STATIC AND DYNAMIC PANEL ESTIMATION OF THE INTERACTION BETWEEN FINANCIAL DEVELOPMENT AND URBANIZATION: EVIDENCE FROM AFRICAN COUNTRIES

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ABSTRACT

This paper explores the interactions between financial development and urbanization for a group of 14 African countries using static and dynamic panel estimation techniques. The results from the cross-sectional dependence tests show evidence of dependence in the panel and the residuals are corrected. To account for the presence of correlation in the residuals, the Driscoll and Kraay standard errors were employed in the estimation of the random- and fixed-effect models. The results from the Hausman test indicate that the random-effects model should be preferred over the fixed-effects estimation technique. The results from the random effects technique indicate that financial development and urbanization have statistically significant effect on each other. Similarly, the results from the Arellano-Bond dynamic panel estimation technique reveal that financial development and urbanization have statistically significant effect on each other as well. The results suggest that both variables engender each other.

Keywords*:* Urbanization, financial development, fixed effects, random effects, GMM
JEL Codes: R0, C23, G21

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I. INTRODUCTION

Every nation in the world engages in the improvement of its financial sector's efficiency. Financial development has been viewed as an important catalyst that complements urbanization. As developed nations formulate and implement policies to improve their financial sectors, so do developing nations such as Benin, Burkina Faso, Cameroun, Cote-d'Ivoire, Ghana, Gabon, Kenya, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Togo, and Zambia. The benefits of pursuing such policies cannot be overemphasized as numerous contemporaneous economic literatures continue to cite the strong positive relationship that exist between financial development and urbanization. As the relationship between the two variables are further studied and discussed, it becomes imperative for urbanization as a term to be correctly defined within the context of this study.

Urbanization has broad definitions and dimensions but can be narrowed to a certain extent. It can be looked at as a population shift from rural to urban areas. United Nations Funds Annual Report (2019) indicated that the world is undergoing the largest wave of urban growth in history. More people are now living in towns and cities. In short, the number of people living in urban areas is expected to increase by approximately 5 billion before 2030. Most of these migrations will unfold in Africa and Asia. As more facts emerge about migrations to urban areas, some economists viewed the trend as the decrease in the proportion of people living in rural areas, and the ways in which societies adapt to the realignments. Within the context of urbanization, it has also been viewed as the process by which towns and cities are formed. It can be quantified either in terms of the level of urban development relative to the overall population, or as the rate at which urban proportion of the population is increasing. Urbanization has also been looked at as improvements in infrastructure constructions, viable financial hubs, regional economic growth, public services expansion, technological advancement, and availability of effective communication systems. There is no doubt that a relationship exists between financial development and urbanization, but accurately estimating the directional impact path or process is still ambiguous and continues to invoke contentious debates. Many economists believe that financial evolutions in any economy depends on the level of urbanization of that region, but some argue that it is the other way around. These economists who believe in these financial evolutions contend that the scope or depth of financial development generally follows urbanization needs. Most of the studies addressing this topic in the extant literature focused mainly on Asian countries, especially China. This paper therefore contributes to the literature by extending the debate on the interaction between financial development and urbanization to a panel of 14 African countries.

The remainder of the paper is organized as follows. Following the present introduction, Section 2 provides the literature review. Section 3 discusses the methodology. Section 4 presents the data and the descriptive statistics. Section 5 discusses the empirical results. Section 6 provides the conclusions and the implications of the study.

II. LITERATURE REVIEW

Many economic studies contend that there is a positive relationship between financial development and urbanization. According to Shaowei and Jinrong (2014), financial development is a very important factor that influences urbanization. Their study specifically investigated the relationship between financial development, urbanization, and urban-rural income gap in China. Measuring financial development as financial scale, financial activities, and financial efficiency, they determined that it significantly impacted urbanization positively and narrowed income gaps or disparities between urban and rural areas. They also said that when a financial sector is efficient, residents in both urban and rural areas of China had opportunities to enjoy the wealth that is created from the capital outlays or investments. Furthermore, farmers in rural areas of china benefited from easy financial access or credit availability centered in near urban areas.

Another study by Wai and Patrick (1973) focused on the relationship between financial development, urbanization, and economic development. They found that when countries have relatively high levels of financial development, urbanization and economic growth tend to be relatively faster over the next 10 to 30 years. They said that financial development plays an important role in increasing urbanization and economic growth and acknowledged those scholars who are wary of drawing links between financial development, urbanization, and economic growth. However, they empathically asserted that the relationship between these variables are not just a contemporaneous association. Finance does not only enhance urbanization, but also plays a very important role in economic growth. Furthermore, they acknowledged that a positive association between contemporaneous shocks to financial development, urbanization, and economic growth does not fully account for the finance-economic growth link. Based on that, they developed more sophisticated methods for measuring the linkages between the three variables by examining a longer-term data set. With this method, they were able to demonstrate more forcefully than others the apparent existence of positive relationships between financial development, urbanization, and economic growth.

While we have abundant studies confirming the existence of a positive relationship between financial development and economic growth, few literatures existed to support such wide claims regarding strong positive relationships between financial development and urbanization. According to Ye, C., et al. (2018), urbanization is the transfer of population economic activities, and financial development plays a significant role in that effect. To further substantiate that fact, their study looked at financial agglomeration that reflected both geographical and spatial allocation of financial resources, financial institutions, and overall financial sector with financial efficiency. Agglomeration is an economic term that refers to the phenomenon of firms being located close to one another. Financial agglomeration transfers and concentrates financial resources in a designated area and consequently creates enterprise zones.

Businesses in these zones are able to obtain financing at lower costs, lower time cost, and reduce financial risk costs. With agglomeration economies, there is the assumption that the net benefit outweighs the added expenses from higher rents or taxes. They went further to say that financial agglomeration is conducive to the industrial upgrading, urbanization, and environmental protection.

Ye, Z. et al (2018) study using a GMM dynamic and fixed-effect panel models investigated if a relationship existed between financial development and urban-rural income disparity. They found that financial development measured by scale, efficiency, and structure respectively expanded the urban-rural income gap. The imbalance of urban and rural financial resources is exacerbated by the financial threshold effects. Also, China's economy did see rapid economic growth from financial development and urbanizations, but the problem of income distribution imbalance between urban and rural residents has exacerbated. They concluded by saying while financial development positively induced urbanization, it negatively impacted rural income distribution significantly.

According to Han, et al. (2020), since the adoption of China's reform and opening-up policy in 1978, the economy has experienced a rapid economic growth and corresponding rapid urbanization. To investigate this claim further, they used the combination weight of game theory and dynamic panel data to investigate the synergistic effects between financial development and improvements in new-type urbanization. They found that the level of financial deepening measured by the loan balance of all financial institutions divided by gross domestic product in China has the maximum impact on urbanization. Also, Bank-dominated financial system supports improvement in new-type urbanization. Small and medium-sized enterprises (SMEs) and stock markets also have strong impacts on new-type urbanization. They concluded by saying that policies such as improving SMEs efficiency, optimizing the financial structure, and relaxing restrictions on private investments are likely to promote further improvements on new-type urbanization in China.

III. METHODOLOGY

The empirical analysis of the study commences with the applications of three cross-sectional dependence tests namely —Breusch and Pagan (1980), Pesaran (2004), and Frees (1995) CD LM techniques. The study next applies both static and dynamic panel data approaches to ascertain the interaction between financial development and urbanization. For static panel data investigation, the pooled ordinary least squares (POLS), standard fixed effects (FE) and random effects (RE) models are implemented to explore the relationship between the two variables. The pooled ordinary least squares (POLS) equations for financial development and urbanization are given by:

$$URB_{(i,t} = \alpha + \beta_1 FD_{i,t} + \beta_2 GR_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$FD_{(i,t)} = \alpha + \beta_1 URB_{i,t} + \beta_2 GR_{i,t} + \varepsilon_{i,t} \quad (2)$$

In equations (1) and (2), $FD_{(i,t)}$is the financial development variable proxied by domestic credit to private sector share of GDP for country i in time t. While $URB_{(i,t)}$

represents urbanization as percent of urban population for country i in period t. GR stands for economic growth measured by annual growth in real GDP. In equations (1) and (2), the economic growth (GR) serves as a control variable in the relationship between financial development and urbanization. Economic growth as a control variable and intended to capture external effects may have been omitted by only examining the direct influence that financial development and urbanization variables may have on each other. Economic growth has been shown in the literature to influence and be influenced by both urbanization and financial development (Stiglingh and Vijloen, 2018, Hassan, 2011, Lewis 2014 and Leitão, 2013). The POLS estimation model has been shown in the literature to produce biased results emanating from time-invariant unobservable variables. To mitigate the drawbacks associated with the POLS, the study implements the fixed- and random-effects models.

The fixed-effects models for financial development and urbanization are given by following the equations:

$$URB_{(i,t} = \beta_1 FD_{i,t} + \beta_2 GR_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (3)$$

$$FD_{(i,t)} = \beta_1 URB_{i,t} + \beta_2 GR_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (4)$$

Where α_i represents the country-specific effects and $\varepsilon_{i,t}$ represents the error term. The financial development, economic growth and urbanization variables remain as defined in equations (1) and (2).

The random effects models for financial development and urbanization are by:

$$URB_{(i,t)} = \beta_1 FD_{i,t} + \beta_2 GR_{i,t} + \alpha + \delta_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$FD_{(i,t)} = \beta_1 URB_{i,t} + \beta_2 GR_{i,t} + \alpha + \delta_{i,t} + \varepsilon_{i,t} \quad (6)$$

In equations (5) and (6), α is the country-specific effects, δ_t represents the time effects, and $\varepsilon_{i,t}$ stands for the error terms. The definitions of financial development, economic growth and urbanization variables are as given by equations (1) and (2). Breusch and Pagan (1980) proposed a Lagrangian multiplier (LM) procedure designed to test for the presence of heterogeneity in the panel. The null hypothesis under the LM test is that the variances across panel members are zero. In other words, this null hypothesis implies that there is no significant difference across units or no panel effect. The alternative hypothesis under the Breusch and Pagan LM test is that the variances across panel members are not zero. The rejection of the null hypothesis implies that the random effects model should be preferred over the POLS approach. In addition, the study implements the Hausman (1978) general specification test to determine whether the fixed-effects model or the random-effects is the most appropriate technique for the panel. The null hypothesis under the Hausman specification test is that the difference in coefficients is not systematic. The alternative hypothesis is that the difference in coefficients is systematic. Rejection of the null hypothesis suggests that the fixed-effects model should be preferred over the random-effects model.

For dynamic panel estimation of the interaction between financial development and urbanization, the study adopts the one-step Arrellano and Bond (1991) generalized methods of moments (GMM) approach. The model includes p lags of the dependent variable, and it deals with the fixed, random, and unobserved effects. The Arrellano and Bond GMM panel estimation technique using the lags of the endogenous variables as instruments corrects for joint endogeneity problem that may be present within the panel, especially in the cases where T is small, and N is large. Arrellano and Bond (1991) dynamic panel data models of the interaction between financial development and urbanization are given by the following equation:

$$URB_{(i,t)} = \beta_1 URB_{i,t-1} + \beta_2 URB_{i,t-2} + \beta_3 FD_{i,t} + \beta_4 FD_{i,t-1} + \beta_5 GR_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (7)$$

$$FD_{(t,i)} = \beta_1 FD_{t-1,i} + \beta_2 URB_{t,i} + \beta_3 URB_{t-1,i} + \beta_4 GR_{t,i} + \alpha_i + \varepsilon_{t,i} \quad (8)$$

In equations (7) and (8), the lags of the dependent variables are included as independent variables to account for possible fixed, random, and unobserved effects in the panel. $FD_{(t-1)}$ is the lag of the financial development variable and $URB_{(t-1)}$ represents the lag of the urbanization variable. GR stands for economic growth while α_i represents the panel level effects. In equation (8), the second lag of the urbanization variable is included as an independent variable. β_1, β_2, β_3 β_4 *and* β_5 stand for the parameters to be estimated with respect to the dependent variables (here, financial development and urbanization). The error terms are represented by $\varepsilon_{t,i}$. The validity of the results from the Arrellano and Bond GMM panel estimation approach is tested by applying the AR2 test of second order serial correlation of the residuals and the Sargan (1958) over-identifying restrictions test. The null hypothesis of the AR2 test is that there is no second-order serial correction in the residuals. The Sargan test is asymptotically distributed as chi-squared under the null hypothesis of no over-identifying restrictions. Under both the AR2 and Sargan tests, the null hypotheses are not rejected when the *p*-values are greater than 5% (i.e. *p*-value > 0.05).

IV. DATA AND DESCRIPTIVE STATISTICS

This study utilizes annual data on economic growth (annual growth of GDP), financial development proxied by domestic credit to private sector percent of GDP and urbanization percent of urban population. The data were retrieved from the website of the World Banks's World Development Indicators https://databank.worldbank.org/reports.aspx?source=world-development-indicators#. The sample consists of 14 African countries namely — Benin, Burkina Faso, Cameroun, Cote d'Ivoire, Ghana, Gabon, Kenya, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Togo, and Zambia. Data availability was the motivation behind the selection of the countries. The sample period runs from 1965 to 2018.

Table 1 displays the descriptive statistics for economic growth, financial development, and urbanization. In Table 1, three different types of statistics are reported including the *overall*, *between*, and *within*. The *overall* statistics represent the conventional statistics which are based on the total number of observations in the panel (in our case, 756 data points). Whereas, *between* statistics are calculated based on the summary statistics of the 14 countries in the panel irrespective of time period; *within* statistics on the other hand, are obtained from the summary statistics of 54 time periods regardless of country. *Overall* mean values for financial development, economic growth and urbanization are 20.74, 3.57 and 34.35 percent, respectively. *Overall* standard deviations ranged from a high of 25.22 for financial development to a low of 5.45 percent for economic growth. Similarly, financial development variable exhibited the highest values of *between* and *within* standard deviations while economic growth documented the lowest values. The minimum and maximum statistics reveal that the three variables varied across panel member countries. For example, Gabon posted the *overall* highest urbanization value while Niger recorded the least.

Table 1: Descriptive Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
FD	*overall*	20.74	25.22	1.54	160.12	N = 756
	between		23.38	4.85	99.45	n = 14
	within		11.29	-24.74	81.41	T = 54
GR	*overall*	3.57	5.48	-24.05	39.49	N = 756
	between		0.67	2.49	4.84	n = 14
	within		5.44	-24.40	39.14	T = 54
URB	*overall*	34.35	16.57	3.30	89.37	N = 756
	between		14.41	10.41	65.18	n = 14
	within		9.04	-7.05	58.54	T = 54

FD = financial development proxied by domestic credit to private sector (% of GDP), GR= annual growth of GDP and Urbanization = % of urban population. N= total number of observations in the panel, n= number of countries in the panel, T = number observations per country (1965-2018).

Table 2 displays the Pearson correction coefficients between economic growth, financial development, and urbanization. The results show that the correlation (-0.04) between economic growth and financial development is negative and statistically insignificant. Similarly, the correlation (-0.03) between economic growth and urbanization is negative and statistically insignificant. However, the correlation (0.35) between financial development and urbanization is positive and statistically significant at the 1% level. Although, the correlation analysis has provided a cursory evidence relative to the relationship between financial development and urbanization, a more rigorous analysis is however warranted to underpin both the static and dynamic interactions between the two variables. To this effect, the study implements the static and dynamic panel data methods to ascertain the relationship between financial development and urbanization.

Table 2: Pearson Correlation Coefficients

	FD	GR	URB
FD	1		
GR	-0.04	1	
URB	0.35^{***}	-0.03	1

***indicates 1% level of significance. FD = financial development proxied by domestic credit to private sector (% of GDP), GR= annual growth of GDP and Urbanization = % of urban population.

V. EMPIRICAL RESULTS

The empirical results are discussed in this section. The empirical analysis of the study commences with the application of three cross-sectional dependence tests including Breusch and Pagan (1980), Pesaran (2004) and Frees CD LM procedures. Table 3 presents the cross-sectional dependence test results. Panel A displays the CD test results on urbanization equation while Panel B exhibits the results for financial development equation. Based on these results, the null hypothesis of no cross-sectional dependence is rejected by all of the three tests. For example, the test statistics 3233.38, 51.06 and 9.13, respectively for Breusch and Pagan (1980), Pesaran (2004) and Frees CD LM procedures are statistically significant at the 1% level, relative to the equation for urbanization. Similarly, the test statistics 1281.00, 12.50 and 3.45 are all statistically significant at the 1% level.

Table 3: Cross-Sectional Dependence Test Results

	Test Stat	Probability
Panel A: Equation for Urbanization		
Breusch and Pagan (1980) LM Test Statistic	3233.38***	0.00
Pesaran (2004) CD LM	51.06***	0.00
Frees CD Test Statistic	9.13***	0.00
Panel B: Equation for Financial Development		
Breusch and Pagan (1980) LM Test Statistic	1281.00***	0.00
Pesaran (2004) CD LM	12.50***	0.00
Frees CD Test Statistic	3.45***	0.00

*** indicates the rejection of the null hypothesis of no cross-sectional dependence at the 1% level, respectively.

To account for the presence of cross-sectional dependence in the panel, the study estimates the static panel models using the Driscoll and Kraay (1998) standard errors. Specifically, the test statistics for the fixed effects, POLS and random effects panel models were computed using Driscoll and Kraay standard errors. Table 4 displays the static and dynamic panel estimation results of the effect of financial development on urbanization. The results from the POLS estimation of equation (1) are presented in Column 1 of Table 4. The results show that financial development has a positive effect on urbanization. The coefficient estimator for FD (0.23, *t*-stat = 7.08) is positive and statistically significant at the 1 percent level. The coefficient estimator for GR (-0.07) is negative and statistically insignificant. However, the results from the POLS may be biased as they are obtained from time invariant unobservable. To mitigate this weakness, the study implements the FE and RE models. However, prior to implementing the FE and RE models the study conducted the Breusch and Pagan (1980) Lagrangian multiplier (B-P LM) test and the

Hausman test to determine which of the two is the most appropriate for the panel. As can be seen from Column 3 of Table 4, the test statistic for the B-P LM is 9006.84 and it is statistically significant at the 1 percent level. This result suggests that the null hypothesis of no random effects in the panel should be rejected. Similarly, the computed Hausman test statistic (0.21, *p*-value= 0.90) displayed in Column (3) of Table 4 is statistically insignificant. This result suggests that the RE method is the most appropriate specification for the panel. Taken together, the results from both the B-P LM and Hausman tests indicate that the RE model should be preferred over the FE technique. Based on the results from these two tests, the study discusses only the results from the RE model. Hence, the results from the FE model of equation (3) presented in Column 2 of Table 4 will not be discussed.

Table 4: **Static and Dynamic Panel Estimation of the Effect of Financial Development on Urbanization**

	Static Panel				*Dynamic Panel*
	(1)	(2)	(3)	(4)	(5)
Independent Variables	POLS	FE	RE	MLE	GMM *1-step*
URB_{t-1}	—	—	—	—	1.52*** (44.56)
URB_{t-2}	—	—	—	—	-0.52*** (-15.16)
FD_t	0.23*** (7.08)	0.17*** (3.13)	0.17*** (3.18)	0.18*** (6.21)	0.02*** (3.17)
FD_{t-1}	—	—	—	—	-0.02*** (-3.24)
GR_t	-0.07 (0.10)	-0.05 (-0.44)	-0.05 (-0.48)	-0.05 (-0.81)	0.01*** (2.87)
Constant	29.88** (2.53)	30.94*** (14.57)	30.90 (1.38)	30.89*** (8.84)	0.13*** (2.63)
R^2	0.12	0.05	0.12	—	—
F-Statistics	26.60***	5.07***	10.25***	—	—
Wald x^2	—	—	—	—	719681.40***
B-P LM	—	—	9006.84***	—	—
Hausman Test	—	—	0.21 [0.90]	—	—
AR (2)	—	—	—	—	1.57 [0.12]
Sargan Test	—	—	—	—	597.43 [0.94]
Observations	756	756	756	756	756
No. of Countries	14	14	14	14	14

***, ** and * represent 1%, 5% and 10% level of significance. Note: Figures in parentheses are *t*-statistics. Figures in brackets are estimated p-values. Sargan test refers to the overidentification test for the restrictions in GMM estimation. FD = financial development proxied by domestic credit to private sector (% of GDP), GR= annual growth of GDP and

Urbanization = % of urban population. B-P LM tests for random effects. Hausman test refers to the Hausman specification test. GMM *1-step* refers Arellano and Bond (1991) panel estimation technique

Column 3 of Table 4 presents the results from the RE model of equation (5) showing the effect of financial development on urbanization. It can be observed that the coefficient estimator for FD (0.17, *t-stat*. = 3.18) is positive and statistically significant at the 1 percent level. This result implies that a unit increase in the financial development variable, on average, leads to approximately 17 percent growth in urbanization. The *F*-statistic (10.25) indicates that the model is well-specified. To check the robustness of the result from the RE model, the study employed the maximum likelihood estimator (MLE). The results from the MLE are displayed in Column 4 of Table 4. The coefficient estimator for FD (0.18, *t-stat* = 6.21) is positive and statistically significant at the 1 percent level. This result suggests that a unit increase in financial development promotes growth in urbanization by roughly 18 percent. From Column 4 of Table 4, it can be observed that the coefficient estimator for GR (-0.05) is negative and statistically insignificant. Taken together, the results from the static panel models of RE and MLE indicate that financial development engenders urbanization for the countries under study.

The conventional panel data approaches of fixed- and random-effects models tend to yield biased and inconsistent parameter estimates due to possible endogeneity problem that might be present in the panel. To correct for this weakness, the generalized method of moments (GMM) developed by Arellano and Bond (1991) is employed. The advantage of the GMM method over the FE and RE approaches stems from the fact that it can mitigate the endogeneity problem that may be present in the panel by using instrumental variables to produce the equivalent moment condition equation. This study utilized the lags of financial development, urbanization, and economic growth as instrumental variables in estimating the GMM models.

Prior to estimating the Arellano and Bond (1991) GMM model of equation (7), the study checked the validity of the selected instruments using the Sargan over-identifying restrictions test and the AR2 serial correlation procedure. The Sargan test is asymptotically distributed as chi-squared under the null hypothesis of no over-identifying restrictions. The result from the serial correlation AR (2) test (1.57, *p*-value =0.12) presented in Column 5 of Table 4 suggests that the null hypothesis of no serial correlation in the residuals should not be rejected. Similarly, the Sargan test statistic (597.43, *p*-value = 0.94) reported in Column 5 of Table 4 confirms the validity of the chosen instruments. This result suggests that the instruments utilized in the GMM estimation are not rejected by the Sargan test of over-identification.

Having established the validity of the instruments, the study next utilizes the Arellano and Bond (1991) GMM model to ascertain the dynamic effect of financial development on urbanization. The results from the Arellano and Bond (1991) GMM model of equation (7) are displayed in Column 5 of Table 4. The results reveal that the coefficient of delayed urbanization (URB_{t-1}) has a positive and statistically significant effect on current level of urbanization (URB_t). The coefficient (1.52, *t*-stat = 44.56) of URB_{t-}

$_1$ is statistically significant at the 1% level of significance. This result implies that 1% increase in lagged urbanization (URB_{t-1}) promotes current urbanization (URB_t) level by roughly 152%. However, the coefficient estimator for URB_{t-2} (-0.52, *t*-stat = -15.16) is negative and statistically significant at the 1% level. This result indicates that the second lag of urbanization (URB_{t-2}) has a detrimental effect on current urbanization (URB_t). The results further show that financial development has contemporaneous effect on urbanization as the coefficient estimator (0.02, *t-stat* = 3.17) for FD_t is positive and statistically significant at the 1% level of significance. This result suggests that 1% increase in the financial development variable leads to approximately 2% increase in urbanization. Contrarily, financial development has negative lagged effect on urbanization given that the coefficient estimator for FD_{t-1} (-0.02, *t-stat* = -3.24) is negative and statistically significant at the 1% level. As expected, economic growth has significantly positive effect on urbanization. The coefficient estimator for GR_t (0.01, *t-stat* = 2.87) is positive and statistically significant at the 1% level. This result implies that 1% increase in economic growth leads to approximately 1% increase in urbanization.

Table 5: Static and Dynamic Panel Estimation of the Effect of Urbanization on Financial Development

	Static Panel				Dynamic Panel
	(1)	(2)	(3)	(4)	(5)
Independent Variables	POLS	FE	RE	MLE	GMM *1-step*
FD_{t-1}	—	—	—	—	1.01*** (209.95)
URB_t	0.53*** (20.58)	0.27*** (4.85)	0.27*** (5.06)	0.27*** (6.15)	0.79*** (3.75)
URB_{t-1}	—	—	—	—	-0.80*** (-3.77)
GR_t	-0.11 (-0.97)	-0.03 (-0.48)	-0.03 (-0.52)	-0.03 (-0.39)	-0.05** (-2.16)
Constant	3.08*** (2.67)	11.57*** (8.11)	11.45 (1.13)	—	0.19 (0.62)
R^2	0.12	0.05	0.12	—	—
F-Stat	233.50***	11.94***	26.13***		
Wald x^2 Stat	—	—	—	37.31***	48982.78***
B-P LM	—	—	11834.21***	—	—
Hausman Test	—	—	1.14 [0.57]	—	—
AR(2)	—	—	—	—	-0.25 [0.80]
Sargan Test	—	—	—	—	685.57 [0.18]
Observations	756	756	756	756	756
No. of Countries	14	14	14	14	14

***, ** and * represent 1%, 5% and 10% level of significance. Note: Figures in parentheses are *t*-statistics. Figures in brackets are estimated p-values. Sargan test refers to the overidentification test for the restrictions in GMM estimation.

FD = financial development proxied by domestic credit to private sector (% of GDP), GR= annual growth of GDP and Urbanization = % of urban population. B-P LM tests for random effects. Hausman test refers to the Hausman specification test. GMM *1-step* refers Arellano and Bond (1991) panel estimation technique

Table 5 presents the static and dynamic panel estimation results of the effect of urbanization on financial development. The results from the POLS of equation (2) are displayed in Column 1 of Table 5. The results show that urbanization has significantly positive impact on financial development. The coefficient estimator for URB_t (0.53, *t*-stat = 20.58) is positive and statistically significant at the 1 percent level. The coefficient estimator for GR (-0.11, *t*-stat = -0.97) is negative and statistically insignificant. The coefficient of determination R^2 is 0.12. The *F*-statistic is 233.50 and statistically significant at the 1% level, indicating that the model is well-specified. The computed B-P LM test statistic displayed in Column 3 is 11,834.21 and statistically significant at the 1 percent level. This result indicates that the null hypothesis of no random effects in the panel should be rejected in relation to the equation for financial development. Furthermore, the Hausman test statistic (1.14, *p*-value = 0.57) reported in Column 3 is statistically insignificant and the *p*-value exceeds 5% alpha. Taken together, the results from both the B-P LM and Hausman tests reveal that the RE panel estimation approach should be preferred over the FE technique. Again, based on the results from these two diagnostic tests, the study discusses only the results from the RE panel estimation approach. Consequently, the results from the FE model of equation (4) presented in Column 2 of Table 5 will not be considered.

Column 3 of Table 5 presents the results from the estimation of the RE model of equation (6) showing the impact of urbanization on financial development. From Column 3 of Table 5, the coefficient estimator for URB_t (0.27, *t*-stat=5.06) is positive and statistically significant at the 1 percent level. This result indicates that 1% increase in the urbanization, on average leads to approximately 27% increase in urbanization. The *F*-statistic (26.13) indicates that the model is correctly specified. To once again verify the robustness of the result obtained from the RE model, the study implemented the MLE. The results from the MLE are presented in Column 4 of Table 5. The coefficient estimator for URB_t (0.27, *t*-stat = 6.15) is positive and statistically significant at the 1% level. This result implies that 1% increase in urbanization leads to roughly 27% increase in financial development. From Column 4 of Table 5, it can be noticed that the coefficient estimator for GR (-0.03) is negative and statistically insignificant. The results from the MLE collaborate those from the RE model. In all, the results from the static panel models of RE and MLE suggest that urbanization promotes financial development for the sample countries.

Prior to estimating the Arellano and Bond (1991) GMM model of equation (8), the study once again, applied the AR (2) serial correction test and the over-identifying restrictions test. The serial correlation AR(2) test statistic (-0.25, *p*-value =0.80) displayed in Column 5 of Table 5 indicates that the null hypothesis of no serial correlation in the residual terms should not be rejected. Equally, the Sargan test statistic (685.57, *p*-value = 0.18) reported in Column 5 of Table 5 confirms the validity of the chosen instruments.

Given the results from these two diagnostics tests, the study next implements the GMM panel estimation approach to determine the effect of urbanization on financial development. The GMM dynamic panel estimator results are displayed in column 5 of Table 5. The results show that the current level of urbanization (URB_t) has a positive and statistically significant effect on financial development. The coefficient estimator of URB_t (0.79, *t*-stat = 3.75) is positive and statistically significant at the 1% level. This result suggests that 1% increase in urbanization leads to roughly 79% improvement in financial development. However, the coefficient estimator of lagged urbanization (URB_{t-1}) (-0.80, *t*-stat = -3.77) is negative and statistically significant at the 1% level. The coefficient estimator of FD_{t-1} (1.01) is positive and statistically significant at the 1% level. This result implies that 1% increase in lagged financial development (FD_{t-1}) increases the current financial development by roughly 101%. The coefficient estimator for GR_t (-0.05, *t*-stat = -2.16) is negative and statistically significant at the 5% level. This result suggests that 1% increase in economic growth retards financial development by approximately 5%. In all, the results obtained from both the static and dynamic panel approaches reveal that financial development and urbanization have significantly positive effect on each other.

V1. CONCULSIONS AND IMPLICATIONS

This paper has examined the interaction between financial development and urbanization for a group of 14 African countries using static and dynamic panel estimation techniques. The sample countries include Benin, Burkina Faso, Cameroun, Cote d'Ivoire, Ghana, Gabon, Kenya, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Togo, and Zambia. To test for the presence of cross-sectional dependence among the panel members, the study applied the Breusch and Pagan (1980), Pesaran (2004) and Frees CD LM techniques. The study implemented the fixed effects, POLS, and the random effects panel models for static interactions between financial development and urbanization. To choose the appropriate model between the random- and fixed-effects models, the study applied the Breusch and Pagan (1980) and the Hausman tests. For dynamic interactions between financial development and urbanization, the study employed the Arellano and Bond (1991) GMM dynamic panel estimator.

The results obtained from the three cross-sectional dependence tests provide evidence that the residuals of the panel member countries are corrected. To correct for the existence of correlation in the residuals, the random- and fixed-effects models were estimated using the Driscoll and Kraay standard errors. Based on the test statistics from both the Breusch and Pagan (1980) and the Hausman tests, the results from the random-effects model are preferred over those from the fixed-effects estimation technique. The results from the random effects model provide evidence that financial development and urbanization have statistically significant impact on one another. Similarly, the results from the Arellano-Bond dynamic panel estimation technique reveal that financial development and urbanization have significant contemporaneous effect on each other. Furthermore, the results from the GMM reveal that the two variables have negatively delayed effect on each other. Taken together, the results from both the static and dynamic panel estimation approaches reveal that financial development and urbanization have significantly positive influence on each other. The finding that financial development engenders urbanization is consistent with Cho, Wu., and Boggess (2003), Kyung-Hwan (1997) and Stopher (1993) who have documented the importance of finance in providing the necessary capital for funding infrastructure including railway transportation, real estate, energy facilities and land investment. From policy perspective, the results from this study imply that policymakers should be cognizant of the fact regarding the feedback relationship between financial development and urbanization. In short, policies designed to promote financial development may also be beneficial to urban development and vice versa.

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