The Nexus between Financial Innovation, Financial Inclusion, and Economic growth in Africa: A PMG Approach

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Abstract: **This study investigates the nexus between financial inclusion, financial innovation and economic growth in Africa by employing the panel autoregressive distribution lags using panel data over the period 2004–2018. The empirical findings reveals that the impact of economic growth on financial inclusion in Africa is positive and significant in the short and long run lending support to the growth led finance hypothesis that financial inclusion leads to economic growth. This paper, also finds a significant positive effect of financial innovation on financial inclusion in the long and short run in line with the supply leading hypothesis. We thus recommend policymakers to implement strategies that reckon incentives that can accelerate economic growth and financial innovations which can ultimately augment financial inclusion.**

Keywords**: financial innovation; economic growth; financial inclusion; panel autoregressive distribution lag; pooled mean group**

JEL Classification: O31; O16; G21

I. INTRODUCTION

Africa leads the world in the digital economy in terms of innovation and telecommunication infrastructure (Dune and Kasekende, 2018). This offers the African continent an opportunity to continuously shape its economies and to aspire growth into a global innovation hub post Covid-19. There exists no universal definition of financial inclusion and financial innovation. Financial inclusion is the process of ascertaining access to or use of affordable financial services and products that suits the necessities of businesses and individuals, conducted in a viable and answerable manner (World Bank, 2017). Tufano (2002) defined financial innovation as the process of development, diffusion, and commercialization of new financial instruments, financial technologies, financial institutions, and financial markets in the economy. The product innovation and process innovation addresses the presence of financial innovation in the financial system. Economic growth is the change in the gross domestic product of an economy. Financial inclusion and financial innovation plays a pivotal role in the financial system through optimising financial efficacy and effectiveness. According to Chipeta and Muthinja (2018), financial innovation boosts bank performance, and also leads to effectual financial intermediation. On the other hand, financial inclusion enhances formal credit and savings availability through reduced financing costs (Ashraf et al. 2010; Sarma and Pais 2008), quicken the bank-based financial institutions development (Babajide et al., 2015; Swamy, 2012), and financial stability.

Evidently, the link between financial inclusion and financial innovation has not been empirically tested and is thus implied. A group of researchers have explored the nexus between financial innovation and economic growth (Bara and Mudzingiri 2016; Qamruzzaman and Wei 2017, 2018; Bara et al. 2016), on firms performance (Carbó Valverde et al. 2016), on demand for money (Kasekende 2016; Dunne and Kasekende 2018), and banking sector growth (Kamau and Oluoch 2016). Most importantly, financial innovations has the potential to bring on board the vulnerable societal population to access the formal financial services and avail the benefit of finance. Alternatively, financial inclusion is the eventual product of financial innovation. Therefore, the question one can ask is; do financial innovations amplify financial inclusion in this Covid-19 era?

This study is distinctive in several aspects. First, we developed an index of financial innovation borrowing from the financial inclusion index concept, for the first time, rather than depending on single indicators which fails to comprehensively define financial innovation. Although the extant empirical literature indicates that several indicators were used to proxy financial innovation, there appears no consensus in this concern. Thus, the current study seeks to ease this gap by computing financial innovation index. Second, unlike extant studies, we employed the panel autoregressive distribution lag (ARDL) to investigate the nexus between financial inclusion, financial inclusion and economic growth. Using this model, the speed of adjustment along with the long-run level relationships in the financial innovation dynamic equation becomes of particular interest to the African countries as it relates to the viability of the Financial inclusion and Economic growth Pact. Third, since coefficients in the short run can differ across groups using the pooled mean group estimation method, the results become fundamental to policy makers especially when crafting country-specific budgetary objectives in the medium term.

Detailed empirical literature is discussed in Section 2. Section 3 covers the research methodology used in the study. The model estimation and interpretation are shown in Section 4, and the summary findings and policy implications are expounded in Section 5.

II. LITERATURE REVIEW

Several studies had been conducted tagging either financial inclusion and/or financial innovation.

2.1 Financial Innovation and Economic growth

The concept of financial innovation has received trifling attention from policy makers and researchers despite the fundamental role it plays in the modern financial system. The financial innovation-growth nexus is explained by four types of the causal hypothesis. First, the supply leading hypothesis assumes that financial innovation enhances economic growth through improved trade efficiency and easy access to financial services and products attributable to financial institutions efficiency (Beck 2010; Shittu 2012). Second, is the demand-leading hypothesis which hypothesise that economic growth augments financial innovation. Therefore, the availability of financial services and products is vital to support the normal speed of joint economic progression. Third, is the feedback hypothesis which hypothesize a bidirectional causation between financial innovation and economic growth (Bara et al. 2016; Bara and Mudzingiri 2016; Qamruzzaman and Wei 2017, 2018). Fourth, is the neutral hypothesis which advocate no causality between financial innovation and economic growth (Sekhar and Gudimetla, 2013 and Lumpkin, 2010). Empirical literature on the financial innovation-growth nexus suggests that there is a strong link between financial innovation and economic growth (see, for example, Bara and Mudzingiri 2016). Financial innovation does not only accelerate the process of financial development but also enhances capital accumulation, which eventually leads to viable economic growth both in the short and long run (Chou and Chin 2011; Orji et al. 2015; Mishra 2010).

2.2 Financial Inclusion and Economic growth

Several studies have examined the finance-growth link and came up with mixed and inconclusive evidence across countries and methodologies. Several researchers opines that the link between financial inclusion and economic growth is positive consistent with the supply-leading hypothesis (Mwaitete and George; Lenka and Sharma, 2017; Okoyo *et al*., 2017; Saidi and Emara, 2017; Sharma, 2016). Some studies concluded a weak or no causal relationship between financial inclusion and economic growth (Gourené and Mendy, 2017), others found the relationship to be inverse (Kim, Yu and Hassan, 2018). Others found a bi-directional causality link between financial inclusion and economic growth consistent with the interdependent approach (Evans and Lawanson, 2017; Kim, Yu and Hassan, 2018; Sethi and Acharya (2018)). Some studies concluded that economic growth drives financial inclusion consistent with the demand following hypothesis (Babajide *et al*., 2015; Evans, 2015).

2.3 Financial Innovation and Financial Inclusion

Economies that effectively and efficiently implement financial innovations have sustainable financial inclusion. Allen et al. (2014) opines that financial innovation in Africa counters financial infrastructural barriers thus enabling the financially excluded population to access financial services. The inclusion of the deprived populations due to geographical barriers in the conventional financial system speed up financial services and concurrently reduces the market fraction. According to Chipeta and Muthinja (2018), financial innovation boosts bank performance, and also leads to effectual financial intermediation which ultimately enhances formal credit and savings availability through reduced financing costs (Ashraf et al. 2010; Sarma and Pais 2008). Evidently, the link between financial inclusion and financial innovation has not been empirically tested and is thus implied. The current study seeks to close this gap and contribute more empirical literature.

III. DATA AND METHODOLOGY

We examined the nexus between financial innovation, financial inclusion and economic growth using the Pooled Mean Group approach of the Panel ARDL model. The PMG approach used in this study comprise of three variables which are financial inclusion (FII), financial innovation (IFI), and economic growth (GDP). Data was obtained from the Global Development Indicators Database (World Bank). We used a panel of 23 African countries sourced based on data availability over the period 2004 to 2018 (see Appendix 1 for a list of countries). Data availability especially on financial inclusion indicators largely determined the study period. We applied the dynamic panel data model for the balanced panel since it permits us to control for model endogeneity problems. Sarma (2008) has critiqued several studies (Evans, 2015; Naceur et al., 2015; Sharma, 2016) for using single indicators as a proxy for financial inclusion. We developed a financial inclusion index using four financial inclusion indicators broadly used in related studies namely depositors with commercial banks, ATMs per 100 000 adults, commercial bank branches per 100 000 adults and credit to the private sector. We computed an index of financial inclusion by means of the principal component analysis (PCA) combining the Sarma (2008) and Camara and Tuesta (2014) methodologies to overcome the each methodology's weaknesses (see Appendix 2). The current study, uniquely, used the PCA to develop an index of financial innovation using three widely used indicators of innovation. (See Appendix 3). We followed the footsteps of Gourené and Mendy (2017) and Said and Emara (2017) who used gross domestic product (GDP) per capita growth as an indicator of economic growth. GDP per capita growth measures closest to the definition of economic growth and also allows for cross-country comparisons and capturing of income distribution effects.

Since there exists no universal definition of financial inclusion and financial innovation, and w we employed several dimensions of financial inclusion and financial innovation in

computing a comprehensive index of financial inclusion and financial innovation for robustness of results. The financial inclusion index (FII) and the index of financial innovation (IFI) are best at measuring financial inclusion and financial innovation as they embraces all the financial inclusion and financial innovation dimensions, and they also have strong theoretical basis making them a better choice for the study. Following Sarma's (2008) arguments, the current study used usage, availability, and accessibility as dimensions of the financial inclusion index as they broadly proxy financial inclusion which is multidimensional. M3/M1, M2/M1 and DCG Growth were used as dimensions of financial innovation as they also broadly proxy financial innovation. This is contrary to other studies that used one variable to proxy financial inclusion and/or financial innovation. Following the footsteps of Sarma (2008), we used equation (1) to compute the indicator for each dimension:

$$ב_{i,d} = \frac{\Omega_{i-m_i}}{M_{i-m_i}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where Ω_i is the value for indicator i, m_i is the minimum value of indicator *i*, M_i is the maximum value of dimension *i*. $ב_{i,d}$ is the standardised value of indicator *i* with d as the dimension. Employing the PCA each indicator was aggregated to a dimension index consistent with Camara and Tuesta (2014). We selected subscript *k* as the principal components number that links with the standardized indicator *p*, λ_k ($k = 1 \ldots p$) as the k^{th} eigenvalue. The i^{th} principal component was represented by P_l ($k = 1 \ldots p$) and we also hypothesized that $\lambda_1 > \lambda_2 > \cdots \lambda_p$.We derived each dimension index corresponding to the standardized weighted averages. Following Camara and Tuesta (2014) all the total variations in the indices of dimensions were considered to evade information that could accurately estimate the overall country's index of financial inclusion and financial innovation. We ran another PCA as shown in Equation 2 to compute the dimension weights for inclusive financial inclusion and financial innovation. ω denotes the weights from the PCA and $א_i$ are the dimensions

$$FII_i = \omega_1 ב_{1k} + \omega_2 ב_{2k} + \omega_3 ב_{3k} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The panel ARDL approach (pooled mean group) estimation methodology is applicable when some variables are integrated of order one or zero. We conducted some unit root tests to determine the order of the variables integration and the nature of variables stationarity (Choi, 2001). We conducted the Im, Pesaran and Shin test (IPS), Augmented Dickey-Fuller (ADF), and Phillips and Perron (PP) tests. The study used the Akaike information criterion (AIC) to determine the optimal lag length. In addition we employed the Hausman test (Hausman 1978) to determine the suitable model to use between the mean group (MG), pooled mean group (PMG), and the dynamic fixed effects (DFE).

3.1 Panel Autoregressive Distribution Lags

We used the panel autoregressive distribution lags (ARDL) PMG approach to investigate the long run relationship for the panel of countries. The study employed the Hausman test to determine the most apt estimation technique from the MG, PMG, and DFE. Financial innovation, financial inclusion and economic growth are persistent justifying the suitability of the dynamic model. We used the ARDL model and the error correction model (ECM) to jointly estimate the short and long-run effects of the panel data. Comparing time series with panel data, panel data assumes heterogeneity whereas time series assumes data homogeneity (Baltagi, 1999). Model misspecifications usually occurs when heterogeneity is disregarded (Baltagi 2008). We employed the panel ARDL procedures of MG, PMG, and DFE to determine the relationship between the variables as suggested by Pesaran, Shin and Smith (1999). These techniques are suitable when estimating non-stationary dynamic panels for heterogeneous parameters across groups. Panel data also gives the researcher numerous data points thus improving the efficiency of the econometric as the degrees of freedom are increased reducing multicollinearity among the study variables (Baltagi 2008; Hsiao 2014).

The MG estimator runs distinct cross section equations, and average the model parameters to produce consistent estimators (Pesaran et al. 1999). On the other hand, the PMG estimator includes the characteristics of the MG and groups the estimators (Pesaran et al. 1999). The PMG estimation also assumes consistency and the independence of the regression residuals across countries (Loayza & Rancière 2006). The PMG also allows for the speed of adjustment to the long-run equilibrium values across countries (Loayza & Rancière 2006; Pesaran et al. 1999). In our study, financial innovation and economic growth are determinants of financial inclusion. Our study hypothesise financial inclusion as a function of financial innovation and economic growth. We used the following ARDL equations to examine the relationship between financial innovation, financial inclusion, and economic growth in Africa:

$$FII_{i,t} = \beta_0 + \beta_{1i}\ FII_{i,t-1} + \beta_{2i}\ IFI_{i,t-1} + \beta_{3i}\ GDPPCG_{i,t-1} + \sum_{i=0}^{n} \Psi_{1,t} \Delta FII_{i,t-1} + \sum_{i=0}^{n} \Psi_{2,t} \Delta IFI_{i,t-1} + \sum_{i=0}^{n} \Psi_{3,t} \Delta GDPPCG_{i,t-1} + \varepsilon_{i,t}$$

Where: IFI is the index of financial innovation; FII is the financial inclusion index and GDPPCG is the Gross Domestic Product per Capita Growth which is a proxy for economic growth.

β are the independent variables long run coefficients.

Ψ are the coefficients in the short run.

$\varepsilon_{i,t}$ is the error term where t and i represent time period and the country, respectively.

3.2 Error Correction Model

Having determined the long-run relationship between financial innovation, financial inclusion, and economic growth, the study then determines the effects in the short-run using the panel-vector error correction model (ECM) (Apergis & Payne 2010). The ECM captures the short and long run effects giving it an edge over other methods (Engle & Granger 1987; Hoffman & Rasche 1996). This study proposed the following generic ECM equation:

$$\Delta FII_{i,t} = \alpha_{0t} + \alpha_1 \sum_{i=1}^{p} \Delta FII_{i,t-1} + \alpha_2 \sum_{i=1}^{p} \Delta IFI_{i,t-1} + \alpha_3 \sum_{i=1}^{p} \Delta GDPPCG_{i,t-1} + \varrho ECT_{i.t} + \mu_{i,t-1} \quad (3)$$

Where ECT is the error correction term; p is the AIC selected lag length; IFI is the index of financial innovation; FII is the financial inclusion index and GDPPCG is the Gross Domestic Product per Capita Growth which is a proxy for economic growth. α_0 is the constant; and ϱ is the long run equilibrium adjustment speed; μ is the error term. The system's adjustment speed to the equilibrium in the long run after a short run shock is explained by the ECT coefficient in the ECM equations. The coefficient of the ECT is expected to be negative and statistically significant showing how the variables converge to the equilibrium level (Bildirici & Kayıkçı 2013).

IV. EMPIRICAL RESULTS

IV.1. Descriptive Statistics

The descriptive statistics for the variables used in the study are displayed in Table 1.

Table 1: Descriptive Statistics

VARIABLE	OBS.	MEAN	STD. DEV	MIN	MAX
FII	345	0.273	0.131	0.132	0.72
IFI	345	0.181	0.042	0.120	0.76
GDPPCG	345	2.630	3.562	-9.216	30.36

Source: Authors' estimation based on World Bank Statistics

On average, financial inclusion level in Africa is very low at 27 percent. The maximum and minimum values of financial inclusion in Africa between 2004 and 2018 are 0.72 and 0.13 respectively, implying that African countries are characterised by serious financial inclusion disparities in line with Mehrotra and Yetman (2015). Financial innovation in Africa ranges between 0.76 and 0.12 and is on average low at 18 percent. The mean economic growth in Africa is 2.63 percent, indicating that the economic output for African economies under investigation was 2.63 percent between 2004 and 2018.

IV.2. Stationarity tests results

Table 2: Levin Lu and Chu (LLC) Unit Root Test @ I (0) and 1(1) Level

	LLC@ 1(0)		**LLC @1(1)**	
	stats	**p-value**	**Stats**	**p-value**
GDPPCG	-16.7	0.00	-20.5	0.00
IFI	-4.84	0.76	-4.62	0.00
FII	-5.02	0.60	-5.35	0.00

Source: Authors' estimation based on World Bank Statistics

The results in Table 2 shows that economic growth (GDPPCG) is stationary at level I (0) whilst financial inclusion (FII) and financial innovation (IFI) are stationary after first difference 1(1). Using the Akaike Information Criteria (AIC), Hannan and Quinn Criteria (HQC), and Schwarz Information Criteria (SIC), the lag length of two was found to be appropriate in each equation (see Table A2 in the Appendix).

IV.3. Cointegration Test

We used the Johansen and Juselius (1990) procedure to check for the long-run relationship between the variables. The results are presented in Table 3 below. The Trace test and the Maximum Eigenvalue test indicate two cointegration relationships which show that there exists a long-run relationship between financial inclusion, bank competition, and economic growth.

Table 3: Results of the Cointegration Test

No of CEs	**Statistic**	**Eigenvalue**	**Critical Value**	**Prob. ****
None*	104.844	0.1210	62.848	0.000
At most 1*	56.621	0.1401	46.286	0.000
At most 2	38.093	0.0345	28.093	0.021
At most 3	9.0303	0.0246	15.322	0.231
At most 4	0.4237	0.0026	3.815	0.470

Source*: Authors' calculations*

* denotes rejection of the hypothesis at 5% level, **denotes MacKinnon-Haug-Michelis (1999) p-values

IV.4. Panel ARDL Results

The current study discusses the results of the error correction and cointegration among financial inclusion, bank competition and economic growth in Africa. The study used the PMG, which assumes an identical long run relationship among financial inclusion, bank competition and economic growth across countries, whilst allowing a country specific short-run relationship. The study used the Hausman test to verify the coefficients long-run homogeneity as Table 4 report the PMG estimation results of the financial inclusion dimensions long-run and short-run coefficients and the error correction term coefficient.

Table 4: Pooled Mean Group Estimation Results (FII) – (2004-2018)

D.fii	Coefficient	Std. Error	z	P> |z|
LR _ec				
gdppcg	0.0228	0.0058	3.91	0.000*
ifi	0.6278	0.3306	-2.04	0.042**
SR				
_ec	-0.4671	0.0680	-6.87	0.000*
gdppcg	0.0121	0.0017	4.22	0.000*
ifi	0.4275	0.2195	1.95	0.051***
_cons	0.1290	0.0294	4.39	0.000*

Note: for all p-values: ***10% significance level, ** 5% significance level; * 1% significance level.

The results in Table 4 show that there is a significant positive relationship between financial inclusion and economic growth in the long run and also in the short run. Increase in the economic growth boosts financial inclusion in the short and long run. This is in line with an intuition expectation of a positive relationship between financial inclusion and economic growth. The outcome of this study supports the "demand-following" hypothesis or the growth-led finance which upholds that a positive relationship exists between economic growth and financial inclusion (Evans, 2015). The positive relationship depends on the context in Africa which is experiencing growth in its economies. Economic growth increases the demand for financial services following the demand from economic agents such as investors. Economic growth attracts private individuals and businesses to invest in a country thereby enhancing their demand for financial services supporting the outcome of the study. This finding contradicts other scholars who opines that the relationship is neutral (absent or unimportant), implying that financial inclusion and economic growth do not influence each other (for example, Khalaf and Ali, 2015 and Gour'ene and Mendy, 2017).

Table 4 also expose a significant positive effect of financial innovation on financial inclusion in the short and long run. The financial innovation coefficient of 0.63 indicates that a 1 percent increase in financial innovation leads to a 63 percent increase in financial inclusion in Africa in the long term. In the short term, a 1 percent change in financial innovation will result in 46 percent increase in financial inclusion in Africa. Our results are in line with the supply leading hypothesis of financial innovation. The supply leading hypothesis views financial innovations as the driving forces for the world financial system towards greater economic efficiency. Financial innovation proliferates the financial system's efficiency by supporting credit market development, easing monetary policy operations and transmission mechanism. It is no doubt that financial innovations are critical in the development of the financial system. Financial sector innovations are enabling the financial services providers to provide services in rural areas assisting in the achievement of the sustainable development goals and inclusive economic growth. Financial innovation also enhances bank performance (Chipeta and Muthinja 2018), leading to efficient financial intermediation which consequentially result in the boosting of financial inclusion.

The error correction term is statistically significant at 5 percent level and is also negative which confirms cointegration relationship among the variables. The error correction term coefficient of -0.4651 shows a quick adjustment rate to the equilibrium of 47 percent per year whenever there is a shock to financial inclusion in the previous period. The relationship is statistically significant at the 1 percent significance level. Policy makers should enhance economic growth and financial innovation which latter feeds into financial inclusion. The results displayed for financial inclusion, financial innovation and economic growth models passed the stability test. We also conducted the Hausman Test to determine the suitable approach to use among the PMG, MG and DFE. Since the probability in the Hausman test is above 5 percent we therefore used the PMG estimator and not the DFE estimator in our study.

V. CONCLUSIONS AND POLICY IMPLICATIONS

This study employed the ARDL panel based Pooled Mean Group estimator to explore the financial inclusion, financial innovation and economic growth nexus. The results of the unit root tests shows that financial inclusion and financial innovation are 1(1) stationary whereas economic growth was (10) stationary justifying the use of ARDL PMG estimator. The empirical findings reveals that the impact of economic growth on financial inclusion in Africa is positive and significant in the short and long run. The findings therefore lend support to the growth led finance hypothesis that financial inclusion leads to economic growth in the short and long run. This however contradicts the proponents of the neutral hypothesis who contend a negative effect of economic growth on financial inclusion (Evans and Alenoghena (2017).

Our study also expose a significant positive effect of financial innovation on financial inclusion in the short and long run in line with the supply leading hypothesis of financial innovation.

In terms of policy implications, a significant positive effect of financial innovation on financial inclusion in the long and short run in line with the supply leading hypothesis cautions policymakers to implement strategies that reckon incentives that can accelerate financial innovations which can ultimately augment economic growth and financial inclusion.

In terms of policy implications, policymakers should implement strategies that reckon incentives that can accelerate economic growth and financial innovations which can ultimately augment financial inclusion. First, the government should inspire a competitive financial environment with greater interfaces by including both informal and formal financial institutions in the financial system. Second, the appropriate initiatives should be

embarked on to merge and adopt new financial services, assets, and payment mechanisms for effective financial development with financial innovation. Financial innovation does not only causes economic growth but also promotes financial inclusion of the country, as well. An efficient financial system is a catalyst for economic growth (Ram 2007). To support financial innovation, the private sector and government should take part in formulating and supporting financial policy in a manner that develops financial innovation at its own pace.

APPENDIX 1: Sampled Countries

Algeria	Angola	Botswana	Burundi	Cameroon
Ghana	Ethiopia	Kenya	Sudan	Madagascar
Malawi	Swaziland	Morocco	Mozambique	Namibia
Nigeria	Gambia	Egypt	South Africa	
Tanzania	Tunisia	Uganda	Zambia	

APPENDIX 2: Financial Innovation Indicators

Indicator	Definition	Reference
M3/M1	The proportion of Total Money Supply to Narrow money	Dunne and Kasekende (2018); Qamruzzaman and Wei (2018; 2017)
DCP Growth	The % change in Domestic Credit to the Private Sector	Michalopoulos et al. (2011); Ajide(2015)
M2/M1	The Proportion of Broad to Narrow money	Qamruzzaman and Wei (2018; 2017)

APPENDIX 3: Financial Inclusion Indicators

Indicator	Definition	Reference
Usage	Credit to the private sector	Sarma (2012, 2008)
Bank penetration	Depositors with commercial banks	Evans (2015); Adeola and Evans (2017); Sarma (2008, 2012)
Access	Commercial bank branches per 100 000 adults	Adeola and Evans (2017); Rasheed et al. (2016)
	ATMs per 100 000 adults	Kumar (2013); Sarma (2008); Rasheed et al. (2016)

APPENDIX 5: Selection Criteria of Lag Length and Diagnostic Tests

Selection Criteria for VAR Lag Order							
Endogenous variables: IFI FII GDPPCG Exogenous variables: C							
Date: 04/22/2021 Time: 22:00				Sample: 2004 2018			
Lag	LogL	LR	FPE	AIC	SC	LM Test	NORM
0	-198.021	NA	5637.51	20.3170	20.3870		-
1	-132.475	99.924	95.5553	12.2683*	14.1560	0.110	0.117
2	-124.114	78.3205	81.2327	11.0962*	12.6719*	0.218	0.871
3	-116.529	34.8902	79.08234	10.8398	12.4839*	0.474	0.782
* indicates selection criteria for lag order							

Appendix 6: Summary Statistics

Description	Obs.	Mean	Std. Dev
Depositors with commercial banks	345	28.91	1.92
ATMs per 100 000 adults	345	10.52	2.83
Commercial bank branches per 100 000 adults	345	10.04	5.26
Credit available to the private sector	345	70.02	24.51
The ratio of broad to narrow money (M2/M1)	345	4.011	0.21
The proportion of aggregate money supply to narrow money (M3/M1)	345	3.513	0.36
The % change in domestic credit to the private sector	345	0.004	0.04
Gross domestic product per capita growth	345	2.58	1.03

APPENDIX 7: Hausman Test Results Hausman DFE pmg, sigmamore

	Coefficients			
	(b)	(B)	(b-B)	Sqrt(diag(v
	DFE	PMG	Difference	S.E
ifi	-0.878	-0.841	-0.037	0.1890
gdppcg	0.169	-0.115	0.284	0.600

Prob> $Chi2$=0.00

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