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Impact of Inflation on Firm Capital Structure Decisions in Nigeria: A Panel Data Approach

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Abstract:
The study provides empirical evidence on the relationship between inflation and firm capital structure dynamics in Nigeria using firm-level panel data comprising 21 quoted companies over a period of 10 years from 2007 to 2016. Three variants of inflation; core inflation, food inflation and headline inflation, are considered while capital structure is proxied by debt-equity ratio. When the three conventional panel data models; pooled least square, fixed effects and random effects models are estimated and compared, the results show that the random effects model is the most plausible description of the relationship between inflation and firm capital structure. The random effects results show that firm's financial leverage has a negative relationship with both core and food inflation rates but has a positive relationship with headline inflation rate. However, while none of the estimated coefficients is significant statistically, we argue that given the relatively large size of these coefficients, they are significant economically. Therefore, we conclude that Nigerian firms increase the level of their financial leverage in response to an increase in headline inflation rate but reduce it in response to an increase in both core and food inflation rates.

Keywords*: Inflation, capital structure, debt-equity ratio*

1. Introduction

There is no doubt that capital structure and its determinants have continued to be a major issue in the finance literature. According to Myers (1984), the capital structure debate is tougher than any other debates in corporate finance including the dividend puzzle. The modern literature in this line of research starts from the influential work of Modigliani and Miller (1958). The initial argument is that given a firm's investment decision and business risk, the choice of capital mix has no consequence either on the firm's internal performance or on its external value. However, so many factors (both firm-specific and macroeconomic) were held constant in the original Modigliani and Miller's model which many authors have criticized. For example, the assumptions that firms do not pay corporate taxes and there are no transaction costs in the stock market implies that the macroeconomic environment is static and can be predicted with accuracy. These assumptions have been viewed by many authors as unrealistic and bogus.

In reality, the macroeconomic environment is dynamic, largely uncertain and exerts significant influence on the firms' internal operations and corporate decisions. The influence of macroeconomic factors on corporate decisions has also received considerable attention in the recent empirical literature (Bokpin, 2009; Camara, 2012; Frank& Goyal, 2009; Gajurel, 2006;Kaloudis& Tsolis, 2018; Mokhova & Zinecker, 2014; Taddese Lemma&Negash, 2013). The Among the important macroeconomic factors in corporate decisions identified by these studies is inflation.

The role of inflation in influencing corporate practices and decisions is well documented in financial literature. Corporate managers make corporate decisions in the areas of investment, financing and dividend to influence corporate activities in the face of uncertainty that characterize business environments, to improve corporate earnings and increase the welfare of the main stakeholders. However, financial economists agree that inflation is a social ill that imposes welfare costs. Even at its anticipated level, inflation can cause distortions in the distribution of income and wealth. Furthermore, unanticipated inflation leads to higher cost of capital, lower investments (Chen & Boness, 1975) and increases business risk (Hatzinikolaou, Katsimbris, & Noulas, 2002).

The trade-off theory of capital structure provides a theoretical link between inflation and capital structure decision of a firm (Köksal& Orman, 2015). The theory predicts that inflation and firm financial leverage move in the same direction. An inflation-induced nominal increase in rate of interest increases the tax benefit of debt and provides an incentive for the use of more debt than equity in financing new projects. Thus, there is positive relationship between inflation rate and firm financial leverage. However, empirical studies in both developing and developed countries indicate mixed evidence.

The aim of this study is to provide empirical evidence on the relationship between inflation and firm capital structure decisions in Nigeria. In particular, the study compares the three static panel data methods; pooled, fixed effects and random effects, in the context of the relationship between inflation and debt-equity ratio of 21 quoted Nigerian firms selected over different industries over the period from 2007 to 2016. The motivation of this study is twofold. First, the

inclusion of three inflation variants; core, food and headline inflation rates, in the capital structure model is novel in the Nigerian literature. So far, only the effect of headline inflation rate has received empirical consideration in the Nigerian literature. Second, the consideration of the three panel data models in the study of 21 quoted countries makes the current study distinct from previous Nigerian studies.

The remainder of this study has the following structure: The next section focuses on literature. Both the theoretical and empirical studies are reviewed. Section 3 describes the data, methods and model for empirical analysis. The empirical analysis and discussion of findings are provided in section 4 while the study is concluded in section 5.

2. Literature Review

The trade-off theory of capital structure provides a theoretical link between inflation and capital structure decision of a firm (Köksal & Orman, 2015). The theory predicts that inflation and firm financial leverage move in the same direction. An inflation-induced nominal increase in rate of interest increases the tax benefit of debt and provides an incentive for the use of more debt than equity in financing new projects. Thus, there is positive relationship between inflation rate and firm financial leverage. However, empirical studies in both developing and developed countries indicate mixed evidence.

Noguera (2001) considers the effect of inflation tax on a firm's capital structure for a panel of 40 major companies in US over the period from 1978 to 1996. The results obtained the pooled least square regression indicate amongst others that inflation does not have explanatory power for capital structure.

Gajurel (2006) considers the effects on capital structure choices of macroeconomic factors; GDP, Inflation and market capitalization ratio to GDP, in Nepal for a period of 10 years from 1995 to 2004. The results show that both GDP growth and inflation rate have negative relationship with both total debt ratio and short-term debt ratio. However, inflation rate has a positive relationship with long-term debt ratio.

Frank and Goyal(2009) considers the relative importance of several factors affecting capital structure decisions of quoted American firms from 1950 to 2003. The results suggest that inflation is among the reliable factors that exert positive influence on market leverage. However, the effect of inflation on book leverage is unreliable.

Bokpin (2009) use the seemingly unrelated regression to study the impact of macroeconomic variables on capital structure decisions for a panel of 34 countries over a period from 1990 to 2006. The findings show amongst others that inflation has a positive influence on the choice of short-term debt over equity.

Camara (2012) examine the effects of macroeconomic variables and macroeconomic conditions on capital structure decisions of US based multinational firms relative to domestic firms using an integrated dynamic partial-adjustment model. The empirical results show that consumer price index and other macroeconomic factors have significant impact on financial decisions of the sampled firms.

In Thailand, Tongkong (2012) uses both multiple linear panel regression and dynamic panel GMM regression to examine whether inflation is among the significant factors affecting capital structure decision of 39 quoted real estate firms for the period 2002 – 2009. The results suggest that inflation and other macroeconomic variables are not among the significant explanatory factors for firm capital structure.

Taddese Lemma and Negash(2013) examine the influence of institutions, macroeconomic factors, industry and firm-specific factors on firm's capital structure decision innine African countries using the system GMM and seemingly unrelated regression. The sample 986 firms the period spans from 1999 to 2008. The results show that among the factors that influence capital structure decisions are legal and financial institutions, GDP growth rate and inflation.

Mokhova and Zinecker(2014) examine the effects of macroeconomic factors on firm capital structure forseven European countries from 2006 to 2011. The countries included are Czech Republic, Hungary, Slovakia and Poland, Greece, France and Germany. Empirical results obtained from both correlation and regression analysis indicate mixed evidence. They find thatinflation and capital structure are weakly and insignificantly correlated in most of the countries except France and Hungary. For France, inflation has a strong positive correlation with total leverage ratio and short-term debt ratio but has a strong correlation with long-term debt ratio. For Hungary, inflation has a negative and insignificant correlation with all the capital structure variables.

Köksal and Orman (2015) examine the capital structure determinants in Turkey using an unbalanced panel of 11726 non-financial firms over the period from 1996 to 2009. The study includes firm-specific factors, tax related factors, industry-specific factors and macroeconomic factors in a firm leverage model and compares two capital structure theories; trade-off and pecking order theories. According to the authors, while the trade-off theory argues that exists positive relationship between inflation and capital structure, pecking order theory argues that inflation plays no role in a model of capital structure. Supporting the trade-off theory, the panel data regression results show that inflation is among the factors that exert a strong positive influence on capital structure such that a 5% decrease in the average firm's debt are due solely to a decrease in inflation.

Kaloudis and Tsolis (2018) examine the effect of both firm-specific and macroeconomic factors on capital structure decisions of US firms using the quantile regression approach, with data covering from 1970 to 2014. The study finds that the main determinant of capital structure is the lagged value of debt ratio while the role of macroeconomic factors is secondary. Inflation is found to be a significant factor for firm capital structure.

3. Methodology

3.1. Data and Sample

To examine the impact of inflation on capital structure decisions in Nigeria. we use firm-level panel data at yearly frequency for 21 quoted companies over the period from 2007 to 2016. The companies, which were selected from different sectors, include Nigerian Breweries, Nestle, First Bank, United Bank for Africa, Oando, Julius Berger, UPDC, Dangote Cement, Lafarge, Livestock Feeds, Okomu Oil, Academy Press, University Press, May & Baker, Morrison, NCR, Tripple Gee, A. G. Levent is, John Holt, Alumin. Extru Ind and BOC Gases. Three inflation variants; core inflation, food inflation and headline inflation, are considered while capital structure is proxied by debt-equity ratio. The inflation data are obtained from the CBN statistical bulletin while debt to equity ratio is calculated from the data obtained from the firm annual reports. The empirical analysis is done in E Views 9.

3.2. Model Specification

We specify our empirical model as follows:

$DER_{it} = \beta_0 + \beta_1 CINF_{it} + \beta_2 FINF_{it} + \beta_3 HINF_{it} + k_i + u_{it}$

Where DER = debt to equity ratio, CINF = core inflation, FINF = food inflation and HINF = headline inflation. Further, β_0 = the intercept term, k_i = the company-specific latent parameter which controls for cross-sectional heterogeneity, β_1, β_2 and β_3 are regression betas and u_{it} = the error terms. The cross-sectional dimension of our panel data is represented by i, its time series dimension is represented by t. We assume that the specified relationships are constant both cross-sectionally and over time, hence, there is no subscript attached to the β's.

Empirically, there are three conventional methods of solving a panel data model; pooled regression, fixed effects and random effects methods. While these methods have their specific assumptions about the heterogeneity term, it is traditional to compare their relative performance using some formal tests. Two of these tests; Likelihood ratio and Hausman tests would be used to determine the best performing model for our panel data.

4. Empirical Analysis

4.1. Panel Data Regression Results

Table 1 shows the estimated pooled least square, fixed effects and random effects models for the relationship between the three inflation variants; core, food and headline inflation rates, and debt equity ratio. Panel A shows the model parameter estimates while panel B shows the model fit and model diagnostic tests. Table 2 shows the model specification tests.

1	2		3		4	
Variable	**PLSM estimate**		**FEM estimate**		**REM estimate**	
Panel A: Model parameter estimates						
Constant	2.9835	(0.0010)	2.9356	(0.0000)	2.9650	(0.0000)
LCINFL	-0.3633	(0.5975)	-0.3723	(0.4581)	-0.3688	(0.4619)
LFINFL	-0.4756	(0.7382)	-0.4650	(0.6530)	-0.4604	(0.6561)
LHINFL	1.0695	(0.8654)	1.0870	(0.4215)	1.0783	(0.4250)
Panel B: Goodness of fit statistics and diagnostic tests						
R-squared	0.0053		0.5319		0.0110	
Adjusted R-squared	-0.0103		0.4689		-0.0045	
F-statistic	0.3397		8.4482		0.7083	
Prob(F-statistic)	0.7965		0.0000		0.5481	
Durbin-Watson	0.5220		1.1107		0.9976	

Table 1: Panel Data Regression Results
Source: Output from E Views

DV = Dependent variable
PLSM = Pooled Least Square Method
FEM = Fixed Effects Method
REM = Random Effects Method
( ) contains p-value of t-statistic

From panel A of table 1, we can see that the results for different methods are broadly comparable, with all the estimated coefficients associated with very high probabilities, indicating that none of the three variants of inflation rates; core, food and headline, has significant relationship with debt to equity ratio of the sampled firms. Further, for all methods, both LCINFL and LFINFL are associated with a negative coefficient (betas < 0) while LHINFL has a positive coefficient (beta > 0). This indicates that debt to equity ratio has a negative relationship with both core inflation and food inflation rates but has a positive relationship with headline inflation rate.

From panel B of table 1, the R-squared is almost zero for both the pooled least square (R^2_{pooled} = 0.0053) and random effects R^2_{Random} = 0.0110) methods but reasonably high for the fixed effects method (R^2_{Fixed} = 0.5319). Also, the F-statistic is too low with very high probability for both pooled least square (F-statistic = 0.3397, p-value = 0.7965) and

random effects (F-statistic = 0.7083, p-value = 0.5681) methods but relatively high with zero probability for the fixed effects method (F-statistic = 8.4482, p-value = 0.0000). Thus, from the perspectives of both pooled least square and random effects methods, there is almost a zero relationship between the three variants of inflation rates and debt to equity ratio of the sampled firms, while from the fixed effects perspective, these variables are highly significantly related and the model linking them is reasonably fitted. Compared with the pooled least square and random effects methods, the fixed effects Durbin Watson is also quite high (DW = 1.1107), suggesting that the fixed effects method performs better than both pooled least square and random effects methods. However, formal tests are required to confirm which method is the most appropriate for the relationship between inflation and capital structure.

Table 2 shows the likelihood ratio and Hausman tests which formally compare the performance of the fixed effects methods with both the pooled least square and random effects method. Consistent with the pooled least square assumption, the Likelihood ratio test tests the null hypothesis that the unobserved firm specific factors are irrelevant in our specified debt to equity ratio model. A rejection of this null hypothesis would imply evidence in favour of the fixed effects method. On the other hand, the Hausman test tests the null hypothesis that these unobserved effects are uncorrelated with the three inflation variants. A rejection of this null hypothesis would also imply evidence in favour of the fixed effects method.

Test	$\chi^2 - \textbf{statistic}$	**p-value**
Likelihood Ratio test	146.983	0.0000
Hausman Test	2.3567	0.5017

Table 2: Model Selection Tests
Source: E views Results Output

From table 2, the Likelihood ratio test (χ^2-statistic = 146.983) is associated with zero probability (p-value = 0.0000), indicating that the test is highly significant. Thus, the null hypothesis that the unobserved firm-specific effects are irrelevant is rejected at less than 1% significance level. This implies that the fixed effects method outperforms the pooled regression method. On the other hand, the value of Hausman test statistic is 2.3567 with a probability of 0.5017, indicating that the test is insignificant. Therefore, we cannot reject the null hypothesis that the unobserved firm-specific effects are uncorrelated with the three inflation variants. This implies that the random effects method outperforms the fixed effects method. In conclusion, there is clear evidence that the random effects beta estimates in column 4 of table 1 are more reliable than those of pooled least square and fixed effects in columns 2 and 3 respectively.

4.2. Discussion of Findings

The random effects results in Column 4 of Table 1 show that statistically, core, food and headline inflation rates all have no significant relationship on debt-equity ratio, both individually and collectively. However, based on the size of the betas, one can say that the effects of these inflation rates all are economically significant, although, there is mixed evidence on the direction of their impacts. The sign of both core and food inflation coefficients tend to be consistent with the view that in a repressed economy, increase in inflation gives firms disincentive to use more debt relative to equity (Cebenoyan, Fischer, & Papaioannou, 1995). The coefficients of -0.3688 and -0.4606 suggest that both core and food inflation rates move in opposite direction with firm debt-equity ratio. In other words, debt-equity ratio would decrease by approximately 0.37% and 0.46% following a 1% increase in core and food inflation rates respectively. Thus, food inflation rate has more economic impact on capital structure than core inflation rate which we attribute to the volatile nature of the former. On the other hand, the sign of headline inflation tends to be consistent with the view that inflation-induced increase in nominal rate of interest increases the tax benefit of debt (Koksal, Orman, & Oduncu, 2013). The coefficient of 1.0783 implies that financial leverage moves in the same direction with headline inflation rate. A 1% increase in headline inflation leads to approximately 1.08% increase in debt relative to equity. Thus, the response of quoted Nigerian firms to changes in headline inflation in terms of their capital structure is in line with static trade-off theory.

5. Conclusions

In this study, we examine the effects of the three inflation variants on capital structure using Nigerian firm-level panel data. The study also considers the effects of unobserved firm-specific factors on the relationship between inflation and capital structure. The three inflation variants are core, food and headline inflation rates while debt-equity ratio is used as a proxy for capital structure. The study covers the period from 2007 to 2016.

When the three conventional panel data models; pooled least square, fixed effects and random effects models are estimated and compared, the results show that the random effects model is the most plausible description of the relationships of interest. Although, the Likelihood ratio tests indicates that the fixed effects model outperforms the pooled least square model, the Hausman specification, however, indicates that the random effects model, which assumes that firm-specific effects are uncorrelated with inflation in the capital structure specification, performs better than the fixed effects model, which assumes that the firm-specific factors are correlated with inflation.

The random effects results show that firm's financial leverage has a negative relationship with both core and food inflation rates but has a positive relationship with headline inflation rate. However, while none of the estimated coefficients is significant statistically, we argue that given the relatively large size of these coefficients, they are significant economically. Therefore, we conclude that Nigerian firms increase the level of their financial leverage in response to an increase in headline inflation rate but reduce it in response to an increase in both core and food inflation rates.

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