	0.938363	Mean dependent var	1.958530
Adjusted R-squared	0.937044	S.D. dependent var	0.740067
S.E. of regression	0.185690	Sum squared resid	6.447897
F-statistic	711.7219	Durbin-Watson stat	0.953536
Prob(F-statistic)	0.000000		
<b>Unweighted Statistics</b>			
R-squared	0.932804	Mean dependent var	26.99646
Sum squared resid	21.48127	Durbin-Watson stat	0.286217

Source: Own computation.

**Appendix C.** Panel ARDL (3, 2, 2, 2, 2) results of PMG model.

Dependent Variable: D(MONEYDEMAND)

Method: ARDL

Sample: 1990 2018

Included observations: 174

Model selection method: Akaike info criterion (AIC)

Dynamic regressors (2 lags, automatic): GDP EXCHANGE REAL INFLATION

Fixed regressors: C

Number of models evaluated: 6

Selected Model: ARDL(3, 2, 2, 2, 2)

Note: final equation sample is larger than selection sample

<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob.*</b>
<b>Long Run Equation</b>				
GDP	1.223746	0.025380	48.21620	0.0000
EXCHANGE	-0.000108	1.54E-05	-6.988782	0.0000
REAL	-0.022639	0.009727	-2.327512	0.0217
INFLATION	-0.035719	0.007152	-4.994269	0.0000
<b>Short Run Equation</b>				
COINTEQ01	-0.154774	0.070913	-2.182590	0.0311
D(MONEYDEMAND(-1))	0.051883	0.077622	0.668398	0.5052
D(MONEYDEMAND(-2))	-0.075280	0.220735	-0.341044	0.7337
D(GDP)	-0.566745	0.366020	-1.548401	0.1242
D(GDP(-1))	0.507900	0.202170	2.512239	0.0134
D(EXCHANGE)	-0.000674	0.010375	-0.064987	0.9483
D(EXCHANGE(-1))	-0.022119	0.027734	-0.797536	0.4268
D(REAL)	0.005575	0.005625	0.991233	0.3236
D(REAL(-1))	-0.002976	0.002301	-1.293339	0.1985
D(INFLATION)	0.002255	0.005583	0.403870	0.6871
D(INFLATION(-1))	-0.002537	0.003240	-0.783155	0.4351
C	-0.841615	0.432600	-1.945481	0.0541
Mean dependent var	0.062949	S.D. dependent var	0.150642	
S.E. of regression	0.081796	Akaike info criterion	-2.575127	
Sum squared resid	0.776099	Schwarz criterion	-1.285701	
Log likelihood	323.2122	Hannan-Quinn criter.	-2.052900	

\*Note: p-values and any subsequent tests do not account for model selection.

Source: Own computation.

## Appendix D. Group-specific ARDL (3, 2, 2, 2).

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<b>Brazil</b>				
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob. *</b>
COINTEQ01	-0.00363	2.30E-06	-1579.8	0.0000
D(MONEY <sup>D</sup> (-1))	-0.21053	0.101155	-2.08124	0.1288
D(MONEY <sup>D</sup> (-2))	-1.02635	0.029969	-34.2471	0.0001
D(GDP)	-0.199	3.442012	-0.05782	0.9575
D(GDP(-1))	0.135586	3.309821	0.040965	0.9699
D(EXCHANGE)	-0.0464	0.012891	-3.59962	0.0368
D(EXCHANGE(-1))	0.022878	0.014948	1.530491	0.2234
D(REAL)	-0.00409	3.01E-05	-135.8	0.0000
D(REAL(-1))	-0.0029	3.19E-05	-91.09	0.0000
D(INFLATION)	0.000146	2.96E-08	4927.944	0.0000
D(INFLATION(-1))	0.000377	1.22E-08	30869.73	0.0000
C	0.129407	0.003292	39.31178	0.0000
<b>China</b>				
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob. *</b>
COINTEQ01	-0.47381	0.00601	-78.837	0.0000
D(MONEY <sup>D</sup> (-1))	-0.02082	0.03911	-0.53237	0.6314
D(MONEY <sup>D</sup> (-2))	-0.05167	0.021906	-2.35846	0.0995
D(GDP)	-0.63932	0.144355	-4.42876	0.0214
D(GDP(-1))	1.352018	0.149832	9.023534	0.0029
D(EXCHANGE)	0.017686	0.000129	137.469	0.0000
D(EXCHANGE(-1))	0.002013	9.05E-05	22.24507	0.0002
D(REAL)	0.029896	4.52E-05	660.7134	0.0000
D(REAL(-1))	-0.00878	3.52E-05	-249.747	0.0000
D(INFLATION)	0.026932	3.23E-05	833.6946	0.0000
D(INFLATION(-1))	-0.01074	3.71E-05	-289.256	0.0000
C	-2.77057	0.594453	-4.6607	0.0186
<b>India</b>				
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob. *</b>
COINTEQ01	-0.08197	0.001771	-46.299	0.0000
D(MONEY <sup>D</sup> (-1))	0.233665	0.035089	6.659263	0.0069
D(MONEY <sup>D</sup> (-2))	0.533427	0.026887	19.83928	0.0003
D(GDP)	-0.36687	0.072425	-5.0656	0.0149
D(GDP(-1))	0.294397	0.111034	2.651408	0.0769
D(EXCHANGE)	-0.00218	5.70E-06	-383.221	0.0000
D(EXCHANGE(-1))	0.00011	5.50E-06	20.08222	0.0003
D(REAL)	-0.00459	2.62E-05	-175.457	0.0000
D(REAL(-1))	0.005877	1.57E-05	373.9635	0.0000
D(INFLATION)	-0.01043	4.08E-05	-255.912	0.0000
D(INFLATION(-1))	0.007147	3.39E-05	210.6818	0.0000
C	-0.50033	0.080568	-6.21001	0.0084

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**Appendix D Cont'd.** Group-specific ARDL (3, 2, 2, 2, 2).

<b>Indonesia</b>				
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob. *</b>
COINTEQ01	-0.16807	0.009814	-17.1263	0.0004
D(MONEY <sup>D</sup> (-1))	0.104054	0.040735	2.55441	0.0836
D(MONEY <sup>D</sup> (-2))	0.349449	0.029321	11.91812	0.0013
D(GDP)	0.711638	0.310382	2.29278	0.1057
D(GDP(-1))	0.730818	0.304483	2.400193	0.0959
D(EXCHANGE)	-0.00075	5.55E-05	-13.4883	0.0009
D(EXCHANGE(-1))	0.001907	5.66E-05	33.66013	0.0001
D(REAL)	0.014214	2.52E-05	564.5578	0.0000
D(REAL(-1))	-0.00691	2.57E-05	-268.776	0.0000
D(INFLATION)	0.007964	5.44E-05	146.327	0.0000
D(INFLATION(-1))	-0.01359	8.37E-05	-162.391	0.0000
C	-1.02827	0.348658	-2.94921	0.0601
<b>South Africa</b>				
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob. *</b>
COINTEQ01	-0.01432	0.000486	-29.4676	0.0001
D(MONEY <sup>D</sup> (-1))	-0.07882	0.029018	-2.71625	0.0728
D(MONEY <sup>D</sup> (-2))	-0.12139	0.024519	-4.95091	0.0158
D(GDP)	-0.89138	0.135744	-6.5666	0.0072
D(GDP(-1))	-0.01904	0.191605	-0.09937	0.9271
D(EXCHANGE)	0.027584	0.005345	5.160489	0.0141
D(EXCHANGE(-1))	-0.15963	0.0106	-15.0584	0.0006
D(REAL)	-0.00093	1.08E-06	-858.831	0.0000
D(REAL(-1))	-0.0065	1.04E-05	-622.605	0.0000
D(INFLATION)	-0.00734	1.04E-05	-702.414	0.0000
D(INFLATION(-1))	0.0015	7.99E-07	1876.591	0.0000
C	0.048183	0.014963	3.220152	0.0486
<b>Turkey</b>				
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob. *</b>
COINTEQ01	-0.18685	0.003371	-55.4305	0.0000
D(MONEY <sup>D</sup> (-1))	0.283746	0.023832	11.90608	0.0013
D(MONEY <sup>D</sup> (-2))	-0.13515	0.019385	-6.972	0.0061
D(GDP)	-2.01554	1.128997	-1.78525	0.1722
D(GDP(-1))	0.55362	1.029667	0.537669	0.6281
D(EXCHANGE)	1.78E-05	1.65E-10	108104.4	0.0000
D(EXCHANGE(-1))	1.97E-06	1.06E-10	18599.8	0.0000
D(REAL)	-0.00105	2.51E-05	-41.9064	0.0000
D(REAL(-1))	0.001364	1.02E-05	133.4191	0.0000
D(INFLATION)	-0.00374	2.55E-05	-146.507	0.0000
D(INFLATION(-1))	8.37E-05	5.96E-06	14.04682	0.0008
C	-0.92812	0.11313	-8.20405	0.0038

Source: Own computation

*Full Length Research Paper*

# **Human capital and stock market performance of some selected emerging economies**

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Received 20 August, 2020; Accepted 24 September, 2020

**This article fills a gap of literature on the relationship between education and the stock market. We adopt the modified Calderon-Rossell model to estimate the effect of quality of human capital on Capital market. Four different techniques were used to check the robustness of the result. Of all the techniques adopted Newey-West to account for different characteristics of emerging economies turnout to be more efficient and appropriate. The article finds that the quality of human capital is an important determinant of stock market development in emerging market countries. Policy makers in emerging economies must seek to implement policies that would make education accessible and meaningful to the populace. By this Free Senior High School policy in Ghana is in the right direction for capital market development.**

**Key words:** Human Capital, Stock Market, GDP.

## **INTRODUCTION**

The stock market in every country is one way to access long term funding for investment and development. Generally Stock markets are believed to be the heartbeat of the economy given their ability to respond almost instantaneously to fundamental changes in the economy and the avenue for the needed long term funding for development. As a result of this belief, there has been considerable development in the stock market since the early 1990s in various economic blocks. Before 1989, there were just a few stock markets in the economies sampled for this article. The rise in number can be attributed to the needed long term equity funds for economic development. The pace and extent of stock

market development in the sampled countries have been unparalleled. This has led to fundamental shift both in the financial structures and in the capital flows from more economically endowed countries.

Theories identify human capital and technology as major factors of development. To achieve sustainable development, the citizenry needs to change their behavior as individuals and as societies. This can be realized through educational reforms or increase access to education. There are two reasons for expecting to find some link between education and the performance of the stock market. The general reason is that it is intuitively plausible that living standards have risen so much over

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JEL classification: G, F, O

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the last millennium because of education.

This article contributes to the literature on the relationship between education and the Stock market. Winful et al. (2013) concluded that education positively affects the Ghana stock market. Goh (1979) present the wealth of an economy in the 21st century is the quality of human resource. This article seeks to substantiate this finding about the Stock markets of emerging economies. The objective here is to establish a relationship between the quality of human capital and Stock market.

## Literature

The realization of the important human capital can be linked to classical economics (Fitzsimons, 1999) and became prominent in the 1950's (Woodhall, 2001). Human capital is now an important factor for a national economic growth in the modern economy.

Intellectual capital assets has become an important resource for performance due to change from manufacturing-based economy to a knowledge-based economy (Firer and Williams, 2003; Orens et al., 2009). The stock market is an example of knowledge-based enterprise or sector.

Rastogi (2002), Garavan et al. (2001), and Youndt et al. (2004) linked human capital to knowledge, skills, education, and abilities. To this article it is the ability to invest appropriately in the stock market. De la Fuente and Ciccone (2002) neglects one's experience and stresses on human capital as knowledge and skills obtained throughout educational activities such as compulsory education, postsecondary education, and vocational education. In the work of Guiso et al. (2004), they proved that individuals who live or were born in areas with higher levels of social capital are more likely to invest in stocks.

Conventional human capital stock can be largely categorized into three parts: output, cost and income-based approach. Examples of the measure using the output approach are School enrollment rates, scholastic attainments, adult literacy, and average years of schooling (Barro, 1991; Barro and Lee, 1993). However, the limitation with the measure is that student's effectiveness can be recognized after participating in activities.

The evidence comes from a few studies. Van Rooij et al. (2011) in their article concluded that individuals with high financial literacy are more likely to invest in the stock market.

The reason being that their knowledge lowers their operation cost. In Maddison (1991) he established that countries with high levels of GDP per Capita are associated with high-quality human capital some thirty years earlier. According to Guiso et al. (2004) individuals born in areas with higher levels of social capital are more likely to invest in stocks.

## METHODOLOGY

A relevant empirical proxy for the ability of individuals in a country is secondary school enrolment. The use of this variable deserve cautious treatment since, quality of human capital is endogenous to stock market development. This is because there may be some omitted variables that correlate with both knowledge and stock market development. It also believed that the relationship might suffer from simultaneity (or reverse causality). Secondly, education is a policy output variable and therefore further caution is called before thinking of it as an explanatory variable determining another output.

From Campos and Horvath (2006) and Loayza and De Soto (2002), we argue that the quality of human capital is associated with the stock market variables and macroeconomic stability variables. The direction of causation is from the latter to the former hence we cannot consider the quality of human capital as exogenous policy tool.

Cadeleron-Rossell's (1990) behavioral structural model was adopted. The model to date represents a more comprehensive attempt to develop the foundation of a financial theory of stock market development. The empirical model includes secondary school education, which is a proxy for the quality of human capital. In this article we create a probabilistic model by starting with a deterministic model that approximates the relationship we want to model:

$$SMC_{it} = \beta_0 + \beta_1 E_{it} + \beta_2 GDP_{it} + \mu_{it}$$

Where, SMC is stock market capitalization relative to GDP, and  $\mu_{it}$  is the white noise or the error variable accounting for model misspecification, omitted variables etc. Another model of equation 1 was also ran by introducing the interaction effect of GDP and Education on the relationship in Equation 1 to determine whether the interaction has a significant effect on the relationship.

$$SMC_{it} = \beta_0 + \beta_1 E_{it} + \beta_2 GDP_{it} + \beta_3 GE_{it} + \mu_{it}$$

Model

$$SMC_{it} = b_0 + b_1 E_{it} + b_2 GDP_{it} + b_3 (E_{it} \times GDP_{it}) + \varepsilon_{it}$$

$$b_0, b_1, b_2, b_3 > 1;$$

Where, GE is the interaction between Education and GDP. The interaction effect here tests whether the effect of GDP on the stock market is influenced by education at  $\alpha=0.05$ . The prior signs based on theoretical literature should be  $b_0 > 0; b_1 > 0; b_2 > 0; b_3 > 0$ . Psacharopoulos and Layard (1979) postulated a positive relationship between education and performance. An increase in GDP is an indication of increased productive activities of firms and we expect the values of firms to increase with GDP.

Since we do not need the assumption of homoscedasticity for OLS to be unbiased, we use OLS with heteroskedasticity to run the regression while maintaining the assumption with no autocorrelation. If the variables is tested at  $\alpha=0.05$  and are not stationary, we then find the first difference model 1 and 3.

"Model difference", looks at the variables in difference and expects the same prior signs. To address the likely problem serial correlation in the error term, we focus on DOLS estimator instead since serial correlation and the endogeneity can be corrected by using the DOLS estimator. We then also correct for heteroskedasticity and serial correlation together with Newey-West estimation technique.

## Descriptive analysis of explanatory variables

The minimum and maximum values for GDP for the 41 countries

**Table 1.** Descriptive statistic of explanatory variables.

Parameter	Obs	Mean	Std	Min	Max	Skewness	kurtosis	prob
SMC	615	391.27	294.24	33.1	1089.2	0.578	2.283	0.001
GDP (millions of \$)	615	18.64	12.46	6.12	26.13	0.654	2.394	0.000
E	615	68.23	19.04	16.15	87.89	3.275	27.654	0.000
ExGDP	615	78.68	27.33	19.37	97.68	3.157	2.947	0.000

Source: Source: Author (2020).

**Table 2.** Lag Selection Test (SMC, GDP and E).

Lag	logL	AIC	SC	HQ
0	-5461.717	65.834	65.93	65.873
1	-4262.678	51.158	51.735	51.393
2	-4138.535	49.919	50.976*	50.348
3	-4086.301	49.579	51.116	50.203*
4	-4069.005	49.675	51.693	50.495
5	-4042.853	49.661	52.159	50.675

\*Indicates lag order selected by the criterion.  
Source: Source: Author (2020).

covering the period under study is 6.12 and 26.13 million US dollars respectively. The minimum value for SMC is 33.1 and a maximum value of 1089.2. The mean values of SMC and GDP were 391.27 and 18.64 with a standard deviation of 294.24 and 12.46. The mean quality of human capital for the period under study is 68.23, with a standard deviation of 19.004. The minimum and maximum Secondary school enrolments as a percentage of the workforce were 23.415 and 114.134, respectively, as shown in Table 1. The standard deviation for the variables presented is widely spread around their respective mean. The results reveal that ability of the individual to invest varied more than GDP. The skewness of the variables as shown in Table 1, reveals that the variables are all asymmetrical. All variables are positive and skewed.

Table 1 shows that the descriptive statistics are not normally distributed about their mean and variance. The data is a systematic one. This indicates that the aggregate stock price on the emerging markets and quality of human capital and GDP are very sensitive to periodic changes and speculations. To interpret, entrepreneurs can benefit considerably higher normal rate of profit from the stock market. This revelation demonstrates the degree of efficiency of the stock market.

## ANALYSIS OF RESULTS

The ability of the individual to invest (E) and GDP to test stationary cointegration relationships was assumed. The article examines the time-series properties of the variables by utilizing unit-root tests and the presence of a stochastic trend in the adapted regression model Fosu et al. (2014). The stationarity of variables using the following tests; LLC, Breitung, IPS and Hadri was determined. This certified that the statistical properties of the selected variables do not change overtime. This is important because nonstationary variables tended to give a misleading parameter estimate of the relationship

between independent variables and stock market returns. Based on the Schwarz information criterion, the stationarity test is sensitive to lag length of a maximum lag order of 2, as shown in Table 2.

The statistics are normal standard with a left-hand side rejection area, except on the Hadri test, which is the right side. A\* indicates the rejection of the null hypothesis of nonstationarity (LLC, Breitung IPS) or stationarity (Hadri) at least at a 5% level of significance. Table 3 shows the stationarity test. At 5% significance and considering p-value, it was found that all three variables had unit-roots. This is so because the variables were lesser than the absolute variables of the test critical values at 5% (55.11, 18.37, and 98.63%). The article fails to reject the null hypothesis of no unit roots in the data series. Variables with unit-roots are transformed into the first difference to bring stationarity in the variable.

To ascertain whether variables were integrated or not, we carried out the test at the first difference. Table 3 indicates that all the variables are stationary at the first difference, meaning that they all had unit-root hence a stable series condition. The p-values of all variables are less than 5%. The absolute values of the test statistics for all variables are also greater than their corresponding test critical values at 5%. This implies the null hypothesis of all the variables having unit roots at first difference cannot be accepted at a 5% significance level. Hence, the article concludes that at first difference all variables, represent a stationary series integrated of the first order.

Since the quality of human capital and GDP are not static, the tendency for multicollinearity to pose some problems concerning with respect to the independent variables' strengths. This exists because the predictive

**Table 3.** Stationarity Tests (A).

Variable	LLC Test		IPS Test		Hadri Test	
	NT	T	NT	T	NT	T
SMC	0.031(4.53)	0.178(6.51)	0.328(0.426)	0.327(0.457)	0.000(12.177)	0.0304(1.584)
$\Delta$ SMC	0.0000(4.866)	0.0115(2.431)	0.0000(5.481)	0.0000(4.047)	0.276(0.577)	0.1754(0.781)
GDP	0.047(1.571)	0.048(1.141)	0.341(0.754)	0.304(0.755)	0.000(14.52)	0.000(7.915)
$\Delta$ GDP	0.0114(2.141)	0.000(3.552)	0.000(5.829)	0.000(5.534)	0.235(0.677)	0.584(-0.597)
E	0.0000(3.471)	0.0001(3.147)	0.0000(3.407)	0.0003(2.918)	0.106(1.054)	0.088(1.113)
$\Delta$ E	0.0142(1.241)	0.1092(1.188)	0.0012(2.407)	0.0123(2.318)	0.177(1.24)	0.166(1.003)
E $\times$ GDP	0.0771(1.241)	0.0472(1.188)	0.0889(1.407)	0.0123(2.318)	0.185(1.23)	0.137(1.003)
$\Delta$ E $\times$ $\Delta$ GDP	0.0142(1.241)	0.1092(1.188)	0.0012(2.407)	0.0123(2.318)	0.177(1.24)	0.166(1.003)

Variables are tested at 5% significance and p-values displayed with their corresponding t-statistic in parenthesis.  
Source: Author (2020).

**Table 4.** Pearson correlation matrix.

	SMC	E	GDP	E $\times$ GDP
SMC	1			
E	0.242*	1		
GDP	0.638**	0.517*	1	
E $\times$ GDP	0.681*	0.547**	0.412	1

\*, \*\*, \*\*\* Correlation is significant at 1%, 5% and 10% level respectively (2-tailed).  
Source: Author (2020).

variables are correlated. Since the correlation numbers are lower than 0.7 as shown in Table 4, the results clearly showed that none of the independent variables were highly correlated; hence we could assume that there is no existence of serious multicollinearity amongst independent variables.

Using the variance inflation factor (VIF), the article measures the impact of collinearity among the independent variable. This shows the extent to which the repressors are related to other repressors and to find out how the relationship affects the stability and variance of the regression estimates. The tolerance factors for the two independent variables quality of human capital (E) and GDP are high (0.726 and 0.861, respectively) with the associated VIFs 5.81 and 6.52, respectively, which are low to the VIF value of 10. This indicates that even though multicollinearity is present it is insignificant in affecting the steadiness and the variance of the regression estimates with an average VIF of 6.16.

Appendix A column 1 is the regression where we determine the relationship between explanatory variables (the ability of the individual to invest in an economy, GDP and interaction of ability of the individual to invest and GDP) with the dependent variable (stock market capitalization) using the variables in levels. We also test the validity of the regression by testing whether all parameters are equal to zero. A large value of F indicates

that most of the variation in stock market capitalization is explained by the quality of human capital and GDP. At 5%, there is a great deal of evidence to infer that the model is valid. Analyses of variance with F-test of the probability of zero (0) means that the model fit the data set and that E and GDP are linearly related to SMC. The relationship between E and SMC is 1.306 with a standard error of 0.358, which yields a t-statistic of 3.65. The relationship between GDP and SMC is also 1.24 with a standard error of 0.134. For both variables, there is enough even to conclude that there is a significant linear relationship between them SMC. The signs are all as expected. The interaction between E and GDP is also significant in explaining SMC variability. That is, there is significant evidence to conclude that GDP complement E in explaining variability in SMC.

An R-square of 0.415 implies 41.5% of the variations in SMC. The F-value of 48.46 with a probability 0.000 implies the data set fits the model. Breuch-Pagan test of a large chi-square 44.97 is indicative that heteroskedasticity is present.

Column 2 of Appendix A shows the OLS result corrected for heteroskedasticity (Table 5). The reported t-statistics from the regression are based on heteroskedasticity-consistent standard errors and covariance. This addresses minor concerns about the failure to meet assumptions, such as minor problems

**Table 5.** OLS Results (levels).

<b>Regress SMC E GDP E×GDP</b>				
<b>Source</b>	<b>SS</b>	<b>df</b>	<b>MS</b>	<b>Number of obs = 615;F( 3, 611) = 48.46</b>
Model	10949.2575	3	3649.7525	Prob > F = 0.000
Residual	11986.9375	611	19.6185565	R-squared = 0.415;Adj R-squared = 0.411
Total	22936.195	614	37.35536645	Root MSE = 0.497

Source: Author (2020).

about normality, heteroscedasticity, or some observations that exhibit large residuals, leverage or influence. With the robust option, the point estimates of the coefficients are the same as in ordinary OLS, but the standard errors take into account issues concerning heterogeneity and lack of normality, hence standard errors did not change any of the conclusions from the original OLS regression as in shown in column 1 of Appendix A.

Since the model fits the data as well and the required conditions are satisfied, the individual coefficients are interpreted. The intercept  $b_0=11.14$  is the average stock market capitalization when GDP and E are zero. This value is misleading to interpret since the value zero is outside the range of values of independent variables.

The relationship between SMC and E is described by 1.306. This indicates that for each additional increase in the E in an emerging market, SMC increases on average by 1.306, assuming that the other independent variable in this model (GDP) is held constant. There is sufficient evidence to infer E and SMC are linearly related ( $\beta_1 = 0$  against an alternative  $\beta_1 > 0$ ). The value of the test statistic of 7.28 with an associated p-value of zero (0) shows that there is overwhelming evidence to infer that the E in emerging market and SMC are linearly related and the sign as expected.

The coefficient  $b_2=1.24$  specifies that for each additional GDP growth or increase, the average stock market capitalization increases by 1.24%, assuming the constancy of E. The nature of the relationship between SMC on E and GDP was expected. The value of the test statistic  $t=2.62$  with a p-value of zero (0) shows that there is evidence to conclude that GDP and SMC of emerging economies are linearly related at a 5% significance level. GDP is important to the SMC in that it is a measure of the health of the economy (Appendix B). A rational stock investor is expected to invest more as the level of GDP rises, which is an indicative of firms on the whole, are performing positively on the stock market. This aggregate performance of firms allows for more reinvesting which should ultimately lead to higher future earnings and stock prices.

The article introduces the interaction effect of GDP and E on the relationship to determine whether the interaction has significant effect on SMC. That is, we suspect that GDP moderate the effect of E on SMC. AIC test confirms that the interaction term cannot be dropped.

Assuming that there is a partial effect of the E on SMC, in other words, GDP complements E. Simply looking at the coefficient of E, it will incorrectly conclude that E has 1.306 effects on SMC. The reason for interacting E and GDP is backed by the theoretical reason that the higher the level of GDP of a country, the higher the level of secondary school. The result shows explicitly that there is a statistically significant interaction between E and GDP. AIC analysis confirms that the interaction term should be included in the model.

The coefficient of E being greater than zero indicates that improvement in E increases SMC for economies with high GDP. Since  $b_3$  is significant, the interpretation of parameter  $b_1$  is not straight forward. To explain the partial effect, we plug in the mean value of GDP. At the mean value of GDP, the partial effect of E on SMC is  $b_1 + b_3$  (mean of GDP) that is  $1.306 + 0.079(18.64) = 2.78$ . This means that one percent increase in the E increases SMC by 2.78 standard deviations from the mean of SMC.

To test the coefficient of the interaction term (2.78) that is statistically different from zero (0), the article rerun the regression, where we replace the interaction term (E and GDP) with the difference between GDP and mean GDP multiply by E. This gives a new coefficient on E, the estimated effect of a  $GDP=18.64$ , along with its standard error. Running this new regression gives the standard error of the coefficient  $\hat{\beta}_1 + \hat{\beta}_3(18.64) = 2.75$  as 0.953, which yields a  $t=2.92$ . Therefore at the average GDP ( $\overline{GDP}$ ), E has a statistically significant positive effect on SMC. The variable of interest E is also positive and significant as expected indicating that higher levels of E are associated with SMC. This outcome indicates that E is good predictors of SMC in emerging countries. The coefficient of 1.306 of the E is misleading because it does not account for the effect of GDP on E which then affects stock market capitalization.

R square of 0.415 is an indication of a moderate correlation between aggregate SMC and the two independent variables. This means that about 41.5% of fluctuations in SMC are accounted for by E and GDP while 58.5% could be explained by other factors not related to the chosen independent variables. The results also shows that the relationship is an actual one and not merely due to the spurious regression problem.

To determine the unbiasedness of the OLS estimator, the article check for the presence of autocorrelation in the

**Table 6.** Pearson correlation matrix (difference).

	$\Delta$ SMC	$\Delta$ E	$\Delta$ GDP	$\Delta$ E $\times$ $\Delta$ GDP
$\Delta$ SMC	1			
$\Delta$ E	0.071**	1		
$\Delta$ GDP	0.252**	0.197*	1	
$\Delta$ E $\times$ $\Delta$ GDP	0.088*	0.064*	0.092*	1

\*, \*\*, \*\*\* (1%, 5%, 10%) (2-tailed).

Source: Author (2020).

errors since the explanatory variables are strictly exogenous. This is analogous to our results in the case of heteroskedasticity, where the presence of heteroskedasticity alone does not cause bias or inconsistency in the OLS point estimates. The Durbin – Watson (DW) statistic obtained by running the analysis using the data series at the level has a value of ( $d=0.217394 < 1$ ). This is an evidence of positive serial correlation among residuals.

The presence of positive serial correlation implies that our OLS coefficients are still unbiased and consistent but inefficient because there is no lagged dependent variable (SMC) on the RHS as an explanatory variable. Breusch-Pagan test of a large chi-square 46.34 implies that heteroskedasticity is present.

To improve upon our results we run OLS with serial correlation and heteroskedasticity using GLS estimating technique. Generalized least squares (GLS) allow models with heteroskedasticity and no cross-sectional correlation and the results are shown in Table 7. This technique also confirms that E, GDP and its interaction are significant in explaining the variations in SMC. Wald chi2 with a p-value of 0.000 implies the model fits the data set.

Comparing column 3 with column 1 of appendix A we realize an improvement in the result. The parameters were overestimated under column 1 Appendix A due to the presence of serial correlation and heteroskedasticity. One percent increase in E is associated with a 0.096% increase in SMC. The partial effect of E on SMC is 0.88. There is a percentage increase given an average GDP, SMC increases by 0.88% instead of 0.096 assuming that GDP is zero for which it is not realistic since the values of GDP for the data series zero cannot be assumed. The parameters are all significant and the signs as expected. A wald chi-square of p-value of 0.000 implies that the data fits the model. The article could also deduce that correcting for heteroskedasticity and serial correlation, the standard errors of the estimated coefficients reduce in value which shows how efficient and unbiased the results are.

Even though there is statistical evidence to show that E and GDP influence SMC, the article cannot draw a firm conclusion based on these results because the regression results displayed are based on level, nonstationary data series and could represent a spurious

problem. The stationarity estimation of nonstationary variables tended to give a misleading parameter estimate of the relationship. It is also established in the literature that stationary and weakly dependent can correct the effect of serial correlation. Since the variables are nonstationary, we find the first difference of the variables. The result from Table 3 shows that the first difference of the variables is stationary. The Pearson correlation matrix of the first difference of the variables improves the problem multicollinearity since the correlation coefficients are relatively lower for the variables in levels (Table 6).

Regression of the first difference of the model using dynamic ordinary least squares technique gives the result in column 4 of Appendix A. The result improves column 1 of appendix A because of the smaller coefficients and Newey standard errors recorded. This implies the result from column 1 of Appendix A is overestimated and that the t-values and standard errors are not reliable. From column 4 of Appendix A the explanatory variables are still significant as expected. The Wald chi-square test is used to test the probability that the correlation coefficients for all the variables included in the models are zero. The article tests the validity of the regression model by testing whether all parameters in each model are all equal to zero. The Wald chi-square 47.3, with a p-value of 0.000, implies that the data set fit the model. The model can be able to explain 31.9% of the variations in SMC. Using DOLS, the article can circumvent the problem of endogeneity between  $y_{it}$  and  $x_{it}$  and the serial correlation between  $u_{it}$  and  $v_{it}$ .

Comparatively, the reported standard error and the coefficients of the parameters have improved significantly. All the variables of interest were significant and with their expected signs. Changes in the E, GDP and the interaction (E $\times$ GDP) are significant in explaining SMC; that is for every 1% increase in E, SMC of emerging markets increases by 0.04% assuming that other variables are constant. To determine the statistical significance of the coefficient of the partial effect of  $\Delta$ E on  $\Delta$ SMC the article replace the interaction variable with GDP minus the average GDP multiple by  $\Delta$ E. This gives the new coefficient on  $\Delta$ E (the coefficient of partial effect), the estimated effect at GDP of 18.64, along with a standard error. Running this new regression gives the standard error of  $\hat{\beta}_1 + \hat{\beta}_3(18.64) = 0.206$  as 0.0743,

which yields  $t = 2.77$ . Therefore at the average GDP, it can be concluded that  $\Delta E$  has a statistically significant positive effect on SMC. That is an enhancement in  $\Delta E$  leads 0.206 increases in SMC of emerging economies. The sign is as expected. This suggests that the enhancement of  $\Delta E$  for emerging economies is important for SMC. This study conforms to the theoretical postulation and the study of Yartey (2008).

The presence of auto correlated errors, makes the OLS estimators unbiased. This is analogous to the result in the case of heteroskedasticity where OLS point estimates do not cause bias or inconsistency in results. For a DW of 0.349, the null hypothesis is rejected. The article concludes that the data does have the first-order autocorrelation. Breusch-Pagan test with a large chi-square 46.15 implies that heteroskedasticity is present. Wald chi2 of the probability of 0.000 implies the data set fits the model well.

Accounting for serial correlation and heteroskedasticity in the model, the article compute Newey-West estimated standard error as depicted in column 5 of Appendix A addressing the problem of serial correlation and heteroskedasticity. There is a significant improvement in the result compared with column 4 of Appendix A. One percent increase in  $\Delta E$  leads to 0.038% increase in  $\Delta SMC$ . This again confirmed that the quality of human capital (E) complement GDP. The coefficient of the partial effect E on SMC of 0.088 with Newey-West standard error of 0.029 yields a t-statistic of 3.02. By implication, 1% increase  $\Delta E$  gives average GDP; SMC will increase by 0.088%. A VIF of 1.07 shows that the coefficients are relatively stable and variance relatively small. Breusch-Pagan test the null hypothesis; the error variances are all equal versus the alternative that the error variances are a multiplicative function of one or more variables. A small chi-square 0.257 implies that heteroskedasticity is probably not a problem or at least that if it is a problem, it is not a multiplicative function of the predicted values. A DW test of 1.93 implies the absence of autocorrelation in the error term at 5% significance level. It is also clear that we correct heteroskedasticity and serial correlation using different estimation techniques; the calculated standard errors reduced in value which, makes the results more reliable.

## Conclusion

The model suggests that the ability of individual to invest per labor force and economic growth can make a statistically significant and economically meaningful contribution to stock market development. This study conforms to the theoretical postulation and the study of Yartey (2008). It is clear from these results that countries with high levels of education (E) stand to benefit more in terms of stock market development (SMC). This result is not different from those of Winful et al. (2013). Poor understanding of issues on the part of the public

discourages potential investors from participation in stock markets. Our work also confirms the findings of Hong-Yih (2000) where they argue that the propensity to invest in shares rises with the level of education. A higher level of education increases confidence in stock market activities.

The results suggest that policy makers should not expect significant stock market development if the country's educational structure is poor. The results are generally in agreement with the theoretical and empirical findings. The findings have important policy implications for emerging countries. Firstly, education play's a crucial role in stock market development. Policymakers in emerging economies may initiate policies to foster growth in secondary school enrolment in emerging economies.

Overall, there is widespread and robust evidence that education play's a key role in enhancing stock market performance, especially in those sectors where productivity and labour utilization is relatively low. Therefore, improving education – and quantitative and qualitative terms – has to be at the heart of policy measures to raise the stock market performance sustainably. By this Free Senior High School policy in Ghana is in the right direction to position the Stock market. It is expected that other African countries with weak capital markets show come up with policies that will make education affordable and accessible to majority of the populace.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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## APPENDIX

## Appendix A. Regression Results.

Variables	OLS	OLS rob		FGLS	DOLS (Newey)	New-West
		Levels				
E	1.306***(0.358)[3.65]	1.306***(0.454)[2.88]		0.096***(0.008)[12.00]	0.038(0.014)	0.013(0.014)[2.66]
GDP	1.240***(0.134)[9.25]	1.240***(0.488)[2.54]		0.582***(0.222)[2.63]	0.109(0.041)	0.109(0.041)[2.67]
ExGDP	0.079***(0.028)[2.82]	0.079***(0.030)[2.66]		0.042***(0.012)[3.41]	0.009(0.000)	0.004(0.001)[3.19]
Constant	11.140***(2.897)[3.85]	11.140***(3.751)[2.97]		-16.253***(2.745)[-5.92]	0.009(0.000)	
Obs Groups	615	615		615	614	614
R-squared	41	41		41	41	41
Wald prob						
F(3, 610)	0.415	0.415		871.14	0.319	19.54
Prob				(0.000)	47.3(0.000)	0.000

Standard error in parenthesis; \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; t-stat is square brackets.  
Source: Author (2020).

## Appendix B. Indicators of stock market development 1996 – 2011.

Country	Total Value Traded (% of ΔGDP)	Stock Market Capitalization (% of ΔGDP)	Turnover Ratio (%)	Number of Listed Companies	ΔGDP per Capita \$
Argentina	3.75	30.10	23.36	135	4285.75
Bangladesh	3.77	5.47	54.44	216	377.21
Bolivia	0.11	14.26	0.97	27	1020.64
Botswana	0.88	23.03	5.38	16	4981.22
Brazil	19.67	38.61	53.21	464	4582.71
Bulgaria	2.08	13.03	13.13	402	3437.66
Chile	12.06	95.18	12.66	252	6669.80
Colombia	2.65	25.02	9.93	117	3295.39
Costa Rica	0.67	9.72	5.29	17	4683.95
Czech Republic	12.64	23.77	53.42	265	11852.47
Ecuador	0.38	7.16	5.20	47	2903.80
Egypt	12.29	34.88	27.11	690	1158.47
Ghana	0.45	15.37	3.29	26	486.02
Hungary	15.57	20.22	66.30	46	9372.58
India	44.04	47.66	103.11	4845	641.97
Indonesia	11.72	26.66	47.89	294	1195.98
Jamaica	3.88	117.63	3.14	39	4178.91
Jordan	39.69	109.20	29.04	169	2135.87
Kenya	1.58	23.49	5.68	55	528.17
Malaysia	68.64	162.95	39.58	748	4919.38
Mexico	8.52	27.38	32.97	168	7468.29
Morocco	7.98	38.12	17.58	60	1796.14
Nigeria	1.73	14.40	8.53	189	684.49
Pakistan	31.50	19.38	167.50	683	631.11
Panama	0.55	24.84	2.75	22	4573.13
Paraguay	0.12	3.37	5.17	54	1558.13
Peru	3.58	31.72	16.37	225	2706.04
Philippines	12.26	51.51	23.53	219	1123.98
Poland	8.11	19.12	61.71	238	7199.95

**Appendix B. Contd.**

Romania	<b>1.45</b>	<b>10.79</b>	<b>21.14</b>	<b>2963</b>	<b>4280.12</b>
Saudi Arabia	73.95	61.17	84.02	87	13402.12
Slovak Republic	2.18	5.83	40.82	346	10871.28
Slovenia	2.65	19.63	24.27	65	16522.56
South Africa	60.32	173.05	32.81	534	4990.85
Sri Lanka	2.81	17.92	16.10	227	1103.19
Thailand	44.10	57.64	84.48	424	2401.98
Tunisia	1.68	13.11	12.61	39	2859.05
Turkey	32.11	23.95	135.91	260	6320.72
Uruguay	0.02	0.74	2.77	13	5460.68
Venezuela	1.69	8.57	14.66	74	5462.98
Zimbabwe	9.40	84.05	11.03	70	592.08

Source: Author (2020).

*Full Length Research Paper*

# **Okun's law: An asymmetrical approach for Zimbabwe (1991-2018)**

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Received 19 August, 2020; Accepted 9 September, 2020

The Okun's law, which explains the inverse relationship between unemployment and output growth, has been observed to have broken down in most developing economies. The failure by researchers to take into account the asymmetric properties of the relationship between unemployment and output has been attributed to the limitations of the Okun's law in explaining the inverse relationship between unemployment and output growth developing economies. The study was carried out with the objective of empirically testing Okun's Law in Zimbabwe, using a two state Markov Regime Switching Model (MRS) from 1991-2018. The study employed both the first difference approach and the gap approach with the Hodrick-Prescott (HP) and the Butterworth filters employed in determining the cyclical components of the gap models. Estimation results show that the Okun's law is valid during economic expansions with the Okun's coefficient having a magnitude of between -0.01 and -0.003, thereby reflecting the existence of an inverse relationship between economic growth and unemployment. The observed Okun coefficients during economic booms are however, economically insignificant and in so doing, attributes unemployment more towards structural causes and less to cyclical causes. During economic contractions, the Okun's law was observed to have broken down and with changes in output observed to be insignificant in explaining unemployment during economic downturns. This result is attributed to the large composition of the informal sector in the economy which is an alternative source of employment to the formal sector when the economy contracts thus, making unemployment invariant to economic contractions. The study recommends that policy makers address the structural constraints to both labor supply and demand in the economy.

**Key words:** Economic growth, Okun's law, regime switching, unemployment, Zimbabwe.

## **INTRODUCTION**

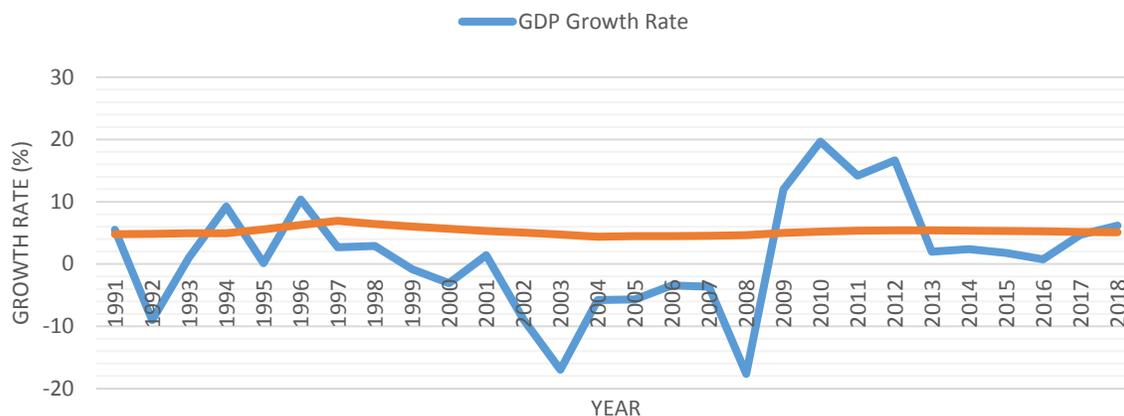
The Okun's law originates from the study between unemployment and economic growth by Okun (1962) on the United States' economy, where he observed that there was an inverse relationship between the two

variables. Okun (1962) observed that a percentage increase in economic growth would result in a 0.3% decline in the unemployment rate. The Okun's law has been observed to fit developed economies better

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JEL Classification: B22, C34, E13, E24, J64.

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**Figure 1.** GDP Growth Rate and Unemployment Rate Trends (1991-2018)  
Source: Researcher's own compilation using World Bank Data Bank data.

whereas in most developing economies the law has failed to explain the inverse relationship between unemployment and output growth. Lal et al. (2010) traces the breaking down of Okun's law in developing economies to failure by researchers to take into account of the asymmetric properties of the relationship between unemployment and output. Symmetrical studies assume that unemployment responds equally to both economic booms and contractions and therefore employ linear models, while asymmetrical studies take into consideration that unemployment responds differently to economic regimes and therefore, employ non-linear estimation methods (Harris and Silverstone, 2001; Cosar and Yavuz, 2019). Despite the success of most symmetrical studies in fitting the Okun's Law in developed economies, Harris and Silverstone (2001) question the accuracy of the observed Okun coefficients in these studies given their use of linear regression models.

Variations in Zimbabwe's unemployment figures have not followed countercyclical movement to changes in output due to the country's methods of employment statistics collation. Zimbabwe's low unemployment rate figures have been disputed as resembling those of developed economies than those of developing economies and this is due to the broad based definition, which includes informal sector employment, used in compiling employment statistics (Luebker, 2008). Figure 1 shows that during the study period, the country's unemployment rate figures have ranged between 4.8% and 6.9% with the average unemployment rate for the period being 5.2%.

Unemployment increased from 4.8% in 1991 to 6.9% in 1997 in line with the deregulation of the labour market resonant with the economic reforms that took place under the Economic Structural Adjustment Program from 1991-1995 which resulted in retrenchments (Kanyenze, 2009; Luebker, 2008). During the crisis decade which ensued from 1998 to 2008 economic output contracted by an

average of 5.6% per year and the unemployment rate declined from 6.4% in 1998 to 4.6% in 2008. The decline in the unemployment rate in the midst of a period of economic decline is reflective of the growing role of the informal sector in absorbing labour from the formal sector and the brain drain that transpired during the same period (Kanyenze, 2009; Matus et al., 2014). The post crisis period of 2009-2018 experienced significant economic growth from 2009 to 2013 but the growth did not lead to a proportionate decline in unemployment as unemployment increased from 5% in 2009 to 5.4% in 2013. Overall from 2009 to 2018 unemployment remained relatively stable reflective of the structural constraints in employment creation amongst which included a difficult business operating environment, low capital investment and declining aggregate demand (Matus et al., 2014).

The study seeks to examine the existence of asymmetry in the Okun's law in Zimbabwe using the two-stage Markov Regime Switching model (MRSM) and in turn to determine if unemployment is cyclical or structural. The study draws its significance mainly on the empirical front where it seeks to add to the scarce literature on the potential asymmetrical properties of the Okun's law in Zimbabwe. On the policy front, the study helps determine if economic growth in Zimbabwe is accompanied by employment creation which is important in ensuring shared growth and poverty eradication in Zimbabwe (Kanyenze, 2009; Kanyenze et al., 2011).

## RELATED LITERATURE

Lee (2000) investigated the robustness of the Okun's Law in 16 OECD countries and observed EU countries had lower Okun coefficients compared to the US. Zagler (2003) performed a study on France, Germany, Italy and the UK and observed that the short-run relationship between output and unemployment was consistent with

Okun's Law but inconsistent in the long run. Studying Greece's 13 regions, Christopoulos (2004) found the Okun's Law to be valid in 6 of the 13 Greek regions.

In Spain, Villvarde and Maza (2008) tested the validity of Okun's Law in 17 Spanish regions and found the Okun's Law to be valid in at least 11 out of 17 regions. In a study of Greece, Portugal, Italy and Spain, Dritsak and Dritsaki (2009) found the Okun coefficient to be present in Portugal, Italy and Spain.

Ball et al. (2012) found the Okun coefficient was present in the US economy and 19 other advanced economies under study with the exception of the German economy. In a study of 15 EU countries Fernandez et al. (2018) empirically determined the Okun's law per age and gender groups and found that EU countries experienced smaller output loss when unemployment is high and that older age groups were less exposed to cyclical unemployment. In a panel data analysis of 8 Eastern European countries from 1992-2014, Soylyu et al. (2018) found the Okun Law to be valid in the 8 Eastern European countries in both the short run and long run.

In a study of China, Pakistan, India, Sri-Lanka and Bangladesh, Lal et al. (2010) observed that the Okun's Law to be valid in Pakistan, India and Bangladesh in the long run with Law breaking down in the short run for all countries. In Jordan, Kreishan (2011) found economic growth to be insignificant in explaining unemployment. Khrais and Al Wadi (2016) performed a study on 20 Middle East Nation Association countries and found that out of the 20 countries under study only Egypt, Jordan and United Arab Emirates was the Okun's Law valid. Pata et al. (2018) observed uni-directional causality from economic growth to three unemployment age groups of 15-24, 25-54 and 15-64, and thereby charactering unemployment in Turkey as cyclical.

In Africa, Kamgnia (2009) conducted a study of 39 countries and observed that overall economic growth led to growth in employment. In a study of 46 Sub-Saharan African economies, Karim and Aomar (2016) found that the Okun's Law failed to hold in most African countries and economic regions. Abraham (2017) conducted a study that encompassed 23 low-income countries in Sub-Saharan Africa and observed that the Okun's Law was only valid in 14 out of the 23 countries under study, excluding Zimbabwe. Abraham and Nosa (2018) tested the validity of the Okun's Law in 6 upper middle income countries in Sub Saharan Africa and observed countries with high rates of economic growth to exhibit the Okun coefficient while countries with low output growth failed to exhibit the Okun coefficient.

In a group of studies that factor in asymmetry in the Okun's law, Harris and Silverstone (2001) found that unemployment was more sensitive to economic contractions than economic expansion in seven OECD countries. Fouquau (2008) employed the two states, MRSM on 20 OECD countries and observed that for most countries in the study the Okun's law was weak in

explaining the relationship between unemployment and output growth. In South Africa, Phiri (2014) observed that the Okun's law held in the long run for South Africa with uni-directional causality from unemployment to economic growth. In Zimbabwe, Ngundu et al. (2018) employed the MRSM Error Correction Model and found the employment elasticity of growth to be to be positive and asymmetric in the short-run. In Turkey, Cosar and Yavuz (2019) employed the MRSM and observed unemployment was more responsive to economic contractions than downturns.

## METHODOLOGY

Okun (1962) developed the unemployment-output relationship using the first difference and the gap empirical approaches. The first difference approach illustrated in Equation 1 demonstrates that changes in unemployment in period  $t$  are related to quarterly changes in real economic output in that same period  $t$ . The first difference in approach provides a convenient way of establishing stationarity (Lee, 2000; Fouquau, 2008).

$$\Delta U_t = \alpha + \beta \Delta GDP_t + \varepsilon_t \quad (1)$$

Equation 2 illustrates the gap approach. The approach is depended on estimates of potential output growth ( $GDP_t^*$ ) and natural rate of unemployment ( $U_t^*$ ). The gap model poses challenges in the identification of the unobservable variables of potential output growth and natural rate of unemployment (Cosar and Yavuz, 2019). However, the gap model has the advantage over the first difference approach in its ability to capture the movements in unemployment around the natural rate of unemployment due to fluctuations in output growth around its trend growth. Thus, the cyclical components of the gap model captures oscillations of output around the trend such that a percentage increase in output growth above its trend growth rate which will lead to a corresponding decline in unemployment below its natural rate of unemployment.

$$U_t - U_t^* = \alpha + \beta(GDP_t - GDP_t^*) + \varepsilon_t \quad (2)$$

$\beta$  in Equations 1 and 2 is defined as the Okun's coefficient. The Okun's coefficient is expected to be negative to reflect the inverse relationship between the two variables. The magnitude of Okun's coefficient determines the extent to which unemployment responds to output. The study adopted empirical regression equation shown in Equations 3 and 4 from studies by Adanu (2002) and Cevik et al. (2013). Equation 3 is representative of the first difference equation where  $\Delta u_t$  and  $\Delta y_t$  are the changes in unemployment and economic output in period  $t$  respectively. Equation 4  $u_t^c$  and  $y_t^c$  are cyclical unemployment and economic growth around their trends respectively. Equation 3 and Equation 4,  $\alpha$ ,  $\beta$  and  $\varepsilon_t$  are representative of the intercept, Okun coefficient and the white noise error term respectively. The Hodrick-Prescott (HP) and Butterworth filters were employed in estimating the trend components of  $u_t^c$  and  $y_t^c$  in Equation 4.  $\sum_{i=1}^k \rho_i \Delta u_{t-1}$  and  $\sum_{i=1}^k \rho_i u_{t-i}^c$  captures the dynamic effects of past unemployment effects on current unemployment in their respective models.

$$\Delta u_t = \alpha + \beta \Delta y_t + \sum_{i=1}^k \rho_i \Delta u_{t-1} + \varepsilon_t \quad (3)$$

$$u_t^c = \alpha + \beta y_t^c + \sum_{i=1}^k \rho_i u_{t-i}^c + \varepsilon_t \quad (4)$$

The estimation method adopted for the regression analysis was the nonlinear approach based on the two-stage MRSM. The two-stage MRSM captures asymmetry in the relationship between unemployment and economic growth such that the Okun coefficient for an economic downswing and upswing are separately captured. The mechanics of the MRSM are based on the states of the world denoted by  $s_t$  and in the case of this study the states of the world were two. From Equation 5 and Equation 6 when  $s_t = 1$ , the economy is in an expansion or upturn regime at time  $t$ ; and when  $s_t = 2$ , the economy is in a contraction or downturn swing at time  $t$ . The parameters  $\alpha(s_t)$ ,  $\beta(s_t)$  and  $\sum_{i=1}^k \rho_i(s_t)$  are economic regime varying intercept, economic regime varying Okun coefficient and economic regime varying lagged unemployment coefficient respectively.

$$\Delta u_t = \alpha(s_t) + \beta(s_t) \Delta y_t + \sum_{i=1}^k \rho_i(s_t) \Delta u_t + \varepsilon_t \quad (5)$$

$$u_t^c = \alpha(s_t) + \beta(s_t) y_t^c + \sum_{i=1}^k \rho_i(s_t) u_{t-i}^c + \varepsilon_t \quad (6)$$

The MRSM is founded on the Maximum Likelihood method based on the Expectation Maximization algorithm (Cevik et al., 2013). The method provides both parameter estimates and the transition probabilities from one economic regime to another. The parameters are obtained in a two stage process that involve firstly, the expectation step which encompasses filtering and smoothing of conditional probabilities of future states, given past states and transition probabilities from one state to another. Lastly, the maximisation stage at which the smoothed probabilities obtained from the first process replace the conditional regime probabilities obtained in the maximisation stage with this final process resulting in estimation parameters and transition probabilities (Wang, 2003; Cevik et al., 2013).

### Estimation techniques

The estimation of the unobservable variables of  $u^*$  and  $y^*$  in the cyclical components of Equation 6 requires the use of trend filters. The study employed the HP filter and the Butterworth filter. Each filter has its own strength and weakness, thereby affecting the sensitivity of coefficients (Lee, 2000; Phiri, 2014; Cevik et al., 2013). For the HP filter Lambda was set to 100, while the moving average period for the Butterworth filter was set to 2. The use of two trending techniques ensured robust regression analysis (Phiri, 2014).

Data observations for use in Equations 5 and 6 must be stationary as use of non-stationary series in regression analysis will lead to faulty estimate results that can give misleading conclusions. The Augmented Dick-Fuller (ADF) test was employed for this purpose. The model adopted for the study has a dynamic component in the form of the lagged unemployment term. Optimal lag selection was done using the Schwartz Bayesian Information Criterion (SBIC), Akaike Information Criterion (AIC) and the Hannan Quinn Criterion (HQIC). To establish the suitability of a non-linear regression analysis the study adopted the Likelihood Ratio (LR) linearity test employed by Cevik et al. (2013). The LR test is based on the null hypothesis denoted by the log likelihood of a linear

model and an alternative hypothesis denoted by the log likelihood of a non-linear model. Rejection of the null hypothesis is determined by the p-value of the LR test. Tests on the residuals are not a pre-requisite for the MRSM as normality and homoscedasticity are not expected in the residuals (Brooks, 2008).

However, for diagnostic purposes, tests for normality, homoscedasticity and serial correlation were conducted using the normality test, correlogram  $Q^2$  test and the correlogram  $Q$  test respectively.

### Data sources and limitations

The study employed time series data from the 1991 to 2018 obtained from the World Bank Data Bank, 2020. The study period was guided by the availability of data.

## EMPIRICAL RESULTS

### Unit root test

Table 1 shows the ADF stationarity test results for the three models' variables. The HP filter model UE was stationary after first differentiation, while GDPGR was stationary in levels. The Butterworth model's UE was stationary after differencing the variable twice with GDPGR being stationary in levels. For the first difference model, UE was stationary in second difference and GDPGR in first difference.

### Lag selection

Lag selection for the autoregressive term in the estimation equation was guided by the AIC, HQIC and SBIC. For the HP filter model, all three information selection criteria agreed on an optimal lag length of 1; thus, the AR lag length for UE was 1. For the Butterworth filter and the first difference models, all three information selection criteria agreed on the lag length of 0 for UE (Table 2).

### Diagnostic test results

Table 3 shows test results conducted on the estimated residuals. The correlogram  $Q$  test was tested for serial correlation to which no serial correlation was observed in the residuals of all three models. The test statistics of the three models led to the acceptance of the null hypothesis of no serial correlation in the residuals. The correlogram  $Q^2$  tested for heteroscedasticity in the residual and no heteroscedasticity was found present in the residuals of all three models. The p-values for the three tests led to the acceptance of the null hypothesis that states that the residual is homoscedastic at 5% level of significance. The test for normality found the residual to be normally distributed for all three estimation equations.

**Table 1.** Stationarity test results.

Model	Variable	ADF probability level	ADF stationarity after differencing
HP filter	UE	0.4356	0.0324 (1 <sup>st</sup> differencing)
	GDPGR	0.0014	-
Butterworth filter	UE	0.5110	0.0000 (2 <sup>nd</sup> differencing)
	GDPGR	0.0161	-
First Difference	UE	0.5832	0.0000 (2 <sup>nd</sup> differencing)
	GDPGR	0.1163	0.0000 (1 <sup>st</sup> differencing)

Source: Researcher's own computation.

**Table 2.** Information criterion selection.

Country	AIC	HQIC	SBIC
HP	1	1	1
Butterworth	0	0	0
Difference	0	0	0

Source: Researcher's own computation.

**Table 3.** Residual test results.

Diagnostic test	HP filter	Butterworth filter	First difference approach
Corr Q Serial Correlation	0.7983	0.7378	0.7346
Corr Q <sup>2</sup> Heteroscedasticity	0.8850	0.6476	0.6524
Normality	0.0004	0.0000	0.0000

Source: Researcher's own computation.

**Table 4.** Linearity test results.

	Log Likelihood (H <sub>0</sub> )	Log Likelihood (H <sub>A</sub> )	LR test statistic	P-value
HP filter	11.3618808	15.337321	7.95	0.0188
Butterworth	18.309027	18.350968	0.08	0.7721
Difference approach	-2.8588252	3.6351525	12.99	0.0015

Source: Researcher's own computation.

### Linearity test

A LR test was conducted to determine the suitability of a non-linear model in estimating the regression equations. The null hypothesis denotes the log likelihood of a linear model, while the alternative hypothesis denotes the log likelihood of a regime-switching model. However, the LR model cannot directly compare a linear model to a regime-switching model due to the differences in the number of states. To adjust to this, the study turned the coefficients of the explanatory variables with the exception of the intercept into non-varying coefficients to

obtain a closer approximation of a linear model as conducted by Cevik et al. (2013). Results in Table 4 showed that the HP filter and the first different estimates are better suited to a non-linear model. However, the Butterworth filter estimates were observed to be better suited to a linear model.

### RESULTS AND DISCUSSION

Table 5 presents the estimate results from the two-stage MRS. Regime 1 is an economic upswing or boom and

**Table 5.** Markov regime switching model estimate results.

	Regime 1: Upswing in the economy	Regime 2: ownswing in the economy	Regime 1: Upswing in the economy	Regime 2: Downswing in the economy	Regime 1: Upswing in the economy	Regime 2: Downswing in the economy
	HP filter		Butterworth filter		First difference	
$\alpha(s_t)$	-0.2527877*** (0.0230133)	0.2376365*** (0.0564034)	-0.0124337 (0.0121017)	0.046636 (0.3143162)	-0.1107487*** (0.0031921)	0.0113931 (0.0671349)
$\beta(s_t)$	-0.0109916** (0.005016)	0.0031806 (0.0038146)	-0.0037381*** (0.0013634)	-0.0174614 (0.0480491)	-0.0082615*** (0.0003685)	0.0001076 (0.007289)
$\rho_1$	-0.3948122** (0.1601164)	1.046934*** (0.0928305)				
$\sigma_i$	0.0870202		0.0552206	0.6556556	0.0061036	0.3087945
$p_{ij}$	0.7004837	0.878646	0.7845163	0.0000001	0.6436722	0.935681

\*\*\* 1% level of Significance, \*\* 5% level of significance, \* 10% level of significance,  $\sigma_i$  is the state varying variance with the exception for the HP filter estimate,  $p_{ij}$  is the probability of states.

Source: Researcher's Own Computation

regime 2 is an economic downturn or contraction. HP filter estimate results validated the Okun coefficient in an economic upswing at 5% level of significance. In the downswing, the Okun Law broke down as the coefficient turned positive and insignificant in explaining the relationship between output and unemployment. The state varying variances could not be obtained due to the presence of a discontinuous region in the cyclical data.

Butterworth filter estimation results produced an Okun coefficient significant at 1% level under an economic boom. The Okun coefficient was also validated in an economic upturn but found to be insignificant in explaining the relationship between economic growth and unemployment. Lastly, the first difference estimation showed that the Okun coefficient exists in an economic upturn and was significant at 1% level. However, the Okun's Law broke down in an economic contraction with the coefficient also observed to be insignificant in explaining the relationship between the two variables. Results in Table 5

shows an asymmetric relationship between unemployment and economic growth, where the Okun's Law was validated under economic booms across all three models. The HP filter results showed that a 1% increase in GDPGR above its potential would result in a 0.01% decline in unemployment. The Butterworth filter estimate results showed that a 1% increase in GDPGR above its trend would lead to a 0.004% decline in unemployment. The first difference model showed that a 1% increase in GDPGR would lead to a 0.008% decline in unemployment. However, despite the Okun coefficients being statistically significant, the coefficients were economically insignificant as they were relatively lower than Okun coefficients from other regional studies. Karim and Aomar (2016) found the Okun coefficient for Southern African nations such as Malawi to range between -0.06 and -0.02, Mozambique between -0.08 and -0.03; thus reflecting that unemployment was more responsive to economic growth for these countries when compared to Zimbabwe. The low magnitudes of the Okun coefficients can be

attributed to the structure of the Zimbabwean economy (Kanyenze, 2009) and the growing importance of the informal sector (Karim and Aomar, 2016). The informal economy of Zimbabwe constitutes 60.8% of the economy (Medina and Schneider, 2018) and absorbing at least 80% of total employment in the economy with most of the employment opportunities being in the agricultural sector (ZIMSTAT, 2020b). However, the agricultural sector suffers from over-employment and unable to create more employment opportunities. Moreover, constraints to sourcing foreign currency for capital imports to increase labor productivity have also limited the scope for informal manufacturing industries to create employment (Matus et al., 2014). Soyulu et al. (2018) also observed the lack of capital as a key factor of unemployment in developing countries. Moreover, in the formal sector, which is less dominant, growth is concentrated in capital intensive production industries (ZIMSTAT, 2020a) with low labor requirements (Matus et al., 2014).

The breakdown in the Okun's law during

economic contractions may be attributed to the high levels of informal activities in the economy. Makochehanwa (2012) as well as Medina and Schneider (2018) observe that as employment in the formal sector declines due to an economy recession, the informal sector absorbs some of the labor, such that the rate of unemployment scarcely rises. It is observable that unemployment in Zimbabwe is structural and not cyclical and attempts to further reduce unemployment through demand side policies may lead to jobless growth.

## Conclusion

The existence of asymmetry in the Okun's law in the case of Zimbabwe was proven. The Okun's coefficient was observed to hold during periods of economic expansion and to have broken down during periods of economic contraction. However, the Okun's coefficient was economically insignificant in influencing unemployment; thereby displaying the presence of structural unemployment as opposed to cyclical unemployment. The results show that attempts by policymakers to reduce unemployment rates through the stimulation of demand alone will be insufficient until constraints to labour demand and supply are addressed. Despite the growing recognition of the importance of the informal sector, employment in the sector is of low productivity and not sufficient enough to be categorized as decent employment. Future studies may need to narrow down the definition of unemployment by disaggregating productive employment, which is mostly prevalent in the formal sector, from the low productive employment, which is common in the informal sector, and estimate the Okun's Law using data on formal unemployment and economic growth.

## CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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*Full Length Research Paper*

# Macroeconomic volatility of Turkey in comparison with South Africa and developed countries

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Received 30 July, 2019; Accepted 26 November, 2019

The purpose of this study is to investigate the business cycle volatility of Turkish economy using the quarterly data over the period 1961:Q1 to 2018:Q4 and to determine the smoothing parameter,  $\lambda$ , of HP filter for annual frequency of observations. The macroeconomic variables such as import, investment and export are more volatile followed by government spending; while consumption and real GDP are less volatile. Price in Turkey is highly volatile, which is about four times as volatile as the average price volatility of South Africa, Japan and USA. Output, consumption and investment in Turkey are twice as volatile as the average volatility of South Africa, Japan and USA. Import and export are more volatile in emerging economies as compared to developed countries. The trend component of annual frequency with  $\lambda_{\text{annual}}=6.25$  is practically identical to the trend component of the quarterly data with  $\lambda_{\text{quarterly}}=1600$ . In Turkish economy, investment, consumption, import, export, and government spending are procyclical; price and inflation are countercyclical; whereas, the share of government consumption in output is acyclical.

**Key words:** Business cycle, correlation, Hodrick-Prescott (HP) filters, macroeconomic variables, volatility.

## INTRODUCTION

Turkish economy has grown fast in the past years despite adverse shocks. This performance has been driven by policy stimulus and a dynamic, well-diversified but fragmented business sector. The overall investment has been strong; but it is excessively funded by debt, raising questions about its quality and allocation. Sustained job creation outside agriculture, which accelerated in the 2010s, has improved well-being, notably in less-developed regions of Turkey. The low-educated and previously inactive women have benefitted the most. Material living conditions have improved faster than other

dimensions of quality of life, such as work-life balance, environmental quality and subjective well-being (OECD, 2018). In spite of these achievements, macroeconomic volatility is a fundamental concern in Turkey similar to other developing countries.

High aggregate instability results from a combination of large external shocks, volatile macroeconomic policies, microeconomic rigidities, and weak institutions. The effects of volatility on macroeconomic performance are even more marked in countries like Turkey, which are often subject to more significant external shocks but do

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not enjoy the internal conditions that would absorb the shocks easily. Since a stable economy with predictable future provides a better business environment for economic growth, ensuring macroeconomic stability is one of the most important targets for policy makers. On the other hand, higher output volatility may lead to a significant cost in terms of social welfare. Common definitions of volatility often refer to the notion of disequilibrium, and measuring economic volatility involves evaluating the deviation between the values of an economic variable and its equilibrium value. This equilibrium value in turn refers to the existence of a permanent state or trend.

The potential growth in Turkey is not sufficiently broad-based productivity growth. Though macroeconomic policy framework was provided in order to support the economy, there was wider fluctuation on the path of economic growth over the years. Over the long term, volatility contributes to a reduction in levels of consumption, investment, unpredictability of economic policy and deterioration in the institutional environment. Hence, the empirical connection between macroeconomic volatility and lack of development is undeniable, making volatility a fundamental development concern.

In the study of business cycles, Hodrick and Prescott (1997) detrend U.S. macro time series with what is known as the Hodrick-Prescott (HP) filter, and then compute standard deviations, correlations, and serial correlations of the major macroeconomic aggregates. This technique can be used to disaggregate a series into trend variations (long term) and cyclical variations (short term). This volatility indicator is therefore based on cyclical or cycle fluctuations. HP filter has become a standard method for removing trend movements in the business cycles literature. Most applications of HP filter have been for quarterly data. However, data is often available at the annual frequency or might be published on monthly basis. This raises the question on how one can adjust the HP filter to the frequency of the observations, so that the main properties of the results are conserved across alternative sampling frequencies. Although most researchers use the value of  $\lambda = 1600$  for the smoothing parameter of HP filter when using quarterly data, there is less agreement in the literature when moving to other frequencies. Correia et al. (1992) suggest a value of  $\lambda = 400$  for annual data, Backus and Kehoe (1992) use a value of  $\lambda = 100$ , while some others use the smoothing parameter of  $\lambda = 25$  for annual frequency of observations. Ravn and Uhlig (2002) suggest the value of  $\lambda = 6.25$  when moving from the quarterly data to the annual frequency. This study therefore aims to investigate macroeconomic volatility of Turkey over a half-century of quarterly data over the period 1961:Q1 to 2018:Q4, and determine the smoothing parameter,  $\lambda$ , of HP filter in moving from quarterly data to annual frequency of observations with empirical evidence

on Turkey.

The remaining part of the article is organized as follows. Section two presents review of theoretical and empirical literature on some facts about the historical properties of business cycles, and on measuring the macroeconomic volatility using Hodrick-Prescott (HP) filter. This section briefly describes the HP filter as widely used technique in econometric work to extract the cyclical component from the time series, and as it has become widely used technique withstanding the criticism on using the smoothing parameter,  $\lambda = 1600$ , with quarterly data for all countries. Section three describes the methodology used to analyze the macroeconomic volatility of Turkey elaborating the technique of HP filter. Section four analyses the macroeconomic volatility of Turkey using both the quarterly data and annual frequency of observations with the smoothing parameter ( $\lambda = 1600$ ) for quarterly data, and  $\lambda = 6.25, 25, 100, \text{ and } 400$  for annual data so as to select the possible smoothing parameter for the annual data. This section also compares the macroeconomic volatility of Turkey with South Africa, Japan and USA with the aim of determining whether or not Turkish economy is highly volatile as compared to other emerging country (South Africa) and developed countries with the evidence from Japan and USA. This section further presents the comparison of the contemporaneous co-movement with real GDP, and persistence of economic variables in Turkey compared with other countries. Finally, conclusions are provided based on the results of this specific study.

### **Historical properties of business cycles and measuring volatility with hodrick-prescott filter**

Sometimes, confidence in government institutions and actions persuade that cyclical instability is a serious problem. Thus in the early success of the Federal Reserve System, 1922-1929, monetary policies were expected to help maintain prosperity. In the 1960s, the late success of Keynesian economics, fiscal fine-tuning, elicited similar hopes. However, the failure of the Keynesian theory in the 1970s has caused many economists to turn to the study of business cycles as equilibrium phenomena. The sequence of serious worldwide recessions in the last few decades soon disproved the perennially attractive idea that business cycles had become obsolete. Beyond that, the credibility of both Keynesian and monetarist explanations has diminished. Once again, the apparent failure of old solutions prompts the profession to pay more attention to the continued existence of business cycles (Zarnowitz, 1992).

The study of business cycles is almost coextensive with short-term macro dynamics, and it has a large interface with the economics of growth, money, inflation, and

expectations. Interest in business cycles is itself subject to a wavelike movement, waxing during and after periods of turbulence and depression, waning in periods of substantial stability and continuing growth. The business cycle can be described as the percentage difference between the observed output and the potential output being known as the output gap. Potential output in neoclassical macroeconomic thought is synonymous with the trend growth rate of actual output (Grech, 2014). In the analysis of the cyclical behavior of components of national output, Backus and Kehoe (1992) justify that though the magnitude of output fluctuations varies across countries and periods, relations among real quantities remain remarkably uniform. That means in spite of the fact that countries differ in their institutions, monetary and fiscal policies, and industrial compositions and structures, the cyclical behavior among variables are remarkably stable. Whereas, Basu and Taylor (1999) state that theoretical concerns of business cycle indicate that the properties of business cycle models depend not only on important structural aspects of the model such as money neutrality, labor market structure, and price adjustment, but also on the closure of the model in international markets. Econometric considerations suggest that more information about the country-specific versus universal features of cycles could be gathered from the study of panel data.

Most of the researches propose measuring volatility on the basis of the standard deviation of the growth rate of a variable, which assumes that the said variable is stationary at the first difference. In other words, this approach puts forward restrictive hypotheses as to the behavior of a series without any prior testing (Cariolle, 2012). Ramey and Ramey (1995) propose studying the effect of economic variability using the standard deviation of the growth rate of GDP per-capita. Raddatz (2007) also uses the standard deviation of the growth rate of several macroeconomic variables (price of primary products, terms of trade, aid per inhabitant, GDP per inhabitant and London interbank offered rate, to examine the contribution of external shocks to the volatility of GDP in African countries.

Potential output is unobservable and must be estimated. Although some institutions have tried to gauge potential output through direct means like surveys of capital utilization, the preferred way has been that of indirect estimation techniques. These can be divided into the statistical filtering methods and the structural approaches (Grech, 2014). However, it should be emphasized that the division between the two branches is not total as some methods use both approaches in the estimation of potential output. Moreover, all approaches claim that their estimation method is based on reasonable economic foundations and provide estimates that could be used uniformly for most analytical purposes. The output series can be decomposed into a permanent

component and a cyclical one that exhibits stationary behavior in that it reverts always to the permanent level. According to Grech (2014), the permanent or equilibrium level of output is not stable rather exhibits an upward trend in most economies, reflecting mainly productivity shocks. Therefore, methods that attempt to extract the cyclical element must be able to identify movements in the time series that are due to the cycle and those that reflect changes in potential output. According to Uribe and Schmitt-Grohe (2017), to characterize business cycle facts, a time series is decomposed into a cyclical component and trend component, and there are various methods to extract the cyclical component: log-linear detrending, log-quadratic detrending, Band pass filtering, and HP filtering.

Like other trend removal techniques such as trend regression, moving average detrending, and band-pass filtering, the Hodrick and Prescott (HP) filter is frequently used to produce new time series such as potential GDP and output gap that are useful in macroeconomic modeling and monetary policy research (Phillips and Jin, 2015). In the study of business cycle, Hodrick and Prescott (1997) discover that consumption of services, consumption of nondurables, and state as well as local government purchases of goods and services are the series that vary least. The investment is about three times as variable as output. Covariabilities of consumption and investment with output are much stronger than the covariability of government expenditure with output. In the study of real business cycle models, Rebelo (2005) also find that investment is about three times more volatile than output, and nondurables consumption is less volatile than output. Almost all macroeconomic variables are strongly procyclical, that is, they show a strong contemporaneous correlation with output. Macroeconomic variables show substantial persistence. If output is high relative to trend in this quarter, it is likely to continue above trend in the next quarter. Habitually economic researchers have a theory that is specified in terms of a stationary environment and wish to relocate the theory to observed nonstationary data without modeling the nonstationarity. Hodrick and Prescott proposed a very popular method for doing this, commonly interpreted as decomposing an observed variable into trend and cycle (Hamilton, 2016). Although the use of the HP filter has been subject to heavy criticism, it has withstood the test of time and fire of discussion well, and today it is widely adopted in academic research, policy studies, and analysis by private-sector economists (Ravn and Uhlig, 2002). The Hodrick-Prescott filter involves the smoothing parameter,  $\lambda$ , and standard practise in the literature is to set this parameter equal to 1600 (in quarterly data) for all countries. Though, Ravn and Marcet (2003) caution that this choice might distort the results when the cyclical component is highly serially correlated and that care

should be taken in checking if the results are reasonable in the light of common wisdom. Ravn and Uhlig (2002) suggest that the  $\lambda$  parameter should be adjusted according to the fourth power of a change in the frequency of observations setting  $\lambda = 6.25$  for annual observations, which is different from the value  $\lambda = 100$  or  $\lambda = 400$  typically found in the literature.

## METHODOLOGY

The study of macroeconomic volatility of Turkey was based on the quarterly data over the period 1961:Q1 – 2018:Q4, and annual data of the period 1961 – 2018 with the aim of determining which smoothing parameter is used in moving from quarterly data to annual frequency of observation. The data were obtained from OECD Stat Data set: Quarterly National Account. According to Phillips and Jin (2015), for the last several decades, the Hodrick-Prescott (HP) filter has been used extensively in applied econometric work to detrend data, particularly to assist in the measurement of business cycles. This study also employs the HP filtering technique to extract the cyclical component using the smoothing parameter ( $\lambda = 1600$ ) for quarterly data, and  $\lambda = 6.25, 25, 100, \text{ and } 400$  for annual data so as to determine which smoothing parameter ( $\lambda$ ) is preferred in moving from quarterly data to annual frequency of observations. The technique of HP filter is explained as follows.

The observed time series are viewed as the sum of cyclical and growth components. Actually, there is also a seasonal component, but as the data are seasonally adjusted, this component has already been removed by those preparing the data series (Hodrick and Prescott, 1997). If growth accounting provided estimates of the growth component with errors that were small relative to the cyclical component, computing the cyclical component would be just a matter of calculating the difference between the observed value and the growth component. Growth theory accounting, in spite of its considerable success, is far from adequate for providing such numbers. If prior knowledge were sufficiently strong so that we could model the growth component as a deterministic component, possibly conditional on exogenous data, plus a stochastic process and the cyclical component as some other stochastic process, estimating the cyclical component would be an exercise in modern time series analysis. The prior knowledge is not of this variety, so these powerful methods are not applicable (Hodrick and Prescott (1997), rather is that the growth component varies "smoothly" over time.

The conceptual framework of the study is that a given time series  $y_t$  is the sum of a growth component  $\tau_t$  and a cyclical component  $c_t$ :

$$y_t = \tau_t + c_t \quad \text{for } t = 1, \dots, T. \quad (1)$$

The measure of the smoothness of the  $\{\tau_t\}$  path is the sum of the squares of its second difference. The  $c_t$  are deviations from  $\tau_t$  and the conceptual framework is that over long time periods, their average is near zero. These considerations lead to the following programming problem for determining the growth components:

$$\text{Min}_{\{\tau_t\}_{t=1}^T} \left\{ \sum_{t=1}^T c_t^2 + \lambda \sum_{t=1}^T [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \right\} \quad (2)$$

Where,  $c_t = y_t - \tau_t$ .

The residual  $y_t - \tau_t$  (the deviation from the trend) is then commonly referred to as the *business cycle component*. The parameter  $\lambda$  is a positive number which penalizes variability in the growth component series. When the smoothness penalty  $\lambda$  approaches zero,  $\tau_t$  would be the series  $y_t$  itself, whereas when  $\lambda \rightarrow \infty$ , the procedure amounts to a regression on a linear time trend (*i.e.* produces a series whose second difference is exactly 0). In other words, the larger the value of  $\lambda$ , the smoother is the solution series. For a sufficiently large  $\lambda$ , at the optimum all the  $\tau_{t+1} - \tau_t$  must be arbitrarily near some constant,  $\beta$  and therefore the  $\tau_t$  arbitrarily near  $\tau_t + \beta t$ . This implies that the limit of solutions to program (2) as  $\lambda$  approaches infinity is the least squares fit of a linear time trend model. The data analyzed are in natural logarithms; so the change in the growth component,  $\tau_t - \tau_{t-1}$ , corresponds to a growth rate.

As Hodrick and Prescott (1997) describe, the following probability model is useful for bringing to bear prior knowledge in the selection of the smoothing parameter  $\lambda$ . If the cyclical components and the second differences of the growth component were identically and independently distributed, normal variables with means zero and variances  $\delta_1^2$  and  $\delta_2^2$  (which they are not), the conditional expectation of the  $\tau_t$ , given the observations, would be the solution to program (2) when  $\sqrt{\lambda} = \delta_1/\delta_2$ . Hodrick and Prescott (1997) (p.4) state that:

"Prior view is that a 5 percent cyclical component is moderately large, as is a one-eighth of 1 percent change in the growth rate in a quarter. This lead us to select  $\sqrt{\lambda} = 5/1/8 = 40$  or  $\lambda = 1600$  as a value for the smoothing parameter."

With a larger  $\lambda$ , the amplitudes of fluctuations are larger, but the relative magnitude of fluctuations of the series changes little. The reason for increasing the volatility with larger smoothing parameter ( $\lambda$ ) is that in detrending the time series data, HP filter removes some values from a trend component and then adds to a cyclical component so that these added values do not represent the real fluctuations of the economy rather it biases up the cyclical component and merges the fluctuations to stretch unnecessarily higher amplitudes beyond the real fluctuation of the economy. So, it is important that all series be filtered using the same parameter  $\lambda$ . So,  $\lambda = 1600$  has been used for the volatility analysis with the quarterly data.

## RESULTS AND DISCUSSION

The time series of more than a half-century were considered for the analysis of the macroeconomic volatility of Turkey. The frequencies of observations of the time series were quarterly (1961:Q1–2018:Q4) and annual (1961 – 2018), with the aim of determining which value of smoothing parameter  $\lambda$  fits the annual frequency of observations. For the quarterly data the smoothing parameter  $\lambda = 1600$  was used based on the recommendation of Hodrick and Prescott (1997). Whereas, in the case of annual frequency of observations, the parameter  $\lambda = 6.25, \lambda = 25, \lambda = 100, \text{ and } \lambda = 400$  were used to determine which parameter,  $\lambda$ , value best fits with the annual frequency.

These parameter values were selected based on the suggestion of Ravn and Uhlig (2002) who state that the  $\lambda$  parameter should be adjusted according to the fourth power of a change in the frequency of observations,

**Table 1.** Volatility of Turkish economy with the quarterly frequency of observations.

Real GDP (y)	Consumption (c)	Investment (i)	Government (g)	Export (x)	Import (m)	Price (p)
1.94	2.31	5.60	3.90	5.25	6.19	3.08

**Table 2.** Ranking of Turkish volatilities in comparison with the volatilities across-country.

Turkish ranking of volatilities		Global ranking of volatilities	
Business-cycle statistic	Average	Business-cycle statistic	Average
$\delta_m/\delta_y$	$\frac{6.19}{1.94} = 3.19$	$\delta_m/\delta_y$	3.23
$\delta_i/\delta_y$	$\frac{5.6}{1.94} = 2.89$	$\delta_i/\delta_y$	3.14
$\delta_x/\delta_y$	$\frac{5.25}{1.94} = 2.71$	$\delta_x/\delta_y$	3.07
$\delta_g/\delta_y$	$\frac{3.9}{1.94} = 2.01$	$\delta_g/\delta_y$	2.26
$\delta_c/\delta_y$	$\frac{2.31}{1.94} = 1.19$	$\delta_c/\delta_y$	1.05

which gives the parameter,  $\lambda = 1600/4^4 = 6.25$  for the annual frequency; whereas  $\lambda = 25$  (*i.e.*  $6.25 \times 4^1$ ) was used based on the recommendation of some other researchers for the annual frequency. The parameter  $\lambda = 100$  (*i.e.*  $6.25 \times 4^2$ ) was also used to check the effectiveness of the smoothing parameter as suggested by Backus and Kehoe (1992) in their analysis of the behavior of cyclical components of national output. In addition, the parameter value  $\lambda = 400$  ( $6.25 \times 4^3$ ) was also checked with reference to Correia et al. (1992) for the annual frequency.

### Turkish macroeconomic volatility

The volatility of investment is about three times as that of real GDP (Table 1). This finding is within the range of Backus and Kehoe (1992) conclusion who investigate the volatilities of ten countries and state that investment is consistently two to four times as variable as output. From Table 1, it is seen that  $\delta$  is the variable's volatility, that is, the standard deviation of the variable's growth rate import is highly volatile followed by investment and export; whereas, real GDP and consumption are less volatile.

The excess consumption volatility ( $\frac{\delta_c}{\delta_y} = \frac{2.31}{1.94} = 1.19$ ) shows that consumption is relatively more volatile than output. This finding agrees with the fact stated by Uribe and Schmitt-Grohe (2017) based on world average ( $\frac{\delta_c}{\delta_y} = 1.05$ ) that across countries, private consumption is more volatile than output. Ranking of standard deviations of Turkish national output from top to bottom is import, investment, export, government spending, consumption, real GDP (Table 2). This result is in line with the ranking of average standard deviations across-country. This reveals Turkey is not that different what is observed around the world.

Table 2 also reflects that output is less volatile in Turkish economy as well as the average around the world. The ranking of standard deviations shows that consumption in Turkey is relatively more volatile as compared to the average global ranking while the standard deviations of import, investment, export, and government are below the average standard deviations across-country. As compared to other variables, the standard deviation of consumption is not differing much from that of real GDP, which reflects that consumption is

**Table 3.** Volatility based on the quarterly frequency of period 1961:Q1 to 2018:Q4.

Parameter	GDP	Consumption	Investment	Government	Export	Import	Price
Turkey	1.94	2.31	5.60	3.90	5.25	6.19	3.08
South Africa	0.93	1.20	3.21	3.05	5.71	6.24	0.82
Japan	0.98	1.03	1.93	0.86	3.69	3.18	0.81
USA	0.73	0.58	1.78	0.77	3.19	3.10	0.55

**Table 4.** Volatility of annual frequency with different parameter  $\lambda$  of HP filter.

HP filter	GDP	Consumption	Investment	Government	Export	Import	Price
$\lambda = 6.25$	3.24	4.39	12.13	6.78	10.18	13.65	5.57
$\lambda = 25$	3.51	4.70	13.01	7.09	10.81	14.45	6.48
$\lambda = 100$	3.65	4.82	13.55	7.26	11.23	14.83	7.64
$\lambda = 400$	3.72	4.86	13.87	7.32	11.43	14.98	9.10

as volatile as output in Turkey as well as around the world,  $\delta_c/\delta_y \approx 1$ .

#### Volatility of Turkish economy relative to South Africa, Japan and USA

The aim of comparison of Turkish economy with South Africa, Japan and USA is to reflect the relative volatility of Turkish economy with the volatility of the country that has similar economic growth (such as South Africa) and the representative leading countries in economy (USA and Japan).

The volatility of national output reflects that real GDP, consumption, Investment, and government spending are more volatile in Turkey compared to South Africa, Japan and USA while import and export are more volatile in South Africa followed by Turkey (Table 3). Price in Turkish economy is highly volatile which is about four times as volatile as the average price volatility of South Africa, Japan, and USA. Real GDP, consumption and investment in Turkey are twice as volatile as the average volatility of South Africa, Japan and USA. Import and export are more volatile in emerging economies as compared to the developed countries.

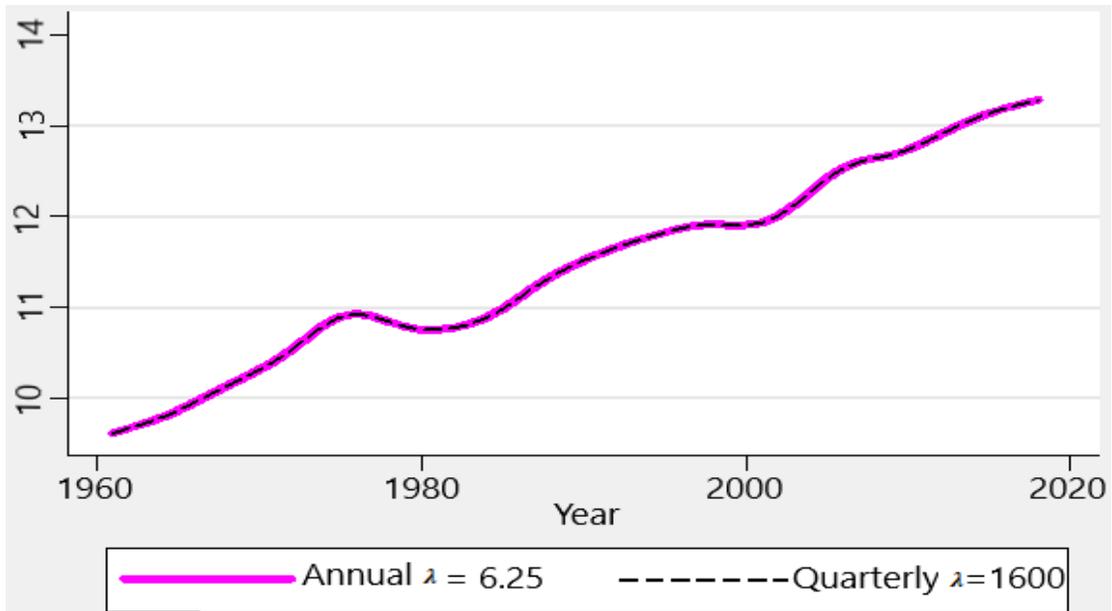
These findings are consistent with that of Uribe and Schmitt-Grohe (2017) who summarize as business cycle in emerging or poor countries are about twice as volatile as business cycles in rich countries. Koren and Tenreiro (2007) state that developing countries specialize in a limited number of sectors, with relatively simple production technologies and a limited range of inputs, and are therefore more vulnerable to shocks in global prices.

#### Volatility of Turkey with annual frequency using different parameter, $\lambda$

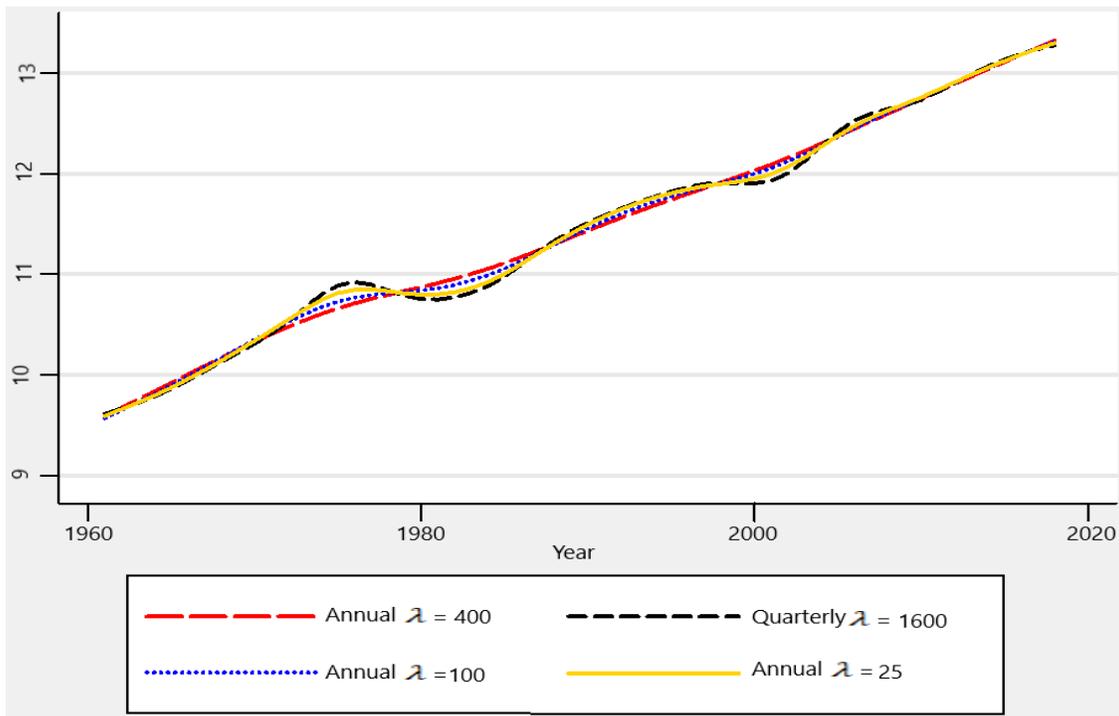
Volatilities of macroeconomic variables increase with the smoothing parameter,  $\lambda$  (Table 4). Investment is four times as volatile as output; while price is twice as volatile as real GDP. The ranking based on volatility from top to bottom reveals import is highly volatile followed by export, investment, government, price, and consumption; while real GDP is the least volatile. This ranking is again coincides with the average ranking around the world.

Even though researchers commonly use the parameter  $\lambda = 1600$  for quarterly frequency of observations, there is no agreement on the parameter value with annual frequency. In detrending the annual data, Ravn and Uhlig (2002) use  $\lambda = 6.25$ ; whereas Backus and Kehoe (1992) use the smoothing parameter  $\lambda = 100$ . On the other hand, Correia et al. (1992) suggest  $\lambda = 100$  for the annual frequency. Some other researchers also suggest different parameter ( $\lambda = 25$ ). Now the question is, which smoothing parameter value is recommended for the frequency of annual observations?

To justify which smoothing parameter adjustment best outfits the annual frequency, the Turkish macroeconomic variables were examined for the period of 1961 – 2018, sampled at the quarterly and the annual frequency. The trend component of the quarterly data was compared, using  $\lambda_{quarterly} = 1600$  with the trend components of the annual data using  $\lambda_{annual} = 6.25, 25, 100, \text{ and } 400$ . The results are shown in Figures 1 and 2. The trend component of the quarterly data using  $\lambda_{quarterly} = 1600$  and the trend component of the annual data using  $\lambda_{annual} = 6.25$  are practically identical (Figure 1), whereas differences are observed for  $\lambda_{quarterly} = 1600$



**Figure 1.** Trend component of Turkish investment at quarterly frequency  $\lambda_{quarterly} = 1600$  (broken line) and annual frequency of observations.



**Figure 2.** Trend component of investment at quarterly frequency annual frequency using different smoothing parameters.

and  $\lambda_{annual} = 25, 100, \text{ and } 400$  (Figure 2). These findings reflect that the annual frequency should be

adjusted to the smoothing parameter  $\lambda_{annual} = 6.25$ . When the smoothing parameter increases from

**Table 5.** Cyclical behavior of Turkish economic variables deviations from trend of variables.

Business-cycle statistic	Correlation coefficient
corr(i, y)	0.73
corr(c, y)	0.68
corr(m, y)	0.56
corr(g, y)	0.37
corr(x, y)	0.31
corr(p, y)	-0.49
corr( $\pi$ , y)	-0.15
corr(g/y, y)	-0.09

Source: Own computation from OECD data, 2019.

**Table 6.** Comparison of cyclical across countries.

Business-cycle statistic	Turkey	South Africa	Japan	USA	World average
corr(i, y)	0.73	0.64	0.84	0.93	0.66
corr(c, y)	0.68	0.75	0.75	0.87	0.69
corr(m, y)	0.56	0.73	0.63	0.78	0.24
corr(x, y)	0.31	0.23	0.37	0.44	0.19
Corr(g/y, y)	-0.09	-0.38	-0.75	-0.74	-0.02

$\lambda_{annual} = 6.25$  to  $\lambda_{annual} = 25, 100, \text{ or } 400$ , the deviation from the trend value with the smoothing parameter  $\lambda_{quarterly} = 1600$  becomes larger and larger (Figure 2). This clearly confirms that the adjustment in moving from the quarterly frequency to annual frequency observation should be  $\lambda_{annual} = 6.25$ . This adjustment holds true with all variables for Turkey, South Africa, Japan and USA as well. The investigation with different smoothing parameter,  $\lambda$  for the annual observation once again reflect that it is only with  $\lambda_{annual} = 6.25$  that the trend component of the annual data coincides to that of the quarterly data with  $\lambda_{quarterly} = 1600$ .

### Cyclical behavior of Turkish macroeconomic variables

Explaining the correlation coefficients of the cyclical deviations of each series with the cyclical deviations of real GNP, Kydland and Prescott (1990) state that a number close to one indicates that a series is highly *procyclical*; a number close to one but of the opposite sign indicates that a series is *countercyclical*. A number close to zero means that a series does not vary contemporaneously with the cycle in any systematic way, in which case the series is said to be *uncorrelated* with the cycle.

Table 5, the degree of contemporaneous co-movement with real GDP, indicates the correlation coefficients of the

cyclical deviations of each series with the cyclical deviations of real GDP of Turkish quarterly frequency observations of period 1961 to 2018. Investment, consumption, import, export, and government are procyclical (positively correlated with output); whereas, price and inflation are countercyclical (negatively correlated with output). The share of government consumption in output (*g/y*) is acyclical or uncorrelated (Table 5). These findings also agree with the facts observed around the world as summarized by Uribe and Schmitt-Grohe (2017).

### Comparison of contemporaneous co-movements with real GDP

Consumption and investment are highly procyclical across the countries. Import is highly procyclical in Turkey, South Africa, Japan, and USA as compared to the correlation of average import across the countries. The share of government consumption in output is more countercyclical in Japan and USA, unlike across countries that is roughly uncorrelated with output. This fact is well described by Uribe and Schmitt-Grohe (2017) as the share of government consumption is countercyclical in rich countries, but acyclical in emerging and poor countries. The government purchases have no consistent procyclical and countercyclical pattern (Table 6). This finding is in line with that of Kydland and Prescott (1990).

**Table 7.** Serial correlations of Turkey and the average across countries.

Business-Cycle	Turkey	South Africa	Japan	USA	World average
corr( $y_t, y_{t-1}$ )	0.78	0.81	0.78	0.87	0.71
corr( $c_t, c_{t-1}$ )	0.85	0.82	0.62	0.87	0.66
corr( $i_t, i_{t-1}$ )	0.85	0.84	0.83	0.90	0.56
corr( $g_t, g_{t-1}$ )	0.73	0.24	0.69	0.84	0.76
corr( $x_t, x_{t-1}$ )	0.80	0.26	0.76	0.69	0.68
corr( $m_t, m_{t-1}$ )	0.85	0.73	0.82	0.78	0.61
corr( $o_t, o_{t-1}$ )	0.88	0.37	0.74	0.51	36.5

$o = (x + m)/y$  to determine whether or not the economy is open.

### Persistence of economic variables in Turkey compared with across countries

All components of demand ( $c, g, i, x$ ) and supply ( $y, m$ ) are positively serially correlated in Turkey, South Africa, Japan, USA as well as across countries (Table 7). The economy of Turkey, South Africa, Japan and USA are more open compared to the average of world economy. Turkey and Japan economy is highly open as compared to USA and South Africa (Table 7).

### Conclusion

The Turkish macroeconomic variables such as import, investment, and export are more volatile followed by government spending; while consumption and real GDP are less volatile. Generally, the Turkish economy is more volatile than South Africa, Japan and USA. Price in Turkey is highly volatile which is about four times as volatile as the average price volatility of South Africa, Japan, and USA. Output, consumption and investment in Turkey are twice as volatile as the average volatility of South Africa, Japan and USA. Import and export are more volatile in emerging economies as compared to the developed countries.

Volatility increases in moving from the quarterly frequency of observations to annual frequency of observation. This confirms that business cycle fluctuation is better expressed with the quarterly frequency compared to the annual frequency of observations. The trend component of annual frequency using the smoothing parameter of  $\lambda_{annual} = 6.25$  is practically identical with the trend component of the quarterly data using  $\lambda_{quarterly} = 1600$ ; whereas, the parameter value of  $\lambda_{annual} = 25, 100, \text{ and } 400$  lead to more deviation from the trend component of quarterly data. Hence the parameter  $\lambda_{annual} = 6.25$  is more preferable to  $\lambda_{annual} = 25, 100, \text{ and } 400$  in detrending the annual frequency observations.

In Turkish economy, investment, consumption, import,

export, and government are procyclical; price and inflation are countercyclical; whereas, the share of government consumption in output is acyclical. The components of aggregate demand (consumption, government spending, investment, and export) and aggregate supply (output and import) are all positively serially correlated in Turkey, South Africa, Japan, and USA; and their economies are more open compared to the economies across countries.

### CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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*Review*

# **Public agencies in Nigeria's oil sector: Wealth distribution, economic development and poverty alleviation in the Niger Delta**

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Received 9 April, 2020; Accepted 19 October, 2020

**Why are host communities where oil companies are operating in the Niger Delta region of Nigeria undeveloped despite huge contribution of petroleum resources to the economy? This question has led to debates among scholars on the role and operation of multinational oil companies in Nigeria. To address this question, detailed literature search was conducted including reviewing archival documents, company information and media reports in order to gain a richer understanding why there is so much poverty, absence of social mobility and negation of socio-economic and infrastructural development in the Niger Delta region. This study also examines how Nigeria's abundant wealth is distributed by some public agencies in oil and gas sector in contemporary Nigeria. The study found that transformative leadership would involve not only the government, but also collaboration and support from crude oil companies, NGOs as well as the local communities. Essentially, the government, politicians, local leaders and crude oil companies must provide a fertile business footprint which can allow less privileged people and communities within and outside the Niger Delta region to develop their capacity and creativity. This study recommends that the concept of community co-operatives which would make a difference to the wider population in the region is a model that must be embraced.**

**Key words:** Nigeria, Niger Delta, corporate governance, CSR, stakeholders, public agencies, wealth distribution, economic development, poverty alleviation.

## **INTRODUCTION**

The context of this paper as introduced in the abstract leads Omoweh (2005) to postulate that the country has witnessed constant instability and summarised that Nigeria represents not only a fragmented capitalist tool, but like other capitalist projects, exists merely to propagate capitalist objectives which directly or indirectly create opportunity for selfish and fraudulent acquisition of

wealth. Therefore, it cannot be overstated that the availability of oil resources in Nigeria has promoted a predatory culture and abysmal governance (Moore, 2004), ignited catastrophic social crisis (Idemudia and Ite, 2006); escalated poverty and produced nothing but huge negative infrastructural and economic development (Obi, 2010; Onigbinde, 2008; Karl, 1997).

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The separation of business by its owners (shareholders/principal) from the managers (executives/ agents) caused some concern and led to increased debate about how to match executive interest with owner's interest. Adam Smith ignited this argument far back in 1776 when he stated that the separation and control of a business manifested in little reward for managers to effectively run a business (Pande and Ansari, 2014). The agency theory recognises the supremacy of the shareholder and sees "the shareholder as a principal in whose interest the business should be run" (Clarke, 2004: 5). The agency theory is concerned with "delegation of authority within a hierarchical relationship" (Jacobides and Croson, 2001: 203). The agency theory argues that managerial ownership provides an effective influence in the functionality of an organization and makes it possible for them to work together with investors and pursue common interests (Jensen and Meckling, 1976). Theoretically, empirical accounts of literature suggest that corporate governance evolved out of the agency theory and a focus on the agency framework reveals that much attention is concentrated on monitoring and control aspects of governance (Filatotchev and Wright, 2011).

However, corporate governance is a combination of checks and balances and it ensures that managerial/ executive creativity and entrepreneurial drive thrive in a way that brings result for the benefit of all (Filatotchev et al., 2006). While it has been recognised that there exists a conflict of interest between the agent and the principal in two fundamental areas: (a) the level or amount of effort the agent can realistically commit or dedicate to serve; (b) risk sharing-agents wash off their hands from negative outcome at the principal's detriment (Bosse and Phillips, 2016); it is still the case that not much attention has been accorded to the transformation processes in governance including variations in relationship between the agent and the principal within national boundaries. For example, Jensen and Meckling (1976) stated that the agency is a component of organizational corporate governance which emerged as an aftermath of executive behaviour in the sense that rather than acting as agents of the principal, they were busy pursuing selfish interests at the expense of the organization (Hendry, 2002). The agency problem refers to the willingness of the executive to ignore risk factors in preference to building a business empire with a view to gaining personal advantage, authority, high status and influence (Hope and Thomas, 2008; Masulis et al., 2007; Stulz, 1990; Jensen, 1986). This behaviour is not limited to businesses alone; it is also the case in government and public sector establishments in Nigeria and other parts of the world.

### **Regulations within the oil sector**

In Nigeria, there are many government departments, agencies or commissions specially and specifically created under the law of the land to act on behalf of the

government and discharge services as regulatory agencies. As agents of the state, Fox et al. (2002) suggested that public bodies perform four significant roles in promoting better life and fostering economic development in developing economies through mandating, facilitating, partnering and endorsing functions. Nigerian government has sometimes shown some appetite to confront its mandating roles by bringing into existence some institutional mechanisms or public agencies at federal and state levels. In the oil and gas sector, key notable agencies are: the Nigerian National Petroleum Corporation (NNPC), the Department of Petroleum Resources (DPR), Ministry of Petroleum Resources, the Niger Delta Development Commission (NDDC), National Petroleum Investment (NAPIMS), Nigerian Gas Company, the Nigerian Maritime Administration and Safety Agency (NIMASA), the Petroleum Products Pricing Regulatory Agency and the Nigerian Content Development and Monitoring Board (Idemudia, 2010; Akinbajo, 2012; Owolabi et al., 2014; Hanson, 2015; Daniel and Nwagbuhiogu, 2015). As part of their functions, both Ministry of Environment and the Department for Petroleum Resources were constituted to support environmental legal provisions including the Oil and Gas Bill (2004) which requires crude oil firms in Nigeria to pursue social responsibility objectives (Idemudia, 2010).

Being public bodies, these agencies function as regulators and agents of the government and formulate institutional and organizational policies, strategies and regulate the activities of oil and gas companies. As part of their responsibilities, they are also expected to ensure enforcement and full compliance of policies, rules and regulations and equally endeavour to see that the benefits of Nigeria's oil resources and other essential services are delivered to the people, localities and regions (Kettl, 2000; Owolabi et al., 2014). Ideally, poverty is expected to be eradicated through efficient wealth distribution and by mobilising and entrenching socio-economic empowerment and infrastructural development across board in the Niger Delta region.

In 2003, the government under the auspices of two public bodies namely: the Securities and Exchange Commission (SEC) and Corporate Affairs Commission in an effort to give a face-lift to corporate governance in Nigeria, came to agreement with the International Corporate Governance and adopted the International Code of Best Practices for companies registered in Nigeria and/or listed on the Nigerian Stock Exchange (Idolor and Braimah, 2015). However, given the aforementioned measures and the plurality of agencies in the oil and gas sector in Nigeria and also taking cognisance that 90% of the total export of the nation's oil wealth is derived from the Niger Delta region (Owolabi et al., 2014), the question that comes to mind is: why have most host communities in the Niger Delta remained impoverished and lack basic social amenities and infrastructural development more than 50 years since oil exploration and exploitation began in the region?

## CHALLENGES AFFECTING THE NIGERIAN OIL SECTOR

### Weak regulation

According to Idemudia (2010), Nigerian government's inability to use its mandating function to boost economic and social conditions or revive the local communities can be attributed to the following factors: poorly equipped institutions, lack of technical knowledge and inability of policy and regulatory agencies like the Department of Petroleum Resources and Ministry of Environment to deliver or effectively discharge their constitutional functions, hence monitoring and compliance over crude oil firms cannot be guaranteed. For example, the National Oil Spillage Detection and Rapid Response (NOSDRA) which came into existence in 2007 to deal with oil spillage in Nigeria admitted that the agency lacks commensurate capacity as well as the technological equipment required to perform the role (Ojo, 2012). In this regard, Echefu and Akpofure (2003) argued that the entire environmental regulatory system indicates a failure of responsibility. It was also on this basis that Akanki (1994) and Yerokun (1992) stated that appointments to executive positions in government establishments centre mostly on political, ethnic and religious grounds rather than merit, skill and individual productivity.

This has been worsened by Nigerian regulators' reliance on crude oil firms for information that can aid them in their monitoring and regulatory roles to the extent that government authorities find it hard to make their way to crude oil installations at swampy and offshore locations (Idemudia, 2010). The agencies and their representatives come on board with the rent seeking culture (Bhagwati, 1982) of their political and bureaucratic masters as against accountability, diligence, productivity and national development. It is hard to see how effective monitoring and enforcement can be carried out, let alone crude oil firms complying with regulatory requirements. Sadly, it has become a case of Nigerian agencies handing over their constitutional authority to the multinational oil corporations and submitting to control against national interest (Idemudia, 2010). What emerges from weak regulatory channels (Ahunwan, 2002) and vulnerable technical capability can be traced to the features of the Nigerian economy with its characteristics designed fundamentally to gain and consume as much wealth as possible without accountability and undermine channelling resources to equip regulatory bodies for productive ventures and enterprise that aid development (Idemudia, 2010).

### Oil subsidy scam

Justice Ayo Irikefe Tribunal of enquiry constituted in 1980, while probing NNPC over oil sales and other financial misconducts, ruled that "NNPC was virtually irrelevant in

the management and control of the oil industry" (Ebohon, 2012: 204). Because the government depends so much on oil income, the oil companies receive better attention and higher priority than the Niger Delta communities and as a result, desired economic, social and infrastructural development in the region are ignored because NNPC as a leading government agency has neither the impetus nor the organizational leadership needed to control the behaviour of its own officials let alone questioning the activities of the oil companies (Idemudia, 2010) or manage the national oil resources and pursue desired social and economic development. For example, President Muhammadu Buhari won a landslide election victory in 2015 general election under the anti-corruption mandate (Turkson, 2016) with a promise to tidy up the oil industry in Nigeria including the state owned NNPC (Clarke and Akwagyiram, 2015).

In an attempt to be open and upfront, the president expressed that as Nigeria's Minister of Petroleum and Natural Resources between 1976 and 1978, the Nigerian National Petroleum Corporation (NNPC) did not have more than three bank accounts but on assumption of office as president in May 2015, he discovered that under the previous administration, the NNPC and Finance Ministry could not identify the number of bank accounts they had (News 24 Nigeria, 2015). Between 2009 and 2011, the country lost about \$6.8 billion as a result of dubious practices and shady oil subsidy deals at NNPC where the Minister of Petroleum Resources had a conflicting role by sitting not only as a board member of NNPC – the country's importer of refined fuel and government regulator and supervisor, but also a board member of the Petroleum Products Pricing and Regulatory Agency (PPPRA), the official fuel subsidy regulators (Brock, 2012).

According to a report produced by Mr Farouk Lawan, Chairman Federal House of Representative Committee that investigated the fuel subsidy scam on behalf of the government, the Nigerian government through its agencies (NNPC, Ministry of Petroleum Resources, PPPRA and DPR) was over-invoicing for domestic fuel consumption and paying daily excess of 24 million litres which was not needed at all; indicating that the government on daily basis was paying for 59 million litres of petrol as against Nigeria's daily consumption of 35 million litres. The report clearly stated that in 2011, the government actually paid over \$17 billion in fuel subsidy and not \$8 billion which Nigerians were earlier made to believe by the government (Eboh, 2012). The report also revealed that it was a deliberate way of concealing a scam whereby some companies and cronies were fraudulently receiving several millions of dollars on fuel importation without delivering a single drop of fuel (BBC News, 2012a, 2013; Eboh, 2012). In the committee's report, aside the companies, individuals or oil executives mentioned as beneficiaries, close associates of the presidency and the ruling political party during the period under review were also mentioned (Eboh, 2012; BBC

News, 2012b, 2013).

This is what happens whenever and wherever there is no accountability and little wonder why none of the beneficiaries – companies, officials or agents has been prosecuted in Nigeria. The amount siphoned from the fuel subsidy account from 2009 to 2011 by state agencies as highlighted could have been invested on jobs, infrastructure and other social development projects that would have benefited both the Niger Delta region and other parts of Nigeria but sadly, it never happened.

### **Poor accountability**

As a national oil corporation, it is no longer a secret that NNPC has questionable accounting procedures and as a result, operates year in year out without publishing its annual report hence it is easy for billions of national wealth to disappear overnight without trace (Turkson, 2016) while thousands of people in the Niger Delta are dying of hunger, poverty and from the effects of oil spillage and pollution. According to the Act that established the Nigerian National Petroleum Corporation (NNPC) in April 1977 as a national oil corporation, NNPC is expected to balance its books, sort out its cost elements and transfer balance to the central treasury account - but in June 2015, the National Economic Council reported that from 2012 to 2015, NNPC realized \$41 billion but could only manage to remit \$21.6 billion to the treasury (Adesina, 2015; Reuters News, 2015). Meanwhile, in 2013 when the Central Bank of Nigeria governor at the time, Lamido Sanusi dictated the abnormality and raised it with NNPC executives and the presidency, he was relieved of his appointment and asked to shut up (Turkson, 2016). Furthermore, the Auditor General of Nigeria, Samuel Ukura, released a report to Nigerian law makers and disclosed that NNPC failed to release about \$16 billion meant for 2014 annual return. Rather than playing the role of a responsible agency, NNPC and some other agencies have become adversaries and prefer to pursue selfish pleasure and enrichment at the expense of highly deprived communities in the Niger Delta, hence President Buhari in February 2016 sacked 26 bosses of public agencies and state-owned companies (Turkson, 2016).

In another scandal with extensive caveats that involved the US oil servicing giant Halliburton, the Halliburton \$182 million bribery scandal as it was called; the International Consortium of Investigative Journalists (ICIJ) in 2015 revealed that Halliburton on behalf of an international consortium used syndicates, offshore and secret bank accounts to pay bribe to some public officials in Nigeria in order to be awarded \$6 billion highly complex liquefied natural gas construction project at Bony Island in the Niger Delta. The concept and planning of the bribery dates to 1994 when the federal government tried to kick start the new multi-billion-dollar gas project.

This illegality was perpetrated up until 2003 through a British lawyer who was later convicted in the United States in 2012 for the role he played in the scandal while Halliburton was fined heavily for the same offence by US authorities. Like other instances, the money was paid to Nigerian public officials and the political party in power at the time through the NNPC (Fitzgibbon, 2015). The personalities involved in the Halliburton bribery issue included high and mighty oil executives as well as former Nigerian leaders to the extent that an official government document published in 2010 confirmed that among those that not only robbed Nigeria through fraudulent oil and gas practices and deals, but halted social mobility and socio-economic development in highly deprived Niger Delta region and Nigeria in general were company executives, minister(s), military and security chiefs, vice president including at least three former Nigerian Presidents (Fitzgibbon, 2015).

Although the LNG plant is up and running, one stands to reason that given the controversial circumstances surrounding the LNG project, it is not impossible that the project may have been inflated or over-budgeted and proceeds channelled into private accounts of some public officials. The bribery scandal must have also caused some distractions thus taking infrastructural and socio-economic development in the Niger Delta for granted. It therefore follows that Nigerian public agencies may not be the rubber bullet needed for ambitious development in the region unless genuine reformation is undertaken.

### **Scandal in the Department of Petroleum Resources (DPR)**

Back in 1998, the Department of Petroleum Resources (DPR) created in the 1950's to function as government agency with the responsibility to license and regulate oil companies involved in upstream and downstream activities in Nigeria in conjunction with the Minister of Petroleum Resources and NNPC were all connected in a complex oil bloc reserve deal commonly identified as OPL 245, an offshore location in the Niger Delta (Akinbajo, 2012). In this scandal, it was disclosed that Shell and Agip used DPR, Minister of Petroleum Resources, NNPC and other dignitaries in government to manipulate established statutory and regulatory requirements and paid the sum of \$1,092,040,000 billion in a desperate effort to acquire the OPL 245 oil bloc projected to contain about 9 billion barrels of crude petrol (Akinbajo, 2012; Hollingsworth, 2016). In this deal, while the director, Department of Petroleum Resources (DPR) on behalf of the Minister of Petroleum Resources, wrote and signed the letter approving the Malabu OPL 245 oil bloc allocation, the Minister of Petroleum Resources awarded the license to Malabu, a company with neither a traceable address nor record/history at a give-away amount of \$20 million. NNPC was involved because the

Nigerian (military) head of state when this oil bloc was awarded was also in-charge of NNPC while his son was overseeing his interest in the fraudulent oil bloc deals (Akinbajo, 2012; Hollingsworth, 2016).

Notwithstanding the controversy over the Malabu oil bloc award, in 2011, Nigerian authorities went ahead to sell the oil field to Shell and Agip (Eni) and a recent report in *London Evening Standard* stated that the Malabu oil block belongs to the Nigerian Petroleum Resources Minister that awarded the license. The report also indicated that, while Nigerian government received about \$208 million from Shell and Eni oil companies as administrative costs, more than \$1 billion was paid to Malabu and five other accounts spread across London, Switzerland and other offshore territories (Hollingsworth, 2016). In the *London Evening Standard* report, an observer and anti-corruption campaigner pointed that the fraudulent \$1 billion which has been lost could be equated to 80% of the country's health budget but regrettably the money disappeared without benefiting the Nigerian communities or citizens to the extent that more than \$85 million Malabu OPL 245 oil deal proceeds traced to Natwest Bank in London became a subject of legal dispute in a British court (Hollingsworth, 2016) while millions of Nigerians are hungry and dying in poverty, pollution and lack basic social amenities.

Similarly, between 2005 and 2007, a private investigator revealed that: DPR, a junior Minister of State for Energy and NNPC acting as government agencies, awarded an oil bloc OPL 291 and collected management fees/bonus and in an unclean deal, gave away a prosperous oil field to Starcrest Energy, a firm that came into existence few days before the bid (Ifeanyi Izeze). The front men were high profile business executives and politicians with strong connections to the Nigerian President, who under his regime, also acted as Minister of Petroleum Resources and sole administrator of the state oil company NNPC, whereby subordinate ministers were overshadowed and influenced whenever important decisions concerning oil and gas in Nigeria were to be taken. At the end of the day, the oil license for OPL 291 ended up in the hands of Addax Petroleum and Starcrest in unclear circumstances (Ifeanyi Izeze). According to Premium Times report, the reality is, Shell has succeeded in taking control of the oil and gas sector in Nigeria (Akinbajo, 2012).

### **Lack of internal control and uncompleted projects**

Shell has been operating in Nigeria since oil exploration and exploitation began at Oloibiri in the Niger Delta and evidence in the region, Ogoniland inclusive strongly indicate that Shell has caused more harm than good and perhaps part of the reason why development in the Niger Delta is a far cry. It is a shame that the public agencies being agents for economic and social development, have

failed to account to the impoverished Niger Delta communities and Nigerians as a whole as they prefer to account to themselves thus making good governance or accountability not to occupy a single space "while mediocrity and impunity have a field day" in Nigeria (Ikpeze, 2013: 155). Following the creation of the Niger Delta Development Commission (NDDC) in 2000 as the name suggests to function as agent for economic, social, infrastructural empowerment and development in the Niger Delta, it was assumed that as a stakeholder, the federal government had commenced complying with its constitutional and moral mandate to pursue socio-economic development through partnership with crude oil firms in the region (Goodstein and Wicks, 2007). While it can be said that NDDC has made some efforts in providing scholarship opportunities and initiated some social projects in health and agriculture (Idemudia, 2007a); it has also been suggested that the NDDC has failed to deliver development to the people of Niger Delta (Omotola, 2007).

Furthermore, there is believe that the NDDC and other agencies in Nigeria's oil and gas sector have stifled socio-economic development opportunities and failed to effectively coordinate development initiatives and eradicate poverty in the region (Idemudia, 2009). These views cannot be overemphasized. For example, in a report published by Vanguard News in August 2015, the NDDC was expected to award contracts based on laid down procedures as contained in the Public Procurement Act (PPA). Rather than following the rules, NDDC officials deliberately by-passed the laid down PPA rules and procedures before projects could be awarded to contractors thereby creating fraudulent avenues through which their cronies go away with huge amounts of money meant for Niger Delta development (Daniel and Nwagbuiogu, 2015) without a real vision or idea of what to do with their loot.

Findings revealed that NDDC executives adopted contract splitting procedure under which big and complex contracts are awarded without necessarily invoking the provisions of the Bureau for Public Procurement (BPP) which makes it easy for officials/agents and political heavyweights to thrive and cart away with billions of NDDC resources while the people and communities are left behind. Amid poverty, inequality and massive underdevelopment in the region, the NDDC officials operate a lavish lifestyle (Daniel and Nwagbuiogu, 2015; Isine, 2015). Report published in The Nation Newspaper in August 2015 indicated that at the inception of NDDC, an elaborate and detailed plan about the way to comprehensively develop the impoverished Niger Delta region through the Niger Delta Regional Development Master Plan was created and disseminated to all sectors. But instead of following the master plan and using it as an important guide to develop the Niger Delta area, it became a tool some senior officials used to lobby for big investments into the NDDC which end up into their

personal accounts leaving the Commission's huge funds hijacked by politicians and others with selfish ambitions (Hanson, 2015). In 2008, the number of projects such as roads, canals, dredging, bridges and shoreline protection awarded by Niger Delta Development Commission (NDDC) were slightly above 2500; as at 2013, the number of projects awarded went up to 6000 and rose further to 8000 in 2015. But there was no project on ground across the region to show for the budgeted 2.2 trillion naira out of which, more than half had been collected. The NDDC's immediate past chairman disclosed that there were about 8000 outstanding projects valued at 1trillion naira and that extra 800 billion naira would be required to cover the outstanding cost (Hanson, 2015). This means, the 2.2 trillion naira earlier budgeted and dispensed was squandered or wasted and could not be accounted for by NDDC.

Meanwhile, not only have there been clear evidence of high-level corruption, budget, documentation and procurement fraud going on at NDDC, it has also been stated that the established mechanisms used for monitoring projects have been negated which is indicative of the reason why majority of the road projects handled by NDDC only last for a few months. The Niger Delta region is deprived of basic infrastructure and means of survival. The impunity and recklessness at NDDC are such that genuine contractors who do not have connection with the authorities are denied payment for executed projects while special priority is given to fraudulent payments that end up in private bank accounts (Hanson, 2015).

According to Isine (2015), a statement credited to former Nigerian President, Goodluck Jonathan while in office pointed at financial abuse by NDDC management by admitting that the federal government over the years committed so much money on the agency, but, there has been nothing much on ground to show or prove that. Mr Jonathan, who incidentally comes from Niger Delta, regretted that rather than NDDC board working harmoniously with the management to pursue common goals or objectives that benefit the people of the region, both the board and management abandoned their responsibilities and engaged in endless battle over money (Isine, 2015). Furthermore, in a full-page open letter advertisement addressed to President Buhari on assumption of office published in the Vanguard Newspaper in November 2015, the Agbarho (Urhobo) Kingdom in Ughelli Delta State expressed their disgust about "massive corruption going on at NDDC in relation to developmental projects in the Niger Delta" (Vanguard Newspaper, 2015: 29). The community while insisting that Mr President probed the atrocities at NDDC and bring both the contractors and officials to order, also brought to light that after many decades of neglect, the NDDC in 2009 awarded a 23-kilometre road construction contract in respect of Agbarho Township roads with huge initial payments made between 2011-2012 but as at

November 2015, there was "no job done on the project" (Vanguard Newspaper, 2015: 29). The Agbarho Kingdom also highlighted that over the years, the NDDC "awarded several contracts to their cronies and made advance payments and sometimes full payments with little or no job done in the affected communities". The community further disclosed that enquiries they conducted at Corporate Affairs Commission (CAC) at Abuja revealed that since 2010, the company that got the contract failed to file or pay its annual returns to CAC and as a foreign company with three directors, "the three directors of the company curiously applied to have their signatures changed in 2010 after awarding the contract and the said application was granted". Similar complaints have also been made by other communities such as Uzere community in Isoko and Warri in Itsekiri (Vanguard Newspaper, 2015: 29).

Nneji (2016) revealed that the governor of Imo state, one of the oil-producing states expressed anger and displeasure over NDDC and branded the agency a notorious moneymaking machine that is majorly serving the interest of the Peoples' Democratic Party and pointed that for a long time, the NDDC has defrauded and short-changed Imo state and her citizens. Being deeply shocked, the governor publicly refuted NDDC's claim that they committed several billions on 272 projects in Imo state which he stated could not be traced or identified anywhere in the state. While labelling the NDDC as a corrupt and fraudulent agency, the governor confirmed that Imo state was yet to benefit or experience a visible impact from NDDC in terms of poverty alleviation and infrastructural development projects (Nneji, 2016). Unfortunately, it can be recalled that similar practices contributed in bringing down the Oil Mineral Producing Areas Development Commission (OMPADEC) which was commissioned through a decree in 1992 purposely to rehabilitate and develop the oil mineral bearing communities. Rather than pursuing its statutory functions, OMPADEC like other agencies, became a medium through which the political establishment and their associates embezzled the national wealth (Omotola, 2007) and failed to deliver the expected and highly deserved development to the people and communities in the Niger Delta region.

## Unemployment

The high unemployment rate and absence of basic social amenities such as food, tap water, good health care, sanitation/sewages, electricity and good roads in the region are by and large the result of the actions taken by Nigerian public agencies and corrupt officials who are on board mainly to promote their selfish interests. Contrary to facilitating equality and development through responsible practices, the agencies as regulators and instruments of wealth distribution and change have over

the years facilitated corruption (Ahunwan, 2002) looting, squandering of wealth and destroyed accountability (Idemudia, 2010; Ikpeze, 2013). This culture perhaps facilitated the disappearance of several billion dollars of oil income from 1960 to 1999 (Human Rights Watch, 2007). Corruption has become the philosophy of Nigerian public bodies thus making it much harder for the government to drive forward sustainable corporate social enhancement programmes in the Niger Delta because resources that could be used to promote development end up in private accounts of corrupt public agencies, government officials and cronies (Ahunwan, 2002; Idemudia, 2010). Amidst huge oil resources and wealth, the region remains the most deprived and poorest part of Nigeria (Watts, 2007).

Although the then Imo State governor as a public officer and agent of change like others, may not particularly be enjoying high public rating in his state; however, in this respect, one can argue that he was as well speaking on behalf of the voiceless millions of impoverished people in the Niger Delta who have been deprived of development opportunities and whose destiny and future have been stolen before their own eyes. The central argument therefore is that the magnitude of scandals and fraudulent practices associated with public agencies, government officials and privileged individuals in Nigeria have become as unbearable as those communities in the Niger Delta suffering them. Consequently, the region has not only been turned upside down, but also recklessly fuelled into crisis and unbearable hardship leading to increased level of sudden death, kidnapping/rebellious activities on government agencies, oil companies/installations (Ikpeze, 2013). The woes of the Niger Delta communities compared to other parts of Nigeria, present an immeasurable image of socio-economic and political disparity. Public mood has become less positive with loss of confidence on public officials and big businesses in the region. These complex crises in the Niger Delta play a part in inspiring this study. Whether or not there would be prosecution over decades of corrupt practices and embezzlement of public funds may not only be a discussion for another day, but also forms a topic for academic research. However, in the meantime, the reality does not match the rhetoric.

### **Implications on leadership and culture**

In the midst of this agency and regulatory quagmire, the behaviour of Nigerian public bodies in the oil sector have huge implications on leadership and culture. Because corruption has become the philosophy of Nigerian public bodies, it makes it much harder for the government to drive forward sustainable corporate social enhancement programmes in the Niger Delta and Nigeria in general. What is needed more than ever before is a new dimension of moral transformation or culture change. Putting Nigerian public bodies on the spot is a reminder

that over the years, their behaviour has been so abysmal to the extent that some government regimes in Nigeria have been brought down as a result. This is a culture that requires systematic and collective responsibility and solution which must be taken seriously by different stakeholders including those in authority at federal, state and local government levels as well as businesses or organizations.

The risks are enormous for a country that is widely regarded as corrupt by the international community. Fundamentally, the caveat ranges from suspicion and labelling to reputational humiliation and lack of trust many Nigerian citizens or passport holders experience inside and outside Nigeria. Historically, the behaviour of public agencies often attracts businesses or some individuals with questionable characters in Nigeria which encouraged fraudulent activities and financial scams such as advanced fee fraud otherwise known as '419' to become notorious with small population of lazy people. However, it also hinders genuine and trustworthy investors from investing in Nigeria. This deprives the country the foreign direct investment (FDI) which it so desperately needs to invest in jobs and boost economic development in the Niger Delta and other parts of the country.

While there is little sign that Nigerian public bodies/agencies and those in leadership positions would ever get better in terms of wealth distribution, poverty alleviation, socio-economic and environmental development becoming a thing of the past remain to be seen, those in authority across Nigeria must know that the greatest leaders are not those that come up with the greatest ideas, but instead, great leaders are those that motivate others to achieve higher results (Wallace, 1975; McDermott, 2004). Perfection is not the most important quality in leadership, what matters most is credibility. Credibility can only be built by honest action, not by covering up or mere pretext (Warren, 2002) as developments or events in the Niger Delta region indicate.

### **SO, WHAT IS THE WAY FORWARD?**

As part of urgent steps that must be taken to empower the people and regenerate development in the Niger Delta, policy makers should follow a strategic bold step starting with the Co-operative Society to move the region forward. This is discussed in the following.

#### **The co-operative society: A panacea and model for community development in the Niger Delta region**

The history of the co-operatives can be traced back to the 18th century as a landmark development. The Fenwick Weavers Society widely known as the earliest formed co-operative in the world was formed in Scotland in 1761 to look after the weaving industry and its members

(Crawford, 2003). The co-operatives evolved as a turning point and a necessary response for addressing the crisis of social inequality that threatened the existence of the less privileged workers and other members of the society (Mori, 2014). The co-operatives are sometimes viewed as enterprises that are triggered into existence by necessity to counter human socio-economic hardship, deprivation, poverty and wider market failures (Ben-Ner, 1984; Caves and Petersen, 1986).

In a simplistic term, a co-operative is a business that constitutes individuals who volunteer to work together in unity to pursue mutual benefits of socio-economic and cultural nature (Tang, 2007; Yu, 1994). Similarly, the International Cooperative Alliance (1995) defined the co-operative as an independent association of individuals bound together on voluntary basis with the objective of meeting basic needs. Fici (2013) identified mutual benefits and interest as important attributes for co-operative categorization while Jones and Kalmi (2012) argued that ownership through membership as well as systematic control added together are attributes that qualify a small business into a co-operative. The transformations that followed paved way for the co-operatives to extend their services to rural communities.

### **BENEFITS OF THE COOPERATIVE SOCIETY**

Across the world, notable instances abound. For example, in Italy, the co-operatives operated in neglected rural communities and provided essential services that were particularly beneficial to their members in key areas like agriculture, electricity and banking services. It was not until the tail end of the 20th century did elaborate objective to extend dividends to the society become the focal point of the co-operative enterprise (Mori, 2014). This meant that greater stakeholder engagement and the need to foster a profound collective process became symbolic as key tenets of the co-operative strategy (Jarventie-Thesleff et al., 2011). In Nigeria, the co-operative Act was passed in 1935 leading to the formation of the cooperative federation of Nigeria in 1945 (Tar, 2008). While there has been limited research in the co-operative discourse in Nigeria, the history of the cooperative is traceable to the long standing unconventional customary savings/loans methods and the earliest experience in the cooperative agenda began in the agricultural sector and slowly moved into marketing as a result of government interest and concentration in crude oil economy rather than promoting both sectors of the economy (Tar, 2008). However, there had been an assumption that back in 2010, about 82,460 cooperative associations with more than 1.4 million membership population were in existence in different local authorities in Nigeria (Enhancing Financial Innovation and Access, 2012).

In China, the history of the co-operative dates to 1918

at Peking University when a professor and some students teamed up to form the Peking University Consumer Cooperative (Liu, 2013) before Chairman Mao's government brought into existence the Railway Workers Consumer Cooperative in 1922 (Zhang, 1995). However, the creation of a new agricultural development policy in 1953 promoted rural agricultural cooperative with remarkable success and established government support has followed ever since with extra directives backing farmers and co-operative enterprises (Deng et al., 2010), thus positioning agricultural cooperatives as the main type of cooperative and an important channel not only for rural development, but also an avenue for economic empowerment to the local population in China (Butcher and Xu, 2014). In the UK, the Co-operative Group, previously called the Co-operative Wholesale Society (CWS) until recently, employed more than 110,000 individuals within its business units such as banking, insurance, food, farming, pharmacy, funerals, property, legal services, online electrical and travel (Calderwood and Freathy, 2014). As the world's biggest consumer co-operative, the Group in 2010 delivered a whopping profit of about £606 million (Co-operative Group, 2011). Chell et al. (2010) suggested that the improvement of social enterprises at global level through the cooperative platform could be narrowed down to three important factors: (a) demand factors, this covers stakeholders/customers or public desire to seek for services from social providers; (b) supply factors, which implies the provision of essential services from social enterprises to end users, and (c) organizational factors and circumstances arising from strategic relationships. Moreover, in China and other economies in Asia, the key factors that have been instrumental to the success of the co-operatives in the agricultural sector for example, includes: full government backing, policy initiatives, encouragement and support from local leaders, facilitation of market reforms, social and environmental considerations (Taimni, 1994).

### **THE NEED FOR THE NIGER DELTA COOPERATIVE SOCIETY**

In Nigeria, meaningful result would not be achieved in the cooperative platform without transformative and compromising leadership (Bass, 1985). However, curiosity and transformative leadership would involve not only the government, but also collaboration and support from the crude oil companies, NGOs as well as the local communities. Essentially, the government, politicians, local leaders and crude oil companies must provide a fertile business footprint which can allow less privileged people and communities within and outside the Niger Delta region to develop not only on individual capacity, creativity or based on endowment, but also at a comparative and professional level (Agirre et al., 2014).

This implies that a business leader must be a manager of managers (Bennis, 1997) before success can be achieved which therefore fits into President Buhari's new economic agenda or mantra on economic diversification from oil and gas to agriculture. Given the alarming gap in social inequality, increase in poverty, deprivation and absence of infrastructural development in the Niger Delta, the concept of community co-operatives that would make a difference to the wider population in the region is a model that must be embraced.

On long term basis, while it can be an opportunity for major stakeholders (Nigerian government and crude oil companies) to venture into agricultural co-operatives with oil producing communities, extending a percentage of crude oil proceeds to the communities, co-operative models such as transportation, building or housing need to be explored as ways of addressing some of the needs of the people in the Niger Delta.

Whether or not crude oil exploration by multinational oil companies and the antecedents of the past 50 years in Nigeria is legally right, the fundamental point remains that what has happened in the region has been an aberration and widely held moral wrong. As a region where life has lost its essence or value and grief unites the communities, what would be required includes governmental and organizational support and collaboration that would not be jeopardised by selfish interest hence an explicit co-operative model which attracts and encourages local participation without undermining resource control. Therefore, because the Niger Delta communities are far more united than the forces that divide them, actualisation of the co-operative agenda and participation by people would undoubtedly be a welcome development.

The management model envisaged is a co-operative practice that involves people and places them at the centre of activities whereby power sharing with other stakeholders regardless of their level, culture or tribe helps to promote individual character and morality, self-discipline and at the same time galvanises a stronger and sustained sense of identity (Grayton, 2004). This was the case in Mondragon Spain. Furthermore, the presence of co-operative movements in and around villages in China helped to forge collaboration and relationship with rural communities and minority groups. It increased local employment opportunities and provided income to local stakeholders (Zhao and Yuan, 2014). This can also be replicated in the Niger Delta region to reduce poverty, underdevelopment and improve peoples' quality of life.

Finally, given that the democratic feature of the cooperative model cannot be compromised, the Nigerian government and oil companies should work hard to give business a good name by accepting that work and achievement cannot just be opportunity to bring home a wage. Rather, an avenue of accomplishing essential elements of life including personal and local community development (Agirre et al., 2014). As victims, the Niger Delta communities have more liabilities than stakes in the

huge resources that accrue from their native lands. Therefore, providing full support and guarantee for essential products, services and different community needs while ensuring there is absence of discrimination, equal access to opportunities and benefit to the people and communities in the region, the focus of the cooperative model in the Niger Delta must be community owned brands that must be managed by community members. Through this seminal model, Nigerian government and the oil companies can attempt to re-write some of the wrongs they perpetrated in the region. Meanwhile, Shell and NNPC have co-operative franchise for their staff in cities such as Lagos and Abuja. In the spirit of resource control, economic empowerment and poverty alleviation, extending a radical and inclusive cooperative society model to Niger Delta communities will help to improve relations between the government, oil companies and the communities. As stakeholders, it will also guarantee a level of hope and empower people and communities to have access to credit facilities for business ventures; improve job opportunities, provide training and boost development in the region. While this may not necessarily make the headline, it can make a difference for people and communities in the Niger Delta because it is often said that *what is good for the goose is also good for gander*.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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*Full Length Research Paper*

# The economic effects of Chinese foreign aid

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Received 2 October, 2020; Accepted 2 November, 2020

Nowadays there is a general skepticism, uncertainty, and misapprehension regarding China's foreign aid to developing countries, and very few studies have tried to answer the issue of whether China's foreign aid fails to foster economic growth in the recipient countries. Therefore, this study intend to examine the effects of Chinese foreign aid (disaggregated into Project Aid and Development Loan Aid) on gross domestic savings, gross domestic investment, and economic growth rate in African countries from 2000 to 2014 after a 1-year lag. To analyze the effects, multivariate regression analysis with fixed effect, random effect, and pooled OLS regression estimations were conducted. The finding of this study supports the theoretical hypothesis of a positive relationship between foreign aid, saving, investment, and economic growth rate, through documenting project aid and development loan aid categories impact positively on gross domestic saving and gross domestic investment. Development loan aid also predicted the economic growth rate. Therefore, these results predicted that project aid and development loan aid categories pour into African countries accelerated economic growth. This research also proposed that it would be better to identify the forms of aid flows when obtaining aid from the donor countries. Therefore, it attempts to contribute to the scholars and policymakers by identifying the effectiveness of specific aid components that serve as the key aid flow tool for donor countries.

**Key words:** African countries, Chinese foreign aid, economic growth, investment, saving.

## INTRODUCTION

Low capital formation has been described by various economic theories as the fundamental problem hinder the growth of most developing countries, particularly Africa, and therefore aid is allocated to play a vital role in capital formation. The general objectives of foreign aid have been to eradicate extreme world poverty, increase saving and investment, and enhance living standards especially in developing countries (Michael et al., 2016). Meanwhile, in the field of development study, whether foreign aid promotes savings, investment, economic growth, and alleviates poverty in the recipient countries is one of the

important issues. Among scholarly scholars and policymakers, the answer to this question remains contentious. In the academic loop, two strings hold opposite views in the literature regarding the issue. The first group of academic researchers documented their views on foreign aid inflows to the recipient countries as if it plays the main role in promoting economic growth through increasing domestic resources and facilitating saving, investment, and enhancing the human capital of the developing countries. The second group stated that foreign aid plays as a catalyst to create corruption,

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reduce domestic saving, and creates aid dependency this causes a negative effect on the economic growth of the aid recipient countries. Moreover, another group of the studies found a mixed result on effects of foreign aid on economic growth, domestic saving, and investment; such as Sabra and Sartawi (2015), Eltalla (2016) and Basnet (2013).

African Countries have received more foreign Aid from China than other international donors. China's foreign aid system had its origins at the Asian-African Conference in Bandung, Indonesia, in April 1955 with the entry of Chinese Premier Zhou Enlai on the global stage (Ministry of Foreign Affairs, 2014). Chinese aid to developing countries especially in Africa has continued to increase, at February 2017, Forum on China-Africa Cooperation (FOCAC); while hosting more than 40 of the continent's leaders in Beijing, China's President Xi Jinping pledged to offer 60 billion US dollars in development finance assistance to African countries, saying that the money came with no expectation of anything in return (Lina and Robertson, 2018). However nowadays, only a few studies have sought to address the issue of whether Chinese foreign aid does not stimulate economic growth in recipient countries. Even the latest interpretation of China's foreign assistance priorities remains hazy. Arguably, the disparity in language, culture, and history also restricts the researcher's further analysis of China's foreign aid, aside from restricted knowledge and evidence released by the Chinese government. It is therefore important to explore the effect of Chinese foreign aid on economic growth in the recipient countries by answering a series of questions focused on this topic. What are the effects of China's foreign aid on African countries' gross domestic savings, gross domestic investment, and GDP growth rates from 2000 to 2014? This set of questions persuaded me to find out more about the effects of Chinese foreign aid.

### **Some stylized facts on African economic growth and Chinese foreign aid**

"Africa is beginning to do well economically. One of the main reasons for such a turnaround in the economic fate of Africa is the emergence of the emerging nations in general and China in particular." Meles Zenawi, former Prime Minister of Ethiopia, 2012 (FUCHS, 2019).

China has a considerable diplomatic presence in Africa. In reality, Beijing is more commonly portrayed with on-the-ground missions in Africa than in the USA. According to the World Bank report (2017), China surpassed the United States of America as the largest trading partner for Africa. As Albert (2017) documented, Chinese product is a destination for 15 to 16% of exports from sub-Saharan Africa and is the source of 14 to 21% of imports from the region. In addition to lending, China is now investing in the construction of infrastructure and several

high-visibility projects that African leaders traditionally favor. The report added that China's soft "non-interference, one-China policy, and no political strings attached" policies have resonated so deeply with African countries who have been so wearied by the stereotypes of democracy, human rights, and good governance proposed by the Western powers.

The Chinese State Council (2015) clarified that between 2000 and 2014, overseas Chinese assistance "captured 4,373 records totaling 354.4 billion dollars. This includes both conventional assistance (approximately 75 billion dollars), and low concessional lending (approximately 275 billion dollars). However, research shows that China's development policy is gradually driven by a desire to gain access to new markets and economic returns as its wealth and power grow. The state added basing the William and Mary research paper (2016) on aid data claims that between 2000 and 2014, China committed 350 billion dollars to foreign aid, parallel to the US \$394.6 billion total. The Chinese government, contractors, and banks extended the 143 billion USD in loans to African governments and their state-owned undertakings from 2000 to 2017 (The initiative, 2018). Finance for Chinese loans varies, but Angola is the top receiver of Chinese loans, disbursing 42.8 billion dollars over 17 years. Such government loans qualify as "official assistance for growth."

In recent research Aid Data (2014), estimated that between 2000 and 2014, a research laboratory at William and Mary claimed that China contributed 350 billion dollars to foreign aid. From this Africa takes the lion's share of the aid (around \$ 122.27 billion) and the respective African countries used it as a catalyst to improve their economic development. Table 1 reveals there are ten top Chinese foreign aid recipients countries in Africa, from these countries Angola, Ethiopia Sudan, Nigeria, and Zimbabwe were taking the top five Chinese foreign aid recipients (15.3, 14.92, 11.30, 7.24, and 6.09 billion dollars respectively).

From the AidData and the other existing data sources, the top five countries have been selected to show the trends of Chinese foreign aid and Economic growth of countries as an example; therefore, the following five countries information and diagrams on GDP growth rate Vs rate of Chinese foreign aid show the trends of Chinese foreign aid and economic growth in African countries (Appendix A).

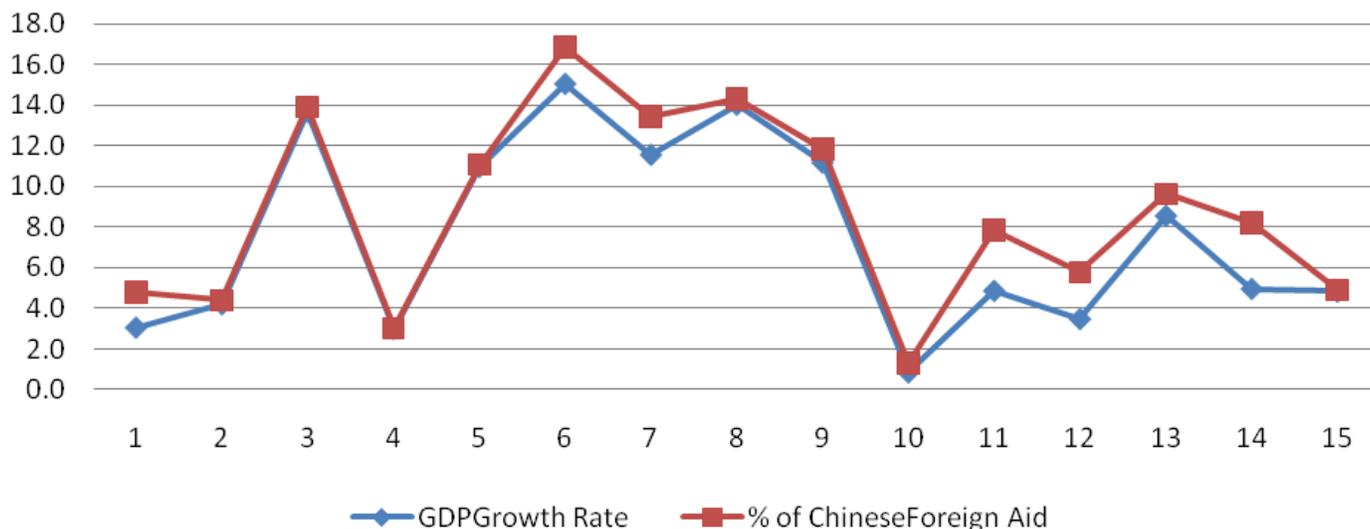
### **Angola**

During the first decade of the 21st century, Angola was among the world's fastest-growing economies, with an estimated annual average GDP growth of 11.1 % from 2001 to 2010 (Specter, 2015). From 2000 to 2014, Angola obtained foreign assistance from China amounting to USD 15.3 billion, this takes part in the

**Table 1.** Top 10 Chinese foreign aid recipient countries in Africa (2000-2014).

Name of recipients	Total aid in billion USD
Angola	15.30
Ethiopia	14.92
Sudan	11.30
Nigeria	7.24
Zimbabwe	6.09
Kenya	6.02
Cameroon	5.94
Ghana	5.45
CoteDivoire	4.43
South Africa	4.45

Source: Author's calculation using AidData (2019).



**Figure 1.** The association between Chinese Foreign Aid and GDP Growth in Angola (2000-2014). Source: Author using data from an African development bank and AidData (2019).

country's annual GDP growth of 11.1%. The following Figure 1 highlights there is a similar pattern of the link between Chinese foreign aid and GDP growth rate performance in Angola for the year 2000 to 2014.

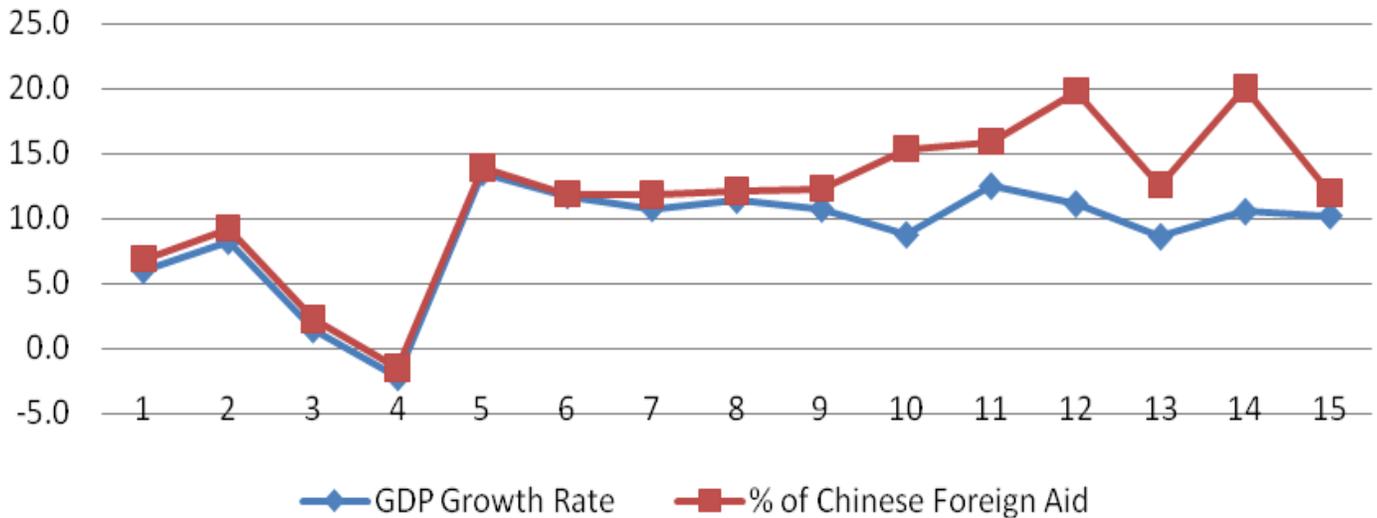
**Ethiopia**

Ethiopia has one of the fastest-growing economies in the world and, it is the second-most populous country in Africa next to Nigeria. Since 2004, the economy has undergone sustained real GDP growth of at least 5% (IMF, 2018). From 2000 to 2014 Ethiopia received foreign funding from China amounting to USD 14.92 billion, this also helped to contribute to the country's controversial annual GDP increase. Figure 2 indicates

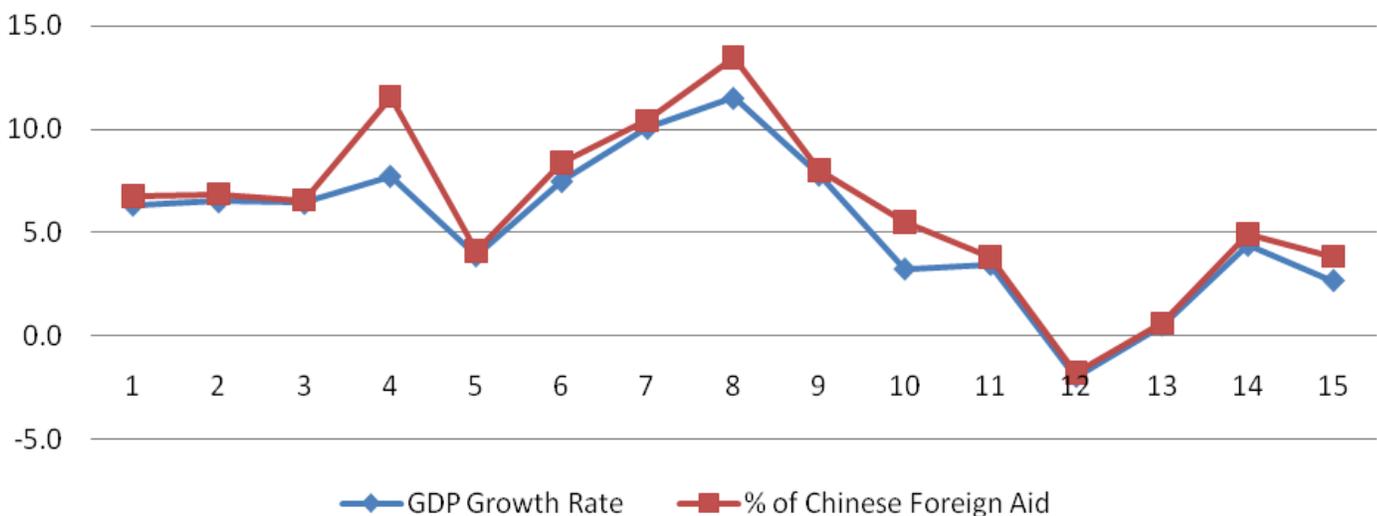
that there is a similar pattern of relationship between Chinese foreign aid and GDP growth rate performance in Ethiopia from the year 2000 to 2014 but the year 2010.

**Sudan**

Sudan's economy boomed based on oil production increases, high oil prices, and massive foreign direct investment inflows until the second half of 2002. Throughout 2006 and 2007, Economic growth was greater than 10% a year (IMF, 2018). From 2000 to 2014 Sudan received USD 11.30 billion in foreign assistance from China. Figure 3 highlights there is a similar pattern of linkage between Chinese foreign aid and the GDP growth rate performance from 2000 to 2014 in Sudan.



**Figure 2.** The association between Chinese Foreign Aid and GDP Growth in Ethiopia (2000-2014).  
Source: Author using data from an African development bank and AidData (2019).



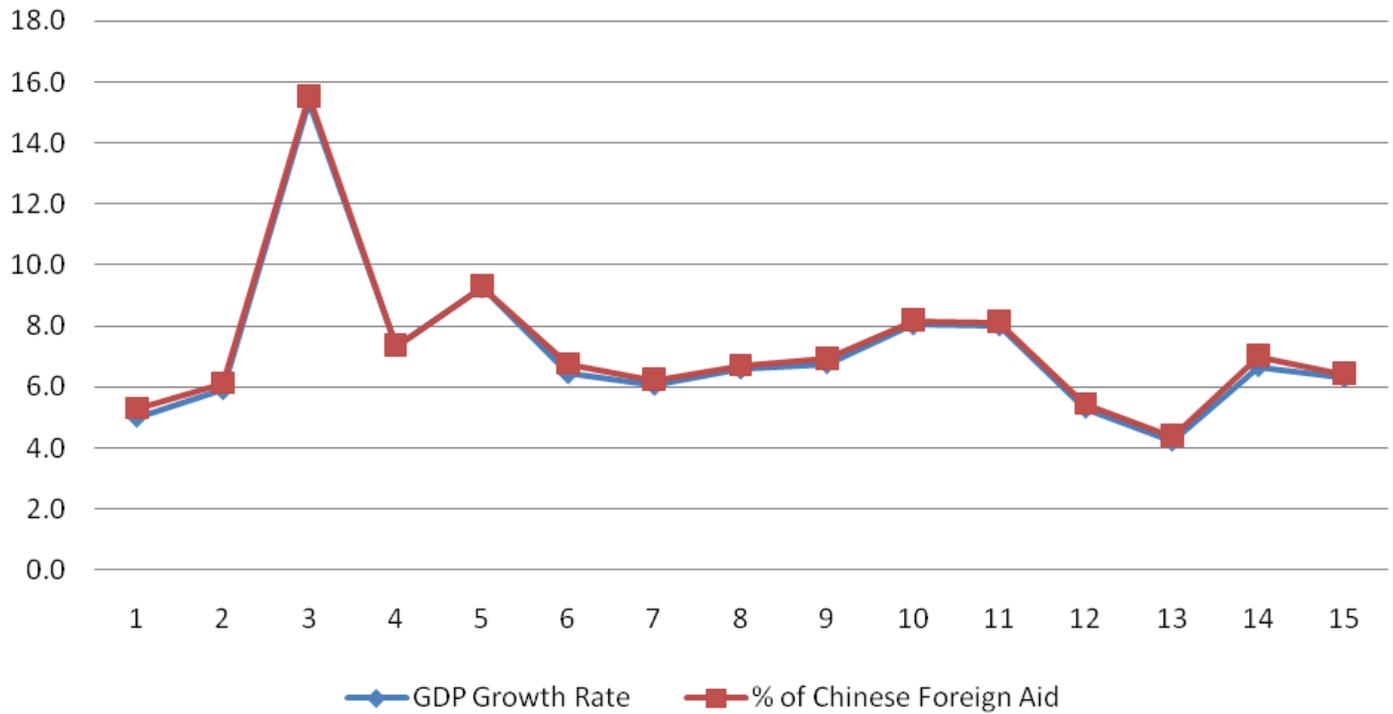
**Figure 3.** The association between Chinese Foreign Aid and GDP Growth in Sudan (2000-2014).  
Source: Author using data from an African development bank and AidData (2019).

## Nigeria

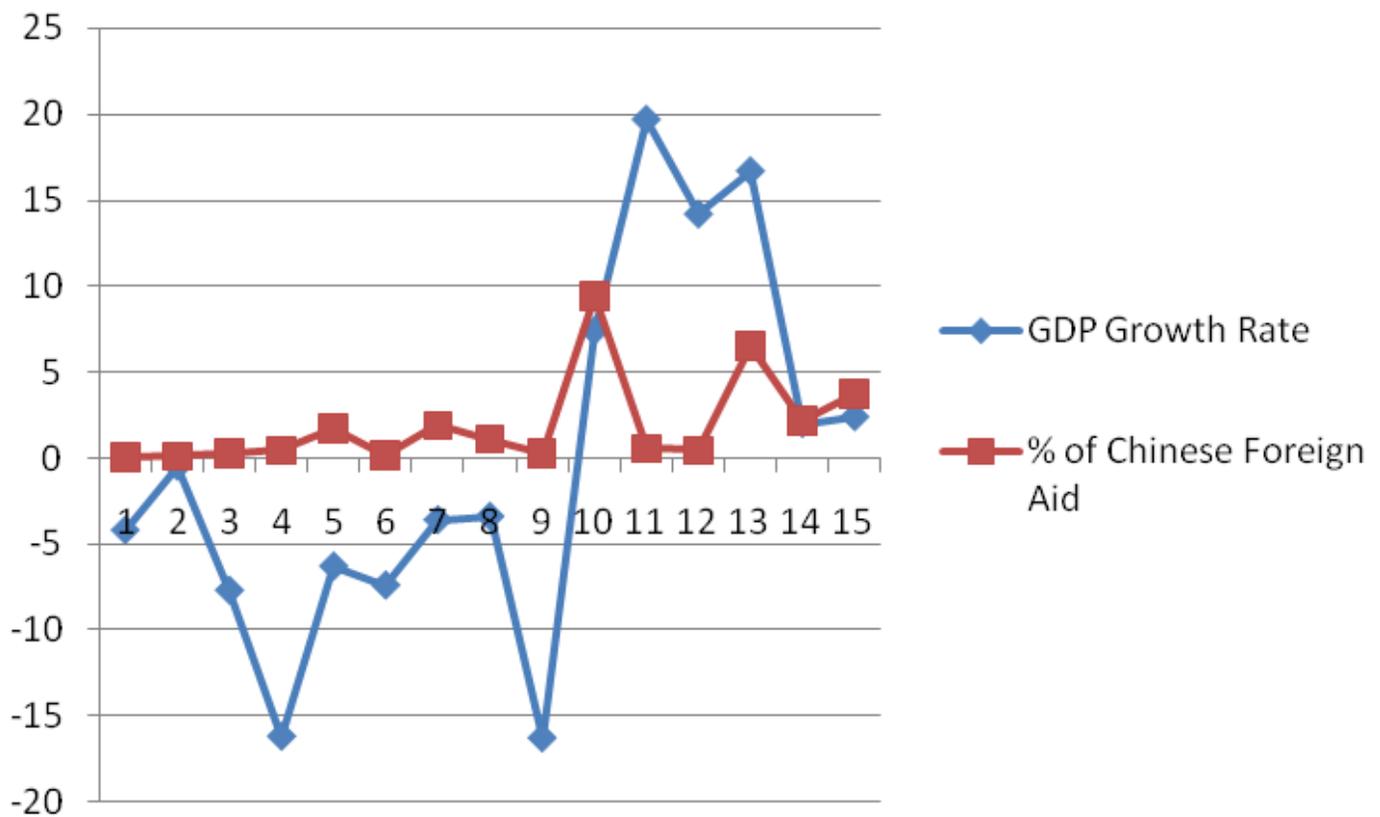
Nigeria's economy is a middle-income, mixed economy and emerging market, with growing sectors of retail, banking, education, media, technology, and entertainment. Nigerian Purchasing Power Parity GDP almost tripled from \$170 billion in 2000 to \$451 billion in 2012, though informal economy value estimates to close the actual figures to \$630 billion (Burger, 2018). From 2000 to 2014 Nigeria received USD 7.24 billion in foreign assistance from China. Figure 4 highlights that there is a similar pattern of linkage between Chinese aid and GDP growth rate performance in Nigeria from 2000 to 2014.

## Zimbabwe

Zimbabwe's economy is largely made up of tertiary manufacturing, which as of 2017 accounted for up to 60% of overall GDP. Zimbabwe's economy expanded by an average of 12% from 2009 to 2013 rendering it one of the world's fastest-growing economies to grow from negative development from 1998 to 2008, before slowing to 0.7% growth in 2016 (Knoema, 2020). From 2000 to 2014 Zimbabwe received USD 7.24 billion in foreign assistance from China. Figure 5 highlights the inconsistent patterns of linkage between Chinese foreign aid and GDP growth rate performance in Zimbabwe, this may be due to the



**Figure 4.** The association between Chinese Foreign Aid and GDP Growth in Nigeria (2000-2014).  
 Source: Author using data from an African development bank and AidData (2019).



**Figure 5.** The association between Chinese Foreign Aid and GDP Growth in Zimbabwe (2000-2014).  
 Source: Author using data from an African development bank and AidData (2019).

contraction of business sales or earnings of the country because there was a negative GDP growth rate in the country.

## **LITERATURE REVIEW: CHINESE FOREIGN AID EFFECTIVENESS DEBATE**

The South-South development of aid, in particular Chinese foreign aid to African countries has re-engendered the debate on the efficacy of aid. The point is that, since Chinese assistance does not conform with the specifications of the OECD / DAC, this assistance would then become inadequate and therefore impede the development of Africa. Nevertheless, instead of debating Chinese aid ineffectiveness, time should be focused on exploring how to bring about growth and development in Africa in Chinese aid. Although Western aid in Africa has been unfavorable and unsuccessful, there are not enough reasons to write off aid, especially China's aid. The lessons they can learn from the experience of global aid failure in Africa and what made aid unsuccessful should be what should be essential for countries in Africa and China and other South-South development partners. Rhetorically speaking, the distinction between Western and Chinese assistance to African countries is that Chinese aid is essentially oriented towards growth and self-reliance. Chinese assistance, for example, is given to recipient countries on the basis of national interests, thereby maintaining a win-win, mutual benefit scenario, as well as contributing to the development of the recipient country. As Sun (2017) documented assessing China Africa aid partnerships outline opportunities and impediments, but two factors will depend on whether China's foreign aid to Africa leads to sustainable development. First, it would depend on possibly the essence of the agreements signed between China and recipient countries in Africa and how both sides handle the finances and supervise projects. Second and most significantly, it will also rely on both sides' commitments.

Besides, the political will and commitment of the donor, as well as the recipient nations is a key aspect that must be taken into account when Chinese aid has to work for the development of Africa. Nonetheless, there is a need for greater political will and commitments on the part of African countries to meet the past obligation and tackle the major development challenges facing their countries cohesively and effectively, most of the promises have come from the ruling elites in African countries. In a 2009 speech in Ethiopia, former Chinese prime minister Wen Jiabao stated that 'Chinese aid to Africa has not only contributed to Africa's capacity for self-development but has also generated practical results in Africa'. Li Anshan and Wenping (2012) also highlighted the advantages that Africa had gained in its interaction with China. They added that re-engagement has increased the continued demand for African goods, increased the negotiating

position for African countries, built infrastructure in the country, and, in effect, contributed to economic growth in Africa.

There is mixed evidence for Chinese foreign aid's effect on economic growth. Some of the following examples have explored the positive and adverse effects of Chinese foreign aid respectively. Chinese foreign aid flows to recipient countries helps to raise savings, fill foreign exchange shortages, and thereby promote the development of capital and stimulate the expansion of trade that would contribute to economic growth (Ye, 2017). As Cheng (2016) discovered in his work titled 'has Chinese foreign aid contributed to the economic growth of African countries', and he found that among the variables he used natural resource rent and governance registered a significantly positive impact on GDP growth. When developing an aid relationship with beneficiaries, China's foreign aid would not enforce political requirements, which would to some degree cope with the 'aid dilemma.' Nour (2011) discovered that while some delays occur within the context of China's assistance to Sudan, China's financing and implementation of projects in Sudan, for example, had a positive impact on the provision of facilities, increased skills, increased production, increased knowledge transfer, increased availability of machinery, equipment, and raw materials, increasing employment opportunities, improving training and capacity-building in these projects and increasing technology transfer, particularly for multi-purpose development work.

Brautigam (2011) explored that the majority of Chinese foreign aid is provided to the recipient countries are in a bilateral way, which might be to fulfill donors' economic interest and consequently inhibit foreign aid effectiveness. As Wang (2014) documented in the working paper entitled "The Western Aid Dilemma and the Chinese Solution," China's concessional loans are all tied, which is perceived to undermine aid effectiveness in recipient countries. Furthermore, the Chinese approach to non-transparency aid working outside the OECD/DAC scheme is perceived to be a behavior that raises the recipient countries' debt burden (Ye, 2017). He added that Chinese foreign aid is assumed to harm political development by neglecting recipients' poor authorities' potential, to assist Chinese agencies to acquire access to extractive resources, to fulfill its economic interests, to improve the resource effectiveness, and to boost the debt burden of recipients, Therefore, Chinese foreign aid can have positive and negative effects on aid recipients' savings, jobs, and economic growth through the same channels as traditional aid dose.

## **MATERIALS AND METHODS**

### **Data type and sources**

By merging the current datasets and information, new dataset panels were created with 55 countries, covering the allocation/flow

of Chinese assistance to African countries recipients for the period 2000-2014. The reason why I have chosen to concentrate on the period of 2000-2014 was that particularly for two reasons: First, the first Forum of Chinese-African Cooperation (FOCAC) was held in 2000 and marked a new era of cooperation between China and Africa. Second, still, the Chinese foreign aid flow dataset was available for this period only. All the African countries, excluding Somalia, are included in the dataset. The World Bank has not calculated GDP values for Somalia during the majority of the period analyzed due to the difficult conditions in Somalia, while other missing values in the dataset was supplemented with other figures.

The key independent variable is Chinese foreign aid; it is formulated by following AidData through different Chinese foreign aid distribution instruments such as a grant, technical assistance, export credit, scholarship, and strategic supplier credit. For this study, by taking Chinese aid flow from this source and by following OECD (2018) aid flow definitions we composed the Chinese foreign aid flow to the recipient countries into two main variables such as project aid and development loan aid. Project aid is the aggregated amount of Chinese foreign aid that accounts for three major distinct types of aid: grant aid, humanitarian, and export credit aid. Grant aid is assistance committed to projects related to infrastructure, industry, trade, service sector, and agriculture. Humanitarian Aid is the amount of foreign aid committed to projects that provide emergency and disaster relief assistance aid and Export credit aid is assistance committed to projects related to, energy generation and supply, Banking and finance Transport and storage, communication, government, and civil society, forestry, and fishing. Project aid also included financing various programs including health program (vaccine campaign), education program (literacy campaign), civic program (awareness-raising campaign), and included thematic activities such as youth and women empowerment. It is an independent variable for all questions and measured as a percentage.

Development loan aid is comprised of Chinese loans aid that is administered to developing and least developing countries for the exclusive purpose of promoting economic development and social welfare. It accounts for four distinct types of aid: loan, debt rescheduling, debt forgiveness, and strategic supplier credit. Loan aid is assistance committed to projects related to communication, industry, mining, construction, trade, tourism, and other social infrastructures. Debt rescheduling and forgiveness are committed to projects related to transport and storage and action related to debt. Strategic supplier credit is assistance committed to projects related to the energy generation and supply industry, mining, and construction, health. These two main independent variables data were mainly obtained from AidData V3.0 (Dreher et al., 2017). Therefore, my key independent variable was represented by the two main types of Chinese foreign aid flows for the year 2000 to 2014, which may not be homogenous. The sums of these two categories are almost equivalent to the total sum of Chinese foreign aid flow to African countries. The AidData was maintained by the College of William and Mary, Development Gateway, and the Brigham Young University (Aid Data Geocoded Global Chinese Official Finance, Dataset, 2000-2014 Version 1.3). Information on GDP by country was obtained from the Penn World Table PWT 9.0, released in 2016. The outcome variables are gross domestic saving, gross domestic investment, and GDP growth rate.

In addition to the above sources, the following data sources were used to organize the new dataset: Organization for Economic Cooperation and Development (OECD), Development Assistance Committee (DAC) database, the annual panel of African countries between 2000 to 2014, and IMF (World Economic Outlook, 2018). Both disaggregated Chinese foreign aid variables are logged to normalized and logged to distinguish the direction of the effect, this helps to ensure that the country years that are not received foreign aid the variables equal to zero not dropped from the analysis after logging (because the log of zero is undefined), therefore these

variables were first amended before logging.

To examine the effects of Chinese foreign aid on gross domestic savings in Africa countries, multiple regression models were employed. The foreign aid-domestic saving model of the study was based on the neoclassical assumption that interconnects national savings and national income. The study model explored the effectiveness of Chinese foreign aid in promoting gross domestic savings in African countries is similar to several other prior research approaches (Balde 2011; Chowdhury and Garonne, 2009). Also in light of the scholarly literature, the foreign aid-savings relationship was tested by econometric models, hypothesizing that domestic savings as a proportion depend on per-capita GDP, inflation rate, interest rate, and aid as a percentage of GDP (Rana and Dowling, 1998; Nushiwat, 2007). Most of these empirical studies of the foreign aid and domestic savings relationship used all or some of these explanatory variables in their models. This study also followed the same path to investigate the role of disaggregated Chinese foreign aid in promoting gross domestic savings in African countries.

In this research, domestic savings are represented as a function of per-capita GDP, interest rate, and inflation rates and Chinese foreign aid as a percentage of the GDP. In mathematical terms, the domestic savings function is expressed as follows:

$$S_t = f(CAID_{disag}, GDP/POP, INT, INF)_{it} \quad (1)$$

Since the Chinese foreign aid amount is disaggregated into two components Project aid and, Development loan aid, the structural form of the foreign aid-savings relationship model will be:

$$S/GDP_{it} = (Pro\_Aid)_{it-1} + (Loan\_Aid)_{it-1} + (GDP/POP)_{it} + (INT)_{it} + (INF)_{it} + \text{Error term} \quad (2)$$

The gross domestic savings function in equation 1&2 is then rewritten as:

$$(S/GDP)_{it} = \alpha_0 + \alpha_1 \ln(Pro\_Aid)_{it-1} + \alpha_2 \ln(Loan\_Aid)_{it-1} + \alpha_3 \ln(GDP/POP)_{it} + \alpha_4 INT_{it} + \alpha_5 INF_{it} + \varepsilon_{it} \quad (3)$$

Where: S represents the gross domestic savings as a percentage of GDP,  $\alpha_0$  represents a constant,  $(Pro\_Aid)$  represents project aid,  $(Loan\_Aid)$  represents development loan aid,  $(GDP/POP)$  represents GDP or aggregate income per capita represents,  $POP$  represents the total annual population,  $INF$  represents the inflation rate,  $it-1$  represents a previous period,  $t$  represents the period time,  $i$  represents the country  $i$ , and alphas are parameters to be estimated by the regression tests.

The second research question examining the effects of Chinese foreign aid and gross domestic investment tuned with the neoclassical investment theory and following different research works and consider the same, which means domestic investment as a share of GDP is a function of the following explanatory variables savings as the ratio of GDP, interest rate, inflation rate, per capita GDP, and the share of domestic savings to GDP (Chowdhury and Garonne, 2009; Grimm and Herzer, 2011). Therefore, to examine the effects of Chinese foreign aid on gross domestic investment in African countries over the years 2000-2014 in one-year time lag employed by following the same footstep:

$$INV/GDP = f(CAID, GDP/POP, INT, S/GDP, INF) \quad (4)$$

Structurally, the Chinese foreign aid-investment equation is in the form of:

$$INV/GDP = GDP/POP + CAID_{disag} + INT + INF + S/GDP \quad (5)$$

$$(INV/GDP)_{it} = \beta_0 + \beta_1 \ln(GDP/POP)_{it} + \beta_2 \ln(Pro\_Aid)_{it-1} + \beta_3 \ln(Loan\_Aid)_{it-1} + \beta_4 (INT) + \beta_5 (INF) + \beta_6 (S/GDP) + \epsilon_{it} \tag{6}$$

Where:  $(INV/GDP)_{it}$  represents the ratio of gross domestic investment to GDP at time  $t$  and country  $i$ ;  $(GDP/POP)_{it}$  represents GDP or aggregate income per capita at time  $t$  and country  $i$ ;  $(Pro\_Aid/GDP)_{it-1}$  represents the project aid at time  $t$  and country  $i$ ,  $(Loan\_Aid/GDP)_{it-1}$  represents the development loan aid at time  $t$  and country  $i$ ,  $INF$  represents the inflation rate,  $it-1$ , is the period time and country  $i$ , of the previous period time and  $INT$  represents interest rates or the cost of capital or cost of lending. The symbols  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \text{ and } \beta_6$ , are parameters that are to be estimated in the model and  $\epsilon_{it}$  represents the error term in period  $t$  and country  $i$ .

To examine the effects of Chinese foreign aid on GDP growth rate, in light of existing macroeconomic theory literature, the annual change in GDP serves as a strong indicator for economic growth or GDP growth and it is represented in the following equation as Mankiw (2008) documented:

$$(GDP)_t = (C)_t + (INV)_t + (G)_t + (X-IMP)_t \tag{7}$$

Also to explore the impact of foreign aid on the economies of the six poorest African countries, Mallik (2008) included in his model the trade openness and the domestic investment level. By following these footsteps the study used the following model to explore the effects of Chinese foreign aid on GDP growth rates in African Countries. By adding the Chinese foreign aid and other control variables to the equation, it takes the form:

$$(GDP)_t = C_t + INV_t + GOV_t + CAID_t + Openess + INSTQ + PoPG + LabF + (X-IMP)_t, \tag{8}$$

The new structural form of the econometric model to examine the effects of Chinese foreign aid on the GDP growth rate of aid recipient countries is:

$$\begin{aligned} (GDP \text{ growth rate})_{it} &= \delta_0 + \delta_1 (C/GDP)_{it} + \delta_2 (INV/GDP)_{it} + \delta_3 (GOV/GDP)_{it} \\ &+ \delta_4 (X-IMP/GDP)_{it} + \delta_5 \ln(Pro\_Aid)_{it-1} + \delta_6 \ln(Loan\_Aid)_{it-1} \\ &+ \delta_7 (LabF)_{it} + \delta_8 (PoPG)_{it} + \delta_9 (OPENNESS)_{it} + \delta_{10} (INSTQ)_{it} + \mu_t \\ &+ \epsilon_{it} \end{aligned} \tag{9}$$

Where:  $\delta_0$  is a constant representing autonomous income,  $(C/GDP)_{it}$  is total consumption as % of GDP,  $(INV/GDP)_{it}$  is a gross domestic investment as a share of GDP,  $(GOV/GDP)_{it}$  represents total government spending (expenditures) as a % of GDP,  $(X-IMP)/GDP)_{it}$  is net exports as a ratio of GDP, and  $\ln(Pro\_Aid)_{it-1}$ , project aid inflows to the recipient countries and  $\ln(Loan\_Aid)_{it-1}$  is development loan aid inflows to the recipient countries,  $(LabF)_{it}$  labor force rate,  $(PoPG)_{it}$  is the population growth rate,  $(OPENNESS)_{it}$  is trade openness,  $(INSTQ)_{it}$  is institutional quality. Also,  $it - 1$  is represents the previous period and country  $i$ ,  $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5, \delta_6, \delta_7, \delta_8, \delta_9, \text{ and } \delta_{10}$

are parameters that to be estimated by the regression tests,  $\mu_t$  is the unobserved country-specific effect, and  $\epsilon_{it}$  is the error term that to be incorporated in all the error terms in the model.

## RESULTS AND DISCUSSION

### Descriptive analysis

The descriptive statistics of the ratio variable are listed in Table 2 to examine what the maximum and minimum ratings are, what the parameters are, and how well they represent data or what is indicated by the standard deviation.

As seen in Table 2, the first two dependent variables values of this study, gross domestic savings and gross domestic investment for the specified period (2000 to 2014) vary from -2.78 to 67.71 and 4.03 to 64.85 among 55 countries respectively, and there is a minor variation in values. It verified by the standard deviation equivalent to 12.52 and 10.27 smaller than the mean value equivalent to 18.91 and 21.91 respectively, and the third main dependent variable GDP growth rate often ranges from -62.07 to 123.13, which does not have a large variation in values, but rather minor variations. It is verified by the standard deviation of 7.58 that is greater than the mean of 4.54. The key independent variable Project aid and development loan aid ranges from 2.30 to 24.69 and 2.30 to 21.89 respectively. There is a small variation that does not make a big difference in developing countries that have received foreign aid from China. The very small standard deviation equal to 3.13 and 3.26, which is higher than the mean equal to 2.3, further supports this small difference in observation. Development loan aid and project aid from China to African countries from 2000 to 2014 have increased. Project aid showed no comparable increase to just like the increase in development loan aid, although both irregular spikes were included in the trend. Appendix B of Figures 1 and 2 shows changes over the study period in Chinese foreign aid disaggregated as Project aid money and development loan aid money.

## DISCUSSION

### Effects of Chinese foreign aid on gross domestic saving

The pooled OLS, Fixed Effect, and Radom Effect test results are presented in Table 3. Saving is the dependent variable and project aid, development loan aid interest rate inflation rate and GDP per capita are the independent and control variables. At first, the study did different regression tests (FE, RE, and POLS); however, the result shows that the significance level is very different between the dependent and independent

**Table 2.** Descriptive statistics for dependent variable, key independent variables, and control variables.

Variable	Observation	Mean	Minimum	Maximum	Standard deviation
Log project aid (1 year lag)	825	15.08443	2.302585	24.69546	3.132310
Log loan aid (1 year lag)	825	17.28426	2.302585	21.89298	3.266546
Gross domestic saving to GDP	825	18.91851	-2.78	67.71114	12.5201
Gross domestic investment to GDP	825	21.91851	4.039	64.852	10.27536
GDP growth rate	825	4.549733	-62.07592	123.1396	7.58239
Inflation rate	825	7.247493	-.7642307	98.22414	7.565863
Interest rate	825	9.582579	-25.94	81.33213	10.06733
Consumptions/GDP	825	84.65989	16.71296	241.9739	23.51299
Government spending/GDP	825	14.48366	.6723754	48.49521	7.428721
Per capita income <sup>a</sup>	825	2255.98	10.342	14413.5	2805.101
Net trade balance /GDP	825	-7.765572	-161.4278	53.16434	21.37777
Labor force tot (%)	825	32.02958	5.167	90.8811	24.22749
Openness	825	77.25895	10.123	376.2241	45.73373
Institutional quality index	825	-4.011685	-14.69625	5.279357	3.687802
Population growth(%)	825	2.394986	-2.628656	5.604957	.9923943

<sup>a</sup>: In millions of 2010 US Dollar

**Table 3.** Regression result: The effects of Chinese foreign aid on Gross Domestic Saving, in Africa from 2000 to 2014.

	(3A)	(3B)	(3C)
	Fixed effect	Random effect	POLS
Independent V	S_GDP	S_GDP	S_GDP
L.log Pro_Aid	0.188*	0.125	-0.208
	(0.107)	(0.106)	(0.156)
L.log Loan_Aid	0.315*	0.269*	0.247
	(0.160)	(0.153)	(0.150)
Log GDP_pop	-0.208	0.390	4.309***
	(0.415)	(0.396)	(0.346)
INT	-0.0709**	-0.0810**	-0.172***
	(0.0338)	(0.0335)	(0.0423)
INF	-0.0874**	-0.0878**	-0.0161
	(0.0384)	(0.0384)	(0.0542)
Constant	13.58***	11.19***	-10.74***
	(3.177)	(3.318)	(2.902)
Observations	770	770	770
R-squared	0.027		0.221
Number of Country1	55	55	

Standard errors in parentheses.\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

variables. To specify one specific approach between random and fixed effects, we did the Hausman test. The Hausman test result shows that the p-value for chi-square is 0.0001, which is significant. The outcome represents that there are fixed effects rather than random effects based on the hypothesis test. The comparative

analysis of rho values also reflects that individual-specific fixed effects are higher than random effects. But, the study also needs to check between OLS and random effects. The Breusch Pagan LM test for random effects is the best method to decide between OLS and random effects. The Breusch Pagan test result shows that OLS

regression is not the best approach to explain the relationship between the dependent and independent variables for this specific case. Therefore, after the Hausman and Breusch Pagan tests, the study decides that the fixed effects regression estimation approach is the best approach to explain data for African countries on the effect of dis-aggregated Chinese foreign aid on gross domestic saving.

As seen in Table 3A, the correlation between project aid and development loan aid on savings is positive and significant. This assumes the theoretical presumption is valid that the higher the financial inflow, the higher the domestic saving is anticipated. Where the impacts of other independent variables are taken into consideration, it is important to verify whether this finding holds. The study took column 3A as our base results based on the tests above. According to the point estimate, a 10% increase in project aid and development loan aid raises the probability of saving by 10.7 and 16% points respectively or when saving increase by 1% project aid and development loan aid will increase by 18.8 and 31.5%. This pointed out that there is a positive and significant relationship between project aid and development loan aid on saving. This coincides with the study finding documented by Phijaisanit (2010) Foreign aid is designed to compensate for the lack of investible funds required for development projects and to fill the gap in savings and foreign currency necessary for investing and importing capital inputs for local development, and Ye (2017) added that the amounts of Chinese foreign aid flow to the aid recipient countries help to boost the domestic savings, fill the shortage of foreign exchange, and hence facilitate the formation of capital and stimulate trade expansion, that would contribute to economic growth. Developing countries that have received more foreign aid from China would achieve better savings based on this outcome.

GDP per capita is expected to contribute to gross domestic savings in African countries. As seen in Table 3A the regression result is -0.208 (negative and insignificant) which is not aligned with assumptions based on previous research. This would suggest that a negative saving would be created by the low per capita GDP. Therefore, in this analysis, GDP per capita can not be defined as a factor that will exert a certain impact on saving. Basing the interest rate and inflation rate their coefficients are negative and significant at 5% levels, this means that interest rate and inflation rate are negatively and significantly associated with saving. As long as other independent variables are held constant, when the interest rate and inflation rate declines by 1 unit, the saving will decline at 7 and 8.7% respectively. The finding of saving and interest rate relationships have coincided with the finding of Loayza et al. (2000) documented a negative effect on the research paper titled 'Saving in Developing Countries'. The aid recipient government should therefore place a strong focus on savings, to

impact economic growth in African countries.

### **Effects of Chinese foreign aid on gross domestic investment**

As indicated in Table 4A, the project aid and development loan aid coefficients are (0.188) and (0.510), which are significant at 10 and 1% level respectively. It indicates a positive and significant relationship between project aid, development loan aid, and investment. In other terms, developing countries receiving more foreign aid from China would achieve higher levels of investment, which would improve economic growth.

As indicated, the coefficient of saving, is positive and significant at the one % level; the coefficient is (0.260). This implies that: a) saving is positive and significantly correlated to the investment, and the probability of this significant relationship existing by chance is less than 1%; b) As long as other independent variables are kept constant when savings increase as a share of GDP by 1 unit, the investment would increase accordingly by 0.260 units. Moreover, the effect is consistent with the assumption that higher investment can be done with more savings. The recipient's government should then put a heavy emphasis on savings. Concerning GDP per capita, its coefficient is negative and insignificant. The negative relationship is not in line with assumptions based on previous research. Therefore, it is not possible to identify GDP / POP as a factor that would have a favorable effect on investment.

The correlation between investment and interest rate is significant. This confirms the theoretical assumption that higher interest rates are expected to result in higher investment through higher savings. It is important to verify if this finding holds when the effects of other independent variables are taken into account. As indicated in Table 4, the interest rate coefficient is equal to 0.059, which is significant at the level of 10%. This indicates that the relationship between investments and interest rates is positive and significant. Lastly, it is expected that the inflation rate would also impact investment. The regression coefficient of the inflation, as indicated in Table 4A, is 0.0600 and positive but not significant, which is not compatible with expectations in earlier studies. Therefore, it is not possible to identify the inflation rate as a factor that would have a definite effect on investment.

### **Effects of Chinese foreign Aid on GDP growth rate**

As can be seen in Table 5, the correlation between development loan aid and the GDP growth rate is significant. This confirms the theoretical assumptions that higher loan aid is likely to yield higher economic growth. Also, it is important to verify if this finding holds when the

**Table 4.** Regression result: The effects of Chinese foreign aid on Gross Domestic Investment in Africa from 2000 to 2014.

Variable	(4A)	(4B)	(4C)
	Fixed Effect	Random Effect	POLS
	INV_GDP	INV_GDP	INV_GDP
L.log Pro_Aid	0.188* (0.108)	0.115 (0.104)	-0.240* (0.123)
L.log Loan_Aid	0.510*** (0.162)	0.437*** (0.145)	0.449*** (0.118)
Log GDP_pop	-0.307 (0.417)	0.0788 (0.375)	0.800*** (0.298)
S_GDP	0.260*** (0.0377)	0.291*** (0.0346)	0.365*** (0.0285)
INT	0.0595* (0.0341)	0.0505 (0.0328)	0.0156 (0.0336)
INF	0.0600 (0.0388)	0.0590 (0.0379)	0.0720* (0.0427)
Constant	6.736** (3.237)	5.874* (3.069)	4.753** (2.303)
Observations	770	770	770
R-squared	0.090		0.278
Number of Country1	55	55	

Standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

effects of other independent variables are taken into account. Then the result of the development loan aid coefficient is 0.389, which is significant at the 5% level. This reveals the positive and significant relationship between development loan aid and GDP growth rate. Based on this outcome, African countries that have obtained more foreign aid, especially development loans from China would achieve a higher GDP growth rate. These findings align with previous work on the effectiveness of foreign aid in supporting economic development, which has been found a positive correlation between foreign aid and GDP growth (Bhattarai, 2009; Feeny and Ouattara, 2006). Also backed by the finding of Lauren Tait and Chatterj (2016) in their study on foreign aid and economic growth in sub-Saharan African countries, they have documented that foreign aid has a positive and significant effect on economic growth.

Based on the project aid, the coefficient is negative and insignificant. The negative relationship is not compatible with prior research and assumptions. Concerning this insignificant relationship, project aid is the data for this independent variable, which can partially justify this outcome. Furthermore, since the outcome is not significant and the probability of occurrence by chance is too low, project aid is therefore not defined as a factor that affects economic growth in Africa based on the timeframe specified. This result coincides with the findings of (Mosley 1980; Rajan and Subramanian, 2008)

in their result they documented that foreign aid was not associated with GDP growth rates in recipient nations. Also, this is inconsistent with the debate from Niyonkuru (2016) he is stated the ineffectiveness of aid is due to the mismanagement of ODA by the recipient countries, Rajan and Subramanian (2008) in their research on the analysis of data for the least developing nations, they documented no significant relationship existed between GDP growth and foreign aid over the study period. Doucouliagos and Paldam (2006) concluded that foreign aid should be reformed to become more effective.

Trade openness, net export, and investment, all are positive and significant at the 0.01 level. The coefficients are 0.041, 0.161, and 0.135 respectively. This suggests that (a) trade openness, net exports, and investment have a positive and significant relationship with economic growth; (b) as long as other control variables are held constant, the increase in trade openness, net exports, and investment with 1 unit, economic growth will increase at 0.041, 0.161 and 0.135 units respectively. This means trade openness, net export, and investment have a positive effect on the GDP growth rate. Regarding the population growth rate, the empirical results found that with a 1% increase in the population growth the economic growth will increase by 162.2%. This suggests that population growth has a great effect on the economic growth in developing countries. These results are supported by the findings of Mallik's (2008) co-integration

**Table 5.** Regression result: The effects of Chinese foreign aid on GDP Growth rate in Africa from 2000 to 2014.

Variable	(5A)	(5B)	(5C)
	(Fixed effect)	(Random effect)	(Pooled OLS)
	GDP growth rate	GDP growth rate	GDP growth rate
L.logPro_Aid	-0.0607 (0.119)	-0.0828 (0.101)	-0.0828 (0.101)
L.logLoan_Aid	0.389** (0.186)	0.292*** (0.103)	0.292*** (0.103)
Laboroftotalemployment	-0.337** (0.150)	-0.00718 (0.0158)	-0.00718 (0.0158)
OPEN	0.0417*** (0.0141)	0.0148** (0.00713)	0.0148** (0.00713)
InstitutionalQual	0.799** (0.319)	0.146 (0.0914)	0.146 (0.0914)
GOV_GDP	-0.0236 (0.0843)	-0.0421 (0.0441)	-0.0421 (0.0441)
C_GDP	0.0698** (0.0331)	0.0470** (0.0229)	0.0470** (0.0229)
Pop_Growth	1.622** (0.683)	1.277*** (0.354)	1.277*** (0.354)
XIMP_GDP	0.161*** (0.0373)	0.0731*** (0.0234)	0.0731*** (0.0234)
INV_GDP	0.135*** (0.0517)	0.106*** (0.0351)	0.106*** (0.0351)
Constant	-1.464 (6.884)	-7.648*** (2.931)	-7.648*** (2.931)
Observations	770	770	770
R-squared	0.056		0.081
Number of Country	55	55	

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

study, which assessed the impact of foreign aid on GDP growth rates in the six poorest African countries from 1960 to 1990, he documented a positive correlation between foreign aid at the proportion of GDP and the real long-term investment.

Regarding the institutional quality and consumption, the positive and significant correlations between institutional quality and consumption are found, as indicated in Table 5A. This depicts that economic growth is positive and

strongly correlated with institutional quality and consumption, and the probability of this significant relationship is at 5%. This positive relationship between institutional quality and economic growth is consistent with previous studies but consumption. The higher the institutional quality the higher subsequent GDP growth rate is expected. Whereas, in terms of the labor of total employment, a negative and significant relationship has registered. The negative relationship is not in line with

assumptions based on previous findings. With regard to this significant relationship, the significant result and the likelihood of the occurrence is low, so the labor of total employment can be identified as a factor that would have a negative effect on GDP growth rate, this may be due to the real demand elasticity of employment in the manufacturing sector is very low.

The Regression output for government expenditure is negative and insignificant. Based on the previous studies, this is not consistent with theoretical expectations. This mean that the higher government expenditure is projected to result in lower economic growth. The potential reason for this insignificant and negative coefficient is that it requires time to witness the conductive influence of improvement in government expenditure on GDP growth rate. However, since the result is not significant, the probability of this relationship happening by chance is not strong. Therefore, the effects of government expenditure should not be defined as a cause that can have a negative effect on GDP growth rate.

## Conclusion

To understand the effects of Chinese foreign aid on gross domestic saving, investment, and GDP growth rate in African Countries, this study used a sample of 55 countries over 15 years from 2000 to 2014. The result revealed that Chinese foreign aid has a significant and positive effect on gross domestic saving, gross domestic investment, and GDP growth rate during the study period in African countries. At the same time, we have controlled for Labor of total employment, Trade openness, Institutional quality, Government expenditure, Total consumption, Population growth, net trade, and Investment.

In general, the result of this study was interesting and may mote light on current debates relating to Chinese foreign aid effectiveness in developing countries especially in African Countries. The findings of this study showed the need to formulate new aid flow methods for developing nations, especially to African countries. As an aid-recipient country, policymakers must focus on the project aid and development loan aid categories/ flow with the efficient uses of Chinese foreign aid or other forms of aid while providing aid to developing countries to gear toward achieving sustainable economic growth. Finally, the African country's government needs to be held accountable for its governance and for the creation of an environment in which the rule of law prevails. Without a democratic environment in the rule of law takes precedence over corrupt politics, Chinese foreign aid inflows will not have a positive effect on reducing the level of poverty in Africa through sustainable economic development.

This study suggests for further study to find out the appropriate way by which the benefits of growth can be distributed equally among every individual of the economy

from the Chinese foreign aid, a study also needed regarding the relationship between Chinese foreign aid and government investment in African countries, and future research also should be conducted into the effects of multilateral foreign aid on private savings, rather than on total savings. The effects of foreign aid inflows on private savings may be different from the effects on total savings.

## CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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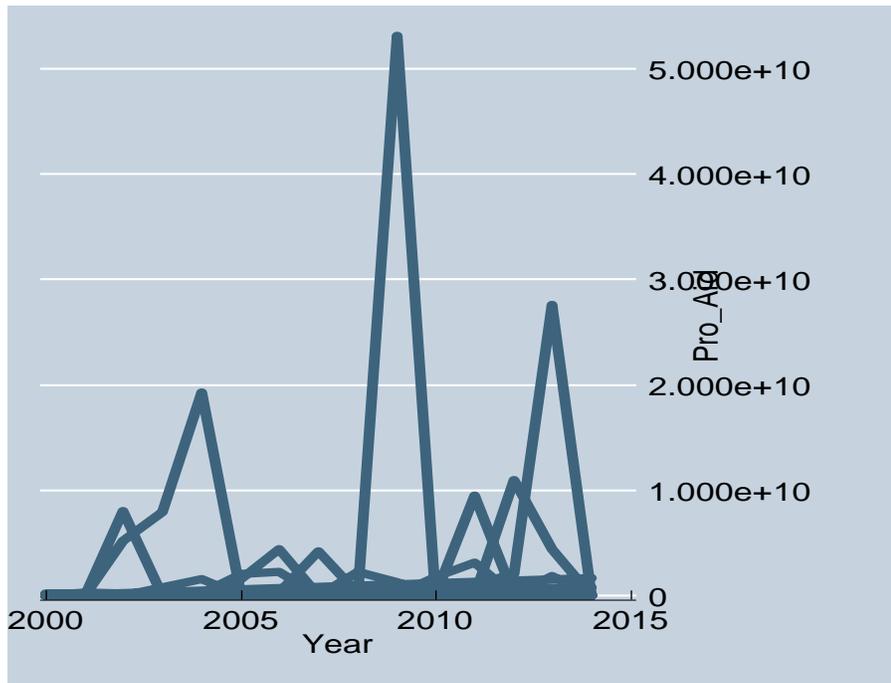
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## APPENDICES

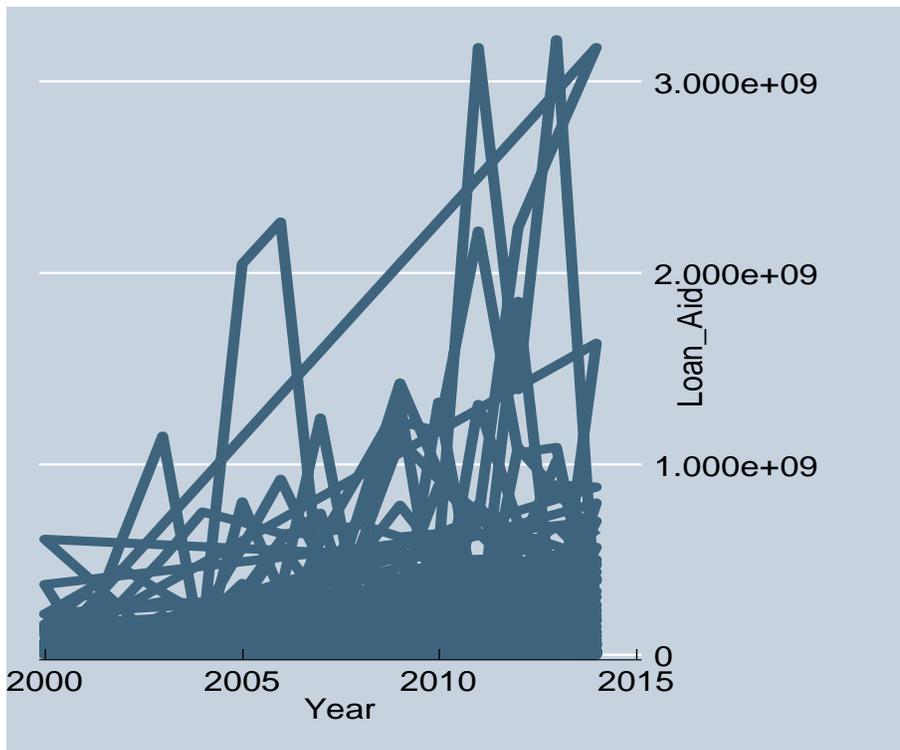
### Appendix A: List of African Countries

Algeria  
Angola  
Benin  
Botswana  
Burkina Faso  
Burundi  
Cabo Verde  
Cameroon  
Central African Republic  
Chad  
Comoros  
Congo, the Democratic Republic of the Congo  
Congo, Republic of the Congo  
Cote d'Ivoire  
Djibouti  
Egypt  
Equatorial Guinea  
Eritrea  
Eswatini  
Ethiopia  
Gabon  
Gambia  
Ghana  
Guinea  
Guinea-Bissau  
Kenya  
Lesotho  
Liberia  
Libya  
Madagascar  
Malawi  
Mali  
Mauritania  
Mauritius  
Morocco  
Mozambique  
Namibia  
Niger  
Nigeria  
Papa New Guinea  
Rwanda  
Sao Tome and Principe  
Senegal  
Seychelles  
Sierra Leone  
South Africa  
South Sudan  
Sudan  
Tanzania  
Togo  
Tunisia  
Uganda  
Zambia  
Zimbabwe

**Appendix B:** Chinese foreign aid flow/Project aid and Development loan aid distribution to African Countries from 2000 to 2014



**Figure 1.** Project Aid to African Countries, 2000 to 2014.  
Source: Author, using own data from AidData (2019).



**Figure 2.** Project Aid to African Countries, 2000 to 2014  
Source: Author, using own data from AidData (2019).

*Full Length Research Paper*

# **The board of directors and the financial performance of the Senegalese public service companies**

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Received 4 August, 2020; Accepted 16 October, 2020

**The Board of Directors (BoD) as an internal mechanism of corporate governance is considered to be a very important means of control. Indeed, according to several studies, its effectiveness depends on several factors relating to BoD size, the independence of its members, the presence of an audit committee, gender diversity and BoD meetings. To see the influence of independent variables on the dependent variable financial performance (Return on Equity \_ROE), we used econometric tests. After the pre-requisite tests, we adopted the random effects model, which was validated through testing. Our empirical validation was conducted on a sample of 30 Senegalese public utility companies over a period of 8 years (2004-2011). The results of the model show that at the 5% threshold, hypotheses H.1, H.2 and H.4 are rejected. On the other hand, H.3 is validated. H.5 was not tested because the audit committee variable was an exception. Our results gave sufficient information to the Senegalese authorities to make good decisions.**

**Key words:** Board of Directors (BoD), financial performance, panel data, modeling.

## **INTRODUCTION**

Since the appearance of the first reports of good practices and due to the bankruptcy of large companies (Enron, 2001; Worldcom, 2002) and the financial crisis of 2008 and its consequences, the last decade has consecrated the notion of corporate governance by placing it at the center of debates. These scandals have certainly affected Northern countries, but also have repercussions in developing countries. These scandals are proof of the inability of governance systems to control the discretionary behavior of leaders.

In Senegal, the management of companies, especially public companies, continued to pose problems.

Governance and performance targets were not always met. Some companies were still unable to satisfactorily fulfill their missions. Thus, the issue of governance began to be raised in 2000, which coincided with the first political changeover. The audits that were conducted during this period by the government services showed shortcomings in the management of several public service companies and led to the arrest of their managers. The governance code was drawn up by the Institut Sénégalais des Administrateurs in 2008.

The question of performance and its determinants has always been the subject of debate and controversy in the

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world of finance, among theorists and practitioners alike. For many financial theorists, including Jensen and Meckling (1976), a firm's underperformance was essentially due to a poor understanding of the conflict of interest between the firm managers and owners. Various control mechanisms are capable of protecting public interest against abuses and managerial discretion in firms. Among these, the BoD occupies a central position (Fama and Jensen, 1983; Charreaux, 1991).

As the central organ of corporate governance, the BoD has a main function relating to the reduction of the discretionary power of managers and subsequently to managing the agency relationship between shareholders and managers as well as the various stakeholders of the company. It oversees the management and quality of the financial information communicated to shareholders. Based on the agency's shareholder theory and considering the explanatory theories of the BoD within the efficiency paradigm, this research focused on the influence of the BoD on the financial performance (Return On Equity=ROE) of<sup>1</sup> Senegalese public service companies. The question raised by such a concern was: could the BoD improve the company's ROE? The general issue guiding our research thus raised the question of the links between the company's BoD and ROE.

### General objective

To determine the characteristics of BoDs that could improve the financial performance of Senegalese public utility companies.

### Specific objectives

- (i) Analyze the BoD of Senegalese public service companies.
- (ii) Analyze the ROE of Senegalese public service companies.
- (iii) Determine the links between the BoD and the ROE of Senegalese public service companies.

Based on the theoretical and empirical debates on the issue, we have formulated the following hypotheses which we have attempted to test in the Senegalese context following the empirical study.

Hypothesis H<sub>1</sub>: BoD size positively influences ROE.

Assumption H<sub>2</sub>: There is a positive relationship between the number of independent Directors on the BoD and ROE.

Hypothesis H<sub>3</sub>: The presence of women in the BoD negatively affects ROE.

Hypothesis H<sub>4</sub>: There is a positive relationship between the number of BoD meetings and ROE.

Assumption H<sub>5</sub>: There is a positive link between the audit committee of the BoD and the ROE.

All of these assumptions were tested through an econometric analysis covering eight years (2004 to 2011).

Our study contributes to the field of empirical research on corporate governance mechanisms:

- (i) Unlike private firms, empirical work on the governance of public companies is scarce, and our research will help increase their number.
- (ii) Given the abundance of empirical studies in Northern countries and the relative scarcity of such studies in Africa, the main contribution of this work is to shed light on the influence of BoDs in improving the financial performance of the Senegalese public service company.
- (iii) Finally, this study could help competent authorities to make the right decisions.

## LITERARY REVIEW

"At the outset, governance is associated with the concern to secure shareholders' investment in large listed companies, to prevent the personal objectives of managers from leading to less shareholder value creation. In the extension of this financial version of governance, the BoD appears to be the main mechanism contributing to the achievement of this objective." (Charreaux, 2000). In addition, a review of the major studies on the topic of BoD identified that the characteristics and functioning of the BoD influence ROE.

### BoD size and ROE

Arguments in favour of large BoDs are derived from resource dependence theory (Pfeffer and Salanick, 1978). Rejecting the idea of contingency theories according to which the environment is an objective reality over which managers have no power, this theory asserts that the firm's survival is conditioned by its ability to control certain indispensable resources by impacting on its environment. Firms must mobilize these scarce resources at the lowest cost. The BoD then becomes a means of creating links with the external environment by integrating within it the various representatives of these most critical resources. Some authors are in favor of a large turnover. Indeed, in an uncertain environment, the larger the size of the BoD, the more the different knowledge of the Directors can improve ROE and exercise effective control over the manager (Linck et al., 2006). Contrary to the resource dependency theory that argues for larger BoD size, Jensen (1993) theorists have

Article 11 of the Code des Obligations de l'Administration (COA)<sup>1</sup> states that public service is constituted by "any activity of a legal person governed by public law with a view to satisfying a need in the general interest".

found that the large number of BoD members poses difficulties in terms of organization and coordination in decision making. BoDs with more than seven to eight directors risk being fragmented and having difficulty reaching consensus on important decisions. In addition, the large size of governance bodies encourages the presence of coalitions and internal conflict, which then reinforces the dominance of the leader. Indeed, when the BoD is large, it can present a barrier to controlling the management of the firm because of poor coordination, flexibility and communication. Andrés et al. (2005) have stated that small BoD members create more value than large BoD members. However, Wintoki (2007) found no significant relationship between CA size and firm ROE. Finally, authors such as Guest (2009) found a negative relationship between Tobin's Q (1969) ( $Q = \text{Firm Market Value/Replacement Value of Fixed Capital}$ ) and BoD size.

This divergence of results led to the conclusion that there is no consensus on the influence of BoD size on ROE. Some have argued for greater size. Others, on the contrary, have shown that a smaller number of directors has increased BoD control and subsequently improved corporate ROE.

### **Independence of BoD members and ROE**

This notion has always been the focus of much research. Indeed, previous studies have focused on the distinction between outside and inside directors. According to the theory of the Jensen and Fama (1983), a high proportion of independent directors leads to better monitoring of managerial decisions. Indeed, the presence of independent directors within internal governance bodies contributes to making the latter more independent of the executive. In addition, the presence of independent external members on the BoD guarantees the protection of shareholders' interests, since their only personal interest is to enhance the value of their human capital directly related to their expertise. Triki and Bouaziz (2012) found that the presence of a significant percentage of independent directors on the BoD has positively influenced the ROE of Tunisian companies. Finally, the co-option of independent directors is strongly encouraged by codes of good governance, such as the Code of Corporate Governance of Listed Companies revised in June 2013, which recommends a minimum quota of independent directors equal to half of the BoD for companies with dispersed capital and no controlling shareholders. However, Conyon and Peck (1998) argued that the quality of managerial control activity could be compromised by the weak personal financial interests of independent directors. Furthermore, the Donaldson and Davis (1989) stewardship theory contrasts with the Jensen and Fama (1983) agency theory by valuing the knowledge and experience of inside directors. Finally,

Agrawal and Knoeber (1996) found a negative relationship.

### **BoD diversity and ROE**

The main argument that there is a link between the proportion of women directors on BoDs and firm performance is based on resource dependency theory (Pfeffer and Salanick, 1978). Indeed, the presence of women in governance bodies constitutes an additional resource to create links with a complex and uncertain environment in order to reduce their dependence and thus obtain the resources necessary for the firm's activities.

Cabinet McKinsey and Company (2007) confirmed the positive link between the high percentage of women on the BoD and financial performance in terms of return on equity, operating margin and return on invested capital. Proponents of this diversity have said that women bring fresh ideas, have a very high communication capacity compared to men, and address strategic issues at BoD meetings that positively impact the business (Adams and Ferreira, 2009). Kochan et al. (2003) found no positive relationship between gender diversity in decision-making positions and company ROE. Triki and Bouaziz (2012) found in the Tunisian context that BoD diversity negatively and significantly affected performance measured by Return On Asset (ROA). The Copé-Zimmerman law of January 27, 2011 required French listed companies to include at least 20% women in their turnover in 2014 and 40% by 2017.

### **Frequency of BoD meetings and ROE**

Jensen (1993), one of the founding fathers of corporate governance theories, questioned the usefulness of meetings of internal governance bodies. According to him, the time devoted to these meetings by the directors is not sufficiently used to control the management of the company. Indeed, many BoD members waste this time on routine tasks such as management reports and various formalities. A company that optimizes the number of BoD meetings will be considered efficient in that it minimizes the agency costs generated by attendance fees, transportation costs and more generally by the use of managerial time. However, Triki and Bouaziz (2012) found that the frequency of BoD meetings positively affected the company's ROE.

### **The specialized committees of the BoD and the ROE**

In France, the corporate governance code for companies revised in June 2013 recommended that listed companies set up an audit committee and a compensation committee

**Table 1.** Operationalization of variables.

Themes	Variable	Measure
BoD	Size	The total number of directors on the BoD
	Independence	The number of BoD independent directors
	Presence of women	The total number of women on the BoD
	BoD meeting	The total number of BoD meetings per year.
	Audit committee	Existence (yes) and total number of directors on the audit committee; (no)
Performance	Financial performance	ROE=Net income/Equity at end of period

Source: Our data.

with at least one independent member. Klein (1998) considered that the creation of specialized committees within the BoD could improve its effectiveness, such as those oriented towards the control of executives (audit, compensation and nomination committees, etc.). Klein (1998) showed that the BoD effectiveness depends on its own structure as well as the structure of its committees. Indeed, he argued that the assignment of independent external directors to the audit committee is likely to improve the company's ROE. The audit committee appears to be the most important of these specialized committees. Indeed, audit committees are tools of institutional trust, the establishment of which is one of the fundamental aspects of the corporate governance system.

In summary, the characteristics related to audit committees have been addressed and dealt with in the accounting literature;

(i) Klein (1998) found a positive relationship between the percentage of outside directors on these committees and ROE. However, Brown and Caylor (2004) showed that the independence of audit committees is not positively related to the company's ROE. They also found that audit costs are negatively related to performance measures. Anderson et al. (2004) showed that fully independent audit committees have access to lower cost debt financing.

(ii) The size of the audit committee is positively related to ROE (Anderson et al., 2004).

(iii) The frequency of audit committee meetings is positively related to ROE (Beasley et al., 2000).

## METHODOLOGY

This is the hypothetico-deductive approach we followed in our research.

### Study area

The study was carried out in the city of Dakar, the capital of Senegal, where the management of all the companies in our sample are located. Dakar is located in the far west of Senegal.

### Sample

For the selection of the sample, we took the thirty public utility companies that were in the portfolio of the State of Senegal for the year 2012. The period over which we collected the information was spread over eight years (2004 to 2011).

### Variables

The independent variables were: BoD size, BoD independence, presence of women on the BoD, BoD meetings and the Audit Committee of the BoD. The dependent variable was ROE. The major difficulties related to management research in Senegal are mainly at the level of obtaining data. Our research has not escaped this reality. Initially, we had set out to study performance from several angles, but problems related to the availability of data led us to revise our ambition downwards. So we chose ROE to measure the company's performance. ROE can be defined very simply: Net profit/equity at the end of the financial year. This indicator, despite its limitations, has been used by several authors as a performance measure with a view to creating value for the owners of the company (Brown and Caylor, 2004). In order to be able to collect data in the field, we have operationalized the variables in the following Table 1.

### Data collection

The study period was spread over eight years between 2004 and 2011. Visits were made to the companies selected for the research. Secondary data was collected using structured sheets and interviews. Data was collected from twenty-one out of thirty public service enterprises.

### The econometric model

The econometric model allows us to establish the variables in regression form and to highlight the weight and influence of each independent variable on the dependent variable, which is the ROE. An eight-year panel, between 2004 and 2011, allowed us to examine the evolution of the relationship between CA and ROE. Each variable has an index (t) and (i). Index "(i)" represents individuals (firm) and index "(t)" represents the time variable. Thus the model can be written as follows:

$$\text{Financial performance}_{it} = \alpha_i + \beta_1(\text{Size})_{it} + \beta_2(\text{Attendance women})_{it} + \beta_3(\text{Attendance independent})_{it} + \beta_4(\text{Frequency of meetings})_{it} + \beta_5(\text{Committee})_{it} + \varepsilon_{it}$$

**Table 2.** Characteristics of Firms (8-year average).

Companies	BoD size	Number women in BoD	Number of independent directors	Audit committee	Number of meetings/Year	ROE(%)
1	8	0.25	0	0	4	-18.48
2	9	0	1	1	4	38.5
3	12	0	0	0	2	33.43
4	13	1.12	0	0	3	-46.6
5	12	1	0	0	3	-0.16
6	11.25	1.37	0	0	3	12.61
7	6	0	0	0	2	2.4
8	8	1	1	0	3	-12.41
9	12	1	2	0	2	-4.65
10	9	0.87	2	0	3	1.4
11	7	1.5	0	0	1	-30.02
12	12	1.75	2	0	3	0.85
13	12	3.12	1	0	3	1.79
14	12	0.25	1	0	3	-4.36
15	15	1	3	0	3	-2.84
16	13.62	0.62	0	0	3	0.95
17	8	1	0	0	3	-15.38
18	16	1	4	0	3	-4.97
19	9	1.25	0	0	2	-25.11
20	8.62	0.12	0	0	2	-3.74
21	16	0.37	0	0	4	2.03

Source: Output.

The coefficients  $\beta_i$  ( $i= 1, \dots, 5$ ) constitute the elasticity of each of the exogenous variables and also make it possible to determine the direction of the relationship between these variables and the endogenous variable. The coefficient  $\alpha$  can be a specific constancy or the same for all firms. The term " $\epsilon$ " measures the residual, i.e. the unexplained part of the explained (dependent) variable.

In our research, we have a sample of panel data so the first thing to do is to specify the homogeneity and heterogeneity of the data generating process (Khalfaoui, 2005). The specification or homogeneity test allowed us to see and understand the nature of the model we have. Is it a totally homogeneous model (no effect)? Is it an individual or specific model or is it possible to use a panel? Hausman (1978) noted that: "For panels of reduced time size, there may be large differences between the parameter estimation realizations of random effects and fixed effects models," and we used Hausman's test to determine the nature of the effects. We used the Hausman test to determine the nature of the effects. The Hausman test is particularly used in individual models in order to make a choice between a fixed-effects and a random-effects model.

In a fixed-effects model, the  $\alpha_i$  parameters are constants and specific for each individual. On the other hand, in a random effects model, the  $\alpha_i$  parameters are no longer deterministic constants. They contain hazards. The residual or error has three factors: unobserved individual effects, unobserved temporal effects, and unexplained effects. Before specifying the model, we performed a few pre-requisite tests (stationarity test on individual data by the LLC method (Levin and Lin, 1992) and stationarity test on individual data by the IPS method (Im et al. 1997)) for a better robustness and reliability of the estimation. Finally, in order to validate our model, we performed the tests of serial correlation (Pesaran), heteroskedasticity (Breusch-Pagan), significance of random effects (Brusch-Pagan) and significance of fixed effects (Fisher test).

## Presentation and discussion of results

We presented successively descriptive analyses, modeling and discussion.

### Descriptive analyses

The results obtained in Tables 2 and 3 gave a general view of the study variables analyzed on a cylindrical panel of twenty-one companies whose data are used over eight consecutive years (2004 to 2011).

### Uni-variate descriptive analysis

(i) ROE reached an average level of -3.56% with a strong standard deviation indicating a high dispersion.

(ii) The average BoD size was 11 directors and is within the optimal range (8 and 11) proposed by Leblanc and Gillies (2004). Compared to the texts in force, OHADA (1997) and Senegalese Law 90-07 of 26 June 1990, the BoD must have a size between 3 and 12 members.

(iii) The presence of women on the BoD was almost nil. However, all companies have complied with OHADA and Senegalese laws, particularly Law 90-07 of 26 June 1990 and the law on parity, which do not take this issue into account.

(iv) The presence of independent directors on the BoD has been almost non-existent.

The standard deviation of 1.14 indicates a strong dispersion. The companies were in conformity with the texts in force (OHADA (1997) and the law 90-07 of June 26, 1990).

**Table 3.** Descriptive analysis of variables.

Variable	Obs	Mean	Std. Dev.	Min	MAX
Size_BoD	168	10.928	2.861	6	16
Woman_BoD	168	0.886	0.871	0	4
Indep_BoD	168	0.809	1.142	0	4
Meetings_BoD	168	2.809	0.733	1	4
Performanc-a	168	-3.561	28.180	-119.3	72.8

Source: STATA 12 output.

**Table 4.** Correlation matrix (all 21 firms in the database) Stars (\*) represent a significance at the 5% threshold.

	Performance	Size_BoD	woman_BoD	Indep_BoD	Meetings_BoD
performance	1				
size_BoD	0.078	1			
woman_BoD	-0.178*	0.188	1		
indep_BoD	0.075	0.44*	0.170*	1	
meetings_BoD	0.151*	0.844*	-0.090	0.127	1

Source: STATA 12 output.

(v) The number of BoD meetings per year averaged 3, with six companies not meeting the minimum (3 meetings/year) required by law.

(vi) The audit committee: there was only one company that had an audit committee and had the best ROE. This exception risked distorting the econometric analysis, which is why we removed this variable.

### Bi-variate descriptive analysis

Through the bi-variate analysis, we try to apprehend the relationships between the variables two by two but especially the relationships between the explanatory variables and the explained variable (Table 4).

#### Performance and BoD size

Our correlation coefficient between turnover size and ROE is 0.07. At the 5% threshold, the correlation is positive but not significant. Our results are close to those of Godard (1998), Wintoki (2007) and Triki and Bouaziz (2012).

#### Performance and number of women in the BoD

Our correlation coefficient between the number of women in the BoD and performance is -0.17. At the 5% threshold, the correlation is negative and significant. So we can say that the relationship between these two variables exists but it is negative. Our results contradict those of gender diversity advocates such as Singh et al. (2008). We find that the negative sign of the coefficient on the variable presence of women in CA was consistent with the expected sign. This result was corroborated by Triki and Bouaziz (2012).

#### Performance and number of independent directors

The correlation coefficient between the number of independent directors and ROE is 0.07. At the 5% threshold, the correlation is positive but not significant. Our results are close to authors such as Yermack (1996) who highlighted the absence of significant correlation between the two parameters mentioned.

#### Performance and number of BoD meetings per year

Our correlation coefficient between the number of BoD meetings per year and performance is 0.1518. At the 5% threshold, the correlation is positive and significant. Our results have been confirmed by Triki and Bouaziz (2012).

In conclusion, the analysis of the correlation matrix showed a low level of correlation between companies' ROE. However, on the direction of variation between the variables we noted a similar evolution between ROE and the size of the BoD, the independence of the latter, the number of meetings. On the other hand, the presence of women on the BoD has evolved in the opposite direction of the ROE of the company, which is quite surprising in view of the parity which is more and more a topical issue.

## MODELLING

### Pre-requisite test results

#### *Stationarity test on the data taken individually*

**Stationarity test by the LLC method:** These results showed that only the size series of the company's turnover is not stationary (Table 5). However, the

**Table 5.** Stationarity test by the LLC method.

	LLC	Conclusion
size_BoD	1,0000	Non-stationary
woman_BoD	0.0044***	Stationary in level
indep_BoD	Impossible to implement	
meetings_BoD	Impossible to implement	
performance~a	0,0000***	Stationary in level

Source: STATA 12 output.

**Table 6.** Stationarity test using the IPS method.

	IPS	Conclusion
size_BoD	Impossible to implement	
woman_BoD	Impossible to implement	
indep_BoD	Impossible to implement	
meetings_BoD	Impossible to implement	
performance~a	0.0001***	Stationary in level

Source: STATA 12 output.

series for the number of women in the firm's BoD and ROE are stationary. Furthermore, given the nature of the data, which were qualitative variables transformed into quantitative variables, it was impossible to apply the stationarity tests to them.

### **Stationarity test using the IPS method**

The results showed that only the variable ROE could be implemented under stata and the hypothesis H0 which states that all components of the variable (ROE) are stationary, against the hypothesis H1 where some components are stationary. The conclusion show only the CA size series was non-stationary, so it is not useful to do a cointegration test because the variables are not integrated in the same order (Table 6).

### **The specification of the model**

The real challenge in the study of panel data lies in modeling individual heterogeneity (country, individual, in our case companies), without neglecting the temporal dimension. Indeed, the greater the individual heterogeneity, the greater the variability of the observations, which increases the precision of the estimators. To do this, we studied fixed-effect models and compound error models.

### **Criterion for choosing between the fixed-effects model and the random-effects model: The Hausman test**

The assumptions of the Hausman test are as follows:

H<sub>0</sub>: Presence of random effects

H<sub>1</sub>: Presence of fixed effects

The test statistic (Prob.  $\geq$  chi2=0.793) is higher than the 10% threshold and the H0 hypothesis cannot be rejected. We must therefore favor the adoption of a random effects model. For our study we have chosen the random effects model. The random effects model was chosen (Table 7).

### **The selected model: the random effects model**

The results of the estimation by the random effects model showed that the variable number of women in the turnover has a significant relationship with the ROE of the firms. The number of women on the BoD is negatively related to ROE. Moreover, the specification appears to be good (Prob.  $\geq$  Chi2=0.01). The elasticities found for each explanatory variable could be framed by confidence intervals. The 95% confidence interval (CI) is an interval of values that has a 95% chance of containing the true value of the estimated parameter. In order to validate our model, we carried out tests (Table 8).

**Table 7.** Hausman's test for specifying which model to choose.

Chi2(2)	0.46
Prob>chi2	0.793

Source: STATA 12 output

**Table 8.** Estimation by the random effects mode.

Performance_ca	Coef.	Std. Err.	Z	P>Z	95% conf	Interval
Size_BoD	0.084	1.217	0.07	0.944	-2.300	2.470
Woman_BoD	-5.642	2.748	-2.05	0.040	-11.029	-0.255
Indep_BoD	1.937	2.580	0.75	0.453	-3.121	6.995
Meetings_BoD	1.670	4.023	0.42	0.678	-6.215	9.559
Constante	-70.672	19.241	-3.67	0.000	-108.385	-32.960

Source: STATA 12 output.

### Results of model validation tests

In fact, the major problems with panel data are serial correlations and heteroskedacity.

#### Serial correlation test (Pesaran)

The results showed that the  $H_0$  hypothesis, which states that there is a serial correlation between the data, was rejected. This is not a good thing for our model. It should be noted that the tests for serial correlation are not appropriate for the data we have available. Indeed, these tests are intended for data over long periods of time ranging from 20 to 30 years.

$H_0$ : There is a serial correlation between the data.  
 $H_1$ : there is no serial correlation between the data.

#### Homoscedasticity test (Brusch-Pagan)

Homoscedasticity qualifies a constant variance of the data residuals composing the sample. Conversely, heteroscedasticity is said to exist when the variance of the model residuals is not constant. Table 9 showed us that the random effects are significant (Prob.  $\geq$  chibar2 =0.000). This means that there is the presence of heteroskedasticity that would inevitably have to be corrected by the WHITE method. We have corrected the heteroskedasticity with White's method specified with the areg command on Stata.

### Random effects significance test (Brusch-Pagan)

Before regressing the random effects model, the Brusch Pagan test for the significance of the random effects should be run.  $H_0$ : Absence of random effects;  $H_1$ : Presence of random effects. The principle remains the same as what is done for the homoscedasticity test.

#### Test of significance of fixed effects (Fisher's test)

Finally, with respect to the Fisher test, the main objective is to ensure the presence of fixed effects or not because the hypotheses are:  $H_0$ : Absence of fixed effects,  $H_1$ : Presence of fixed effects. However, the Brusch-Pagan test has shown that the random error model is better suited, so it was no longer useful to do this test since the Fisher test only applies to the fixed effects model. After the validation tests, the estimated general model and the results associated with the estimation are as follows:

PERFORMANCE  $i t = - 70.67 + 0.84$  Size CA  $i t - 5.64$  Women\* CA  $i t + 1.92$  Indep. CA  $i t + 1.67$  Meeting CA  $i t$  (the star indicates the significant variable at the 5% threshold).

The selected model: PERFORMANCE  $i t = - 70.67 - 5.64$  woman.

## DISCUSSION

### Rejected hypotheses

**$H_1$ : BoD size positively influences ROE: rejected**

The size of the turnover has no significant relationship

**Table 9.** Heteroscedasticity test (Breusch-Pagan).

Chibar2(01)	30.91
Prob>chibar2	0.000

Source: STATA 12 output.

with the ROE of the companies. Contrary to the resource dependency theory that argues for larger BoD size, agency theorists (Jensen, 1993) consider that large BoD size poses difficulties in terms of organization and coordination in decision making. Our result was confirmed by Wintoki (2007) Triki and Bouaziz (2012) who found no significant relationship between the size of the BoD and the firm's ROE.

***H<sub>2</sub>: There is a positive link between the number of independent directors on the BoD and ROE: rejected***

BoD independence has no significant effect on corporate performance. In parallel with the work that seeks to identify the link between the independence of the BoD and the achievement of performance for a firm, there is a hybrid current in the financial literature between advances in agency and *stewardship* theories. This trend leads to the conclusion that the BoD independence has no effect on the firm's performance. Our result was close to the hybrid current. It was corroborated by Kaymak and Bektas (2008); Klein (1998) who found no significant relationship between the two parameters mentioned.

***H<sub>4</sub>: There is a positive link between the number of BoD meetings and ROE: rejected***

The number of annual BoD meetings has no significant relationship to the company's ROE. Omri and Mehri (2003) found the same result in the Tunisian context.

**Validated hypothesis**

***H<sub>3</sub>: The presence of women in the BoD negatively affects the ROE: validated***

Our results indicated that the coefficient on the variable presence of women in CA is negative and statistically significant at the 5% threshold (coef. = -5.64;  $P > |z| = 0.040$ ). We found that the negative sign of the coefficient on the presence of women in the BoD was consistent with the expected sign. Indeed, this result was corroborated by Farrell and Hersch (2005) who found a negative impact of BoD diversity on ROE due to the reduced number of women in the BoD. Similarly, Triki and Bouaziz (2012) found in the Tunisian context that BoD diversity negatively and significantly affected the

performance measured by ROA. In addition, our results on the significant negative relationship between the presence of women and ROE could be explained by the low percentage of female representation on the BoD. Indeed, Kanter's theory (1977) indicates that within social groups, there are two types of categories; the dominant and the dominated (i.e. tokens). Kanter postulated that the number of dominants models the perception of the members of the group, in this case the BoD. Thus, the dominated (tokens), who are less important in number, behave in a similar way than the dominants, in order to be better integrated. According to this theory, minorities should ideally reach a representation percentage of 35% of the total workforce within a group before they hope to exert a significant influence on the group. However, our results indicated that the threshold of 35% of the workforce was not reached (the average of women on the BoD was 0.88) and that as a result, these women directors were not able to play an effective role on the BoD. Finally, these differences in results could be explained by several factors. Differences in the countries where the analyses were carried out in terms of culture, legislation and involvement in the professional situation of women may be the cause. The diversity of the methods and indicators used could also be an explanation for this heterogeneity of results. Indeed, Triki and Bouaziz (2012) found in the Tunisian context that the diversity of the turnover has negatively and significantly affected the performance measured by the ROA. On the other hand, when performance was measured by Tobin's Q or by ROE, these authors found a non-significant relationship between performance and BoD diversity.

**Conclusion**

The ambition of our research was to determine the influence of the BoD on the ROE of public service companies in the Senegalese context. We have adopted the hypothetical-deductive approach, making assumptions based on previous work. Verification or refutation of the hypotheses is done through the use of statistical and econometric tools. Initially we had five independent variables (BoD size, BoD independence, presence of women on the BoD, BoD meetings and the Audit Committee of the BoD) and the dependent variable is the ROE. The variable (audit committee) has been removed because it is an exception in our field data.

Introducing this variable into the model risked biasing the results. At the end of the tests, assumptions  $H_1$ ;  $H_2$  and  $H_4$  were rejected. On the other hand, hypothesis  $H_3$  was validated. We did not find a significant relationship between governance and ROE. Our conclusion was confirmed by Bauer et al. (2004), who, based on a sample of 300 FTSE companies, found no significant relationship between governance and performance, whether in terms of stock market or accounting performance. Louizi (2011), based on a sample of 132 French listed companies over the period 2002-2008 with 14 variables concerning the functioning of the BoD, shows that there is no significant influence of the BoD on performance. Indeed, out of the 14 variables, only the independence of the BoD has a positive and significant link on the company's performance. Kiel and Nicholson (2003) even state that attempts to identify direct links between corporate performance and governance practices are "naïve" and that there are no adequate recommendations for all firms. At the end of this research, other studies could be envisaged:

- (i) The influence of the BoD on performance using other measurement criteria. For this, it is necessary to involve the Government of Senegal for access to the financial and accounting information of companies.
- (ii) The influence of the characteristics of the BoD on overall performance. Thus, the notion of performance would no longer be limited to ROE, but would integrate environmental and social performance within it.
- (iii) Other variables such as the profile of the executives, their seniority and remuneration, the profile of the Chairman of the BoD, etc. could be included in a future empirical study.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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