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Cash flow volatility and capital structure in MENA and Africa: the moderating role of fixed assets

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ABSTRACT

This paper investigates the direct association between cash flow volatility and capital structure (i.e. debt ratio). This study further examines the moderating role of fixed assets on the association between cash flow volatility and capital structure in the Middle East and North Africa (MENA) and African markets. This study applies a two-step system generalized method of moment regression as the main estimation technique to minimize endogeneity concern. The data consist of non-financial listed firms in 20 MENA and African countries covering 2011 to 2020. The results reveal that cash flow volatility is significantly and positively related to capital structure of MENA and African firms. The results also reveal that fixed assets have a negative moderating impact on the relationship between cash flow volatility and the capital structures of MENA and African firms. The results are robust to different estimation techniques. The findings inform managers to consider cash flow stability as a major factor in corporate risk management and strategic decision making and consider fixed asset investment decisions and the quality of fixed assets as a significant factor in debt choice. Moreover, policymakers should formulate efficient capital structure policies that consider cash flow stability factors and encourage fixed asset investments.

IMPACT STATEMENT

This study investigates the direct impact of cash flow volatility on capital structure (*i.e.,* debt ratio) and examines the moderating impact of fixed assets on the link between cash flow volatility and capital structure of listed firms in 20 Middle East and North Africa (MENA) and African countries spanning 2011 to 2020 applying the panel two-step system generalized method of moment as the main estimation method. The findings reveal that cash flow volatility increase debt ratio in the firms' capital structure while the fixed assets negatively moderate the positive link between cash flow volatility and debt ratio in the firms' capital structure. The findings suggest that managers should consider cash flow stability and fixed assets quality as important factors in corporate risk management and debt choice. Besides, policymakers and investors should encourage capital structure and investment policies that consider cash flow stability and quality of fixed assets to mitigate risk of financial distress that can reduce investment value.

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1. Introduction

Despite the rich theoretical literature on cash flow management effect on firm's financing choice, the empirical literature is indecisive. Finance literature has focused on the major factors driving capital structure and financing behaviour. This study explores the association between recent trends in finance literature by investigating the effect of cash flow volatility on capital structure and the moderating effect of fixed assets. Harris and Roark (2019) and Keefe and Yaghoubi (2016) argued that cash flow volatility positively impact capital structure. Conversely, Memon et al. (2018) finds a negative association between cash flow volatility and capital structure. Keefe and Nguyen (2023) noted that cash flow volatility appears to be a determinant of capital structure and further research is needed.

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Middle East and North Africa (MENA) and African markets are considered inefficient and developing markets which makes them an ideal testing ground for financial theories grounded on developed markets. Nguyen et al. (2021), Flannery and Hankins (2013), and Matemilola et al. (2018) define capital structure as the debt and equity mix used to fund a firm's investments. The literature of capital structure emphasizes on the positive association of leverage on performance and value of firms (e.g. Kraus & Litzenberger, 1973; Modigliani & Miller, 1963; Myers, 1984; Ross, 1977). However, the literature also recognizes the association of higher costs, such as agency costs, financial distress, and bankruptcy costs (Etudaiye-Muhtar et al., 2017; Modigliani & Miller, 1963; Nguyen et al., 2021).

A healthy cash flow stream is a significant consideration in investment decisions (e.g. investors), financial decisions (e.g. managers), and solvency decisions (e.g. creditors). Investors and creditors rather avoid investments with unstable cash flows and negatively view firms with volatile cash flows (Firmansyah & Novianti, 2020; Vengesai & Kwenda, 2018). Volatile cash flow produces capital disruption, lowers firm's debt repayment capacity, and discourages investments (Shaheen et al., 2021). Another consideration is fixed assets which are tangible assets acquired by firms for long-term usage; Frank and Goyal (2009) consider such corporate assets easier to value by creditors or investors, which lowers financial distress. Considering fixed asset in the study is vital, Denis and McKeon (2018) observed a decline in fixed asset investments by firms in recent years (i.e. tangible assets), which impacted major financial characteristics of firms, such as capital allocation, financial policy, and profitability. When financial needs arise, fixed assets are used as collaterals by creditors to lower credit risk (Li & Islam, 2019). Hence, fixed assets affect debt capacity, and therefore, its capital structure. Following the literature, this study uses capital structure and debt ratio interchangeably, and also uses fixed assets and tangible assets interchangeably.

By investigating the impact of cash flow volatility on capital structure and the moderating effect of fixed assets, this study enriches the existing literature by considering an important research gap that is overlooked in the literature. This study draws insights from the pecking order and trade-off theories of Myers and Majluf (1984), and Fazzari et al. (1988) cash flow sensitivity theory. This study also makes a first attempt to examine how fixed assets moderate the link between cash flow volatility and capital structure. Considering the importance of fixed assets, Denis and McKeon (2018) noted that less fixed assets investments have changed firms' strategies and earnings patterns recently.

Past researchers have examined how cash flow volatility is linked to capital structure in the developed nations. However, the literature on how cash flow volatility affect capital structure is limited and inconclusive in Africa and MENA nations (Vengesai & Kwenda, 2018). Such developing markets are characterized by inefficient capital markets, bank-based financial systems, and economic volatility (Awartani et al., 2016). Moreover, this study used a large sample of 10,890 listed firms to represent the Africa and MENA nations.

2. Literature review

2.1. Theoretical literature

The foundation of capital structure literature started with Modigliani and Miller (1958) theory, which posits that capital structure has no effect on firm value in a perfect capital market. The second proposition of Modigliani and Miller (1963) considered the tax effects as a source of imperfection which makes capital structure relevant.

The capital structure literature is grounded on pecking order theory, agency theory, and the trade-off theory (Matemilola et al., 2018). External funding decisions in firms are based on the conflicting capital structure theories of trade-off theory and pecking order theory (Guizani & Ajmi, 2021; Saif-Alyousfi et al., 2020). Kraus and Litzenberger (1973) trade-off theory argues that capital structure directly impacts value, and an optimal capital structure exists that equates the costs and benefits of debt. The pecking order theory focuses on financing hierarchy starting with retained earnings, followed by debt, and equity is the last option (Myers & Majluf, 1984). In the context of the notion that managers favour retained earnings as a source of finance (Myers & Majluf, 1984), agency theory suggests that an optimal capital structure produces the lowest agency cost (Mitnick, 1975). Likewise, Jensen and Meckling (1976) view of agency theory posits that the optimal debt level exist that equates the costs and benefits of debt.

Like the classical theories of capital structure, trade-off theory is inadequate to explain capital structure because of the unrealistic assumptions (Myers, 1977). Therefore, we draw insights from the pecking order theory and cash flow sensitivity theory to explain how cash flow volatility is linked to capital structure. Fazzari et al. (1988) state that firms rely more on retained earnings face volatile cash flows and unstable liquidity position. In the context of the pecking order theory and cash flow sensitivity theory, cash flow volatility does not directly impact cost of capital; but it impacts the financing capacity which pushes firms to use costly source of finance.

2.2. Empirical literature

Despite the rich literature linking cash flow volatility and capital structure, the empirical literature remains inconclusive (Memon et al., 2018). The empirical literature establishes a significant association between capital structure and volatile cash flow (e.g. Harris & Roark, 2019; Memon et al., 2018). A major strand of the literature proposes a positive relationship between cash flow volatility and capital structure. Typically, higher cash flow volatility indicates increased risk within firms. Harris and Roark (2019) concluded that cash flow volatility causes operating cash flow deficits that motivate the use of debt, establishing that cash flow volatility is positively associated with capital structure. Correspondingly, Harris and Roark (2019) findings reveal firms with short-term cash deficits prefer debt over equity which suggest volatility seems to increase debt ratio. In contrast, Keefe and Yaghoubi (2016) report negative association between cash flow volatility and capital structure, considering fixed assets as a control variable.

Volatile cash flows produce short-term cash needs, and firms tend to use debt as an external financing source to satisfy financial needs when internal funds are depleted (Myers & Majluf, 1984). The negative implications of high leverage, such as default risk and agency cost, are recognized in the literature. Therefore, this study expects cash flow volatility to be positively associated with capital structure.

Hypotheses 1:

***H_1*:** There is a positive relationship between cash flow volatility and capital structure.

Generally, a higher level of fixed assets allows firms to have higher debt capacity since creditors examine fixed assets as a determinant of credit risk. In the case of increased financial distress, fixed assets act as collateral, minimizing credit risk, which facilitates external financing and motivates the use of debt (Guizani & Ajmi, 2021; Li & Islam, 2019; Saif-Alyousfi et al., 2020). Lower investments in fixed assets by firms might increase profitability, but lower debt capacity and increase cash flow volatility (Denis & McKeon, 2018). By improving access to debt finance, fixed assets can lower the impact of cash flow volatility on capital structure. Financing friction is defined as the limitation that firms are exposed to when using external financing sources. Denis and McKeon (2018) consider cash flow volatility and low fixed assets as financing friction. From this perspective, Myers and Majluf (1984) pecking order theory predicts a positive association between fixed assets and debt level.

Hypothesis 2:

***H_2*:** There is a negative moderating effect of fixed assets on the relationship between cash flow volatility and capital structure.

3. Methodology and data

3.1. Model specification

Dynamic economic models make a vital contribution to the literature on capital structure and cash flow management. However, the literature discusses a major defect: the endogeneity problem that refers to the correlation of explanatory variables with the error term (Matemilola et al., 2018; Tesema, 2024; Vengesai & Kwenda, 2018). Another discussed problem of dynamic economic models is the lagged dependent variable (i.e. the persistency problem). Accordingly, the most recent studies of capital structure and cash flow management adopted the panel system generalized method of moment 'GMM' (e.g. Matemilola et al., 2018; Shaheen et al., 2021; Tesema, 2024; Vengesai & Kwenda, 2018). The GMM model is considered consistent and unbiased. Nkoa (2018) stated that GMM model is commonly adopted in the

literature because of its ability to overcome endogeneity problem. Accordingly, this study follows Li and Islam (2019), Saif-Alyousfi et al. (2020), and Matemilola et al. (2018) by adopting static and dynamic panel models, including pooled OLS, pooled OLS with correction of autocorrelation and heteroskedasticity, the random effects (RE) model, the fixed effects (FE) model, and the two-step system generalized method of moments. This study used the two-step system generalized method of moments as the major model to test the proposed hypotheses.

Using evidence from MENA and African markets, this study examines the impact of cash flow volatility on capital structure and the moderating effect of fixed assets on such an association using the Stata analysis software. Moreover, this study uses the two-step system generalized method of moments (two-step system GMM) as the major method to test the proposed hypothesis. The specific model for this study to test the direct effect of cash flow volatility on capital structure (i.e. Hypothesis 1) is

$$\begin{aligned} TDEBT_{ij,t} = {} & \lambda TDEBT_{ij,t-1} + \beta_0 + \beta_1 SD\_EBITDTA_{ij,t} + \beta_2 TA\_TA_{ij,t} + \beta_3 D\_TA_{ij,t} + \beta_4 MBR_{ij,t} \\ & + \beta_5 SMG_{ij,t} + \beta_6 MLD_{ij,t} + \beta_7 IR_{ij,t} + \beta_8 GDP\_G_{ij,t} + \delta_i + \alpha_t + \mu_{it.} \end{aligned}$$

The specific model for this study to test the moderating effect of fixed assets on the association between cash flow volatility and capital structure (i.e. Hypothesis 2) is:

$$\begin{aligned} TDEBT_{ij,t} = {} & \lambda DEBT_{ij,t-1} + \beta_0 + \beta_1 SD\_EBITDTAt_{ij,t} + \beta_2 FA\_TA_{ij,t} + \beta_3 (SD\_EBITDA * FA\_TA)_{ij,t} \\ & + \beta_4 Ln\_TA_{ij,t} + \beta_5 D\_TA_{ij,t} + \beta_6 MBR_{ij,t} + \beta_7 SMG_{ij,t} + \beta_8 MLD_{ij,t} + \beta_9 IR_{ij,t} \\ & + \beta_{10} GDP\_G_{ij,t} + \delta_i + \alpha_t + \mu_{it.} \end{aligned}$$

where ij,t represents firm, country, and year, respectively. $TDEBT_{ij,t}$ is the ratio of total debt to total assets. $TDEBT_{ij,t-1}$ is the ratio of total debt to total assets for the previous year. $SD\_EBITDTA_{ij,t}$ is the standard deviation of earnings before interest, tax, and depreciation, scaled by total assets. $FA\_TA_{ij,t}$ is the ratio of fixed assets to total assets. $Ln\_TA_{ij,t}$ is the natural logarithm of total assets. $D\_TA_{ij,t}$ is the depreciation to total assets ratio. $MBR_{ij,t}$ is the ratio of the market value of total assets to book value of total assets. $SMG_{ij,t}$ is the ratio of market capitalization to GDP. $MLD_{ij,t}$ is the ratio of credit of private sector as a percentage of GDP. $IR_{ij,t}$ is the annual real interest rate adjusted to inflation. $GDP\_G_{ij,t}$ is the percentage change in annual real GDP. λ is an adjustment to previous year's TDEBT. δ_i is firm-specific effect. α_t is year fixed effect. μ_{it} is error term.

3.2. Data and variable justification

This study uses a sample that includes listed firms representing 20 MENA and African countries considering 10 years periods starting from 2011 to 2020. The selected period eliminated the impact of the global financial crisis (2008) and the recent financial crisis caused by COVID-19 pandemic on MENA and African regions. Moreover, this study follows Awartani et al. (2016) by selecting a sample of listed firms in MENA markets, including Bahrain, KSA, Kuwait, Qatar, UAE, Morocco, Tunisia, Jordan, Oman, and Egypt. The selected firms in African markets include Botswana, Ivory Coast, Tanzania, Ghana, Kenya, Nigeria, Mauritius, South Africa, Zambia, and Zimbabwe due to data availability. Financial firms are excluded because of their capital structure distinctions, and firms with major missing variables are excluded. The sample consists of 990 non-financial listed firms representing 10,890 observations and mainly obtained using Refinitiv DataStream while market-specific factors are obtained using World Development Indicators.

3.2.1. Cash flow volatility and capital structure

Healthy cash flow has many financial implications, such as evading the disruption of investment and encouraging firm stability (Firmansyah & Novianti, 2020). Therefore, volatile cash flow impacts the financial behavior of firms and, hence, their capital structure (Denis & McKeon, 2018). There is no consensus on cash flow volatility measure in the literature, the mainstream of the literature used the standard deviation of operating income to measure cash flow volatility (e.g. Denis & McKeon, 2018). This study follows Shaheen et al. (2021) by using the standard deviation of earnings before interest, tax, and depreciation scaled by total assets to measure cash flow volatility.

The literature on capital structure uses different debt ratios to measure capital structure. Myers (1977) highlighted that debt is more supported by total assets, while Frank and Goyal (2009) and Matemilola

et al. (2012) and Bany-Ariffin et al. (2016) use the book value of debt because the market value of debt is volatile. Therefore, this study follows the mainstream literature by using the ratio of total book value of debt to total book value of assets (e.g. Denis & McKeon, 2018; Frank & Goyal, 2009).

3.2.2. Moderating effect of fixed assets

Fixed asset level is a significant factor in the relationship between cash flow volatility and capital structure. As cash flow volatility leads to financial distress, such as default risk and agency cost, creditors use the fair value of fixed assets as collateral. This can mitigate financial friction, lower the cost of debt, and secure higher debt capacity (Li & Islam, 2019). Therefore, firms with higher levels of fixed assets, which can be used as collateral for creditors, tend to use more debt and are expected to have increased debt ratios (Frank & Goyal, 2009; Öztekin & Flannery, 2012). Consequently, fixed assets are expected to have a negative moderating impact on the association between cash flow volatility and capital structure. This study follows Shaheen et al. (2021), Guizani and Ajmi (2021), and Denis and McKeon (2018) by using the ratio of fixed assets to total assets.

3.2.3. Firm-level control variables

The literature discusses many important firm-specific and market-specific factors that impact on cash flow and capital structure. Many of these factors are reliable and vary in nature, reliability, and significance (Frank & Goyal, 2009). Li and Islam (2019) emphasize how firm-specific factors impact on capital structure and financing choice. The firm-specific factors included in this study are investment growth opportunities, size, and non-debt tax shield.

Investment growth opportunities are an important factor in explaining capital structure (e.g. Frank & Goyal, 2009; Guizani & Ajmi, 2021). More investment growth opportunities may increase financial distress and agency costs, and lower cash flow problems (Frank & Goyal, 2009), and encourage firms to source for debt to fund investment growth opportunities. According to pecking order theory, higher investment growth opportunities encourage the usage of more debt. Öztekin and Flannery (2012) and Flannery and Hankins (2013) findings reveal that investment growth opportunities is positively linked to debt. However, trade-off theory argues that increased growth opportunities can increase financial distress and agency problems, which limits the capacity of firms to borrow money (Kraus & Litzenberger, 1973). This study follows Harris and Roark (2019) by using the market-to-book of assets ratio to measure investment growth opportunities.

Typically, the characteristics of larger firms include higher investment growth opportunities, better access to finance, stable cash flow, and increased debt. However, the theoretical literature on firm size and capital structure is contradictory. The trade-off theory suggests that larger firms have lower default risk, diversified investment, more reputable, and higher debt capacity which allows them to maximize the tax shield benefits and establishes a positive relationship (Kraus & Litzenberger, 1973). Conversely, the pecking-order theory suggests that larger firms have lower debt because they usually prefer to use internally generated funds (Myers & Majluf, 1984). The mainstream empirical literature supports trade-off theory. For instance, Harris and Roark (2019), Frank and Goyal (2009), and Flannery and Hankins (2013) find a positive impact of firm size on debt ratios. This study follows Nguyen et al. (2021), Guizani and Ajmi (2021), Tesema (2024) and use the natural logarithm of total assets as proxy for firm size.

Unrelated to the use of debt, some investments can produce a non-debt tax shield that lowers tax expenses such as tax credit and depreciation (DeAngelo & Masulis, 1980). Öztekin and Flannery (2012) state that non-debt tax shield can be considered a substitute for tax shield, even though it is free of debt-related expenses. In the context of trade-off theory, the non-debt tax shield is negatively associated with capital structure as it decreases the attractiveness of debt. DeAngelo and Masulis (1980) and Memon et al. (2018) consistently found that non-debt tax shield negatively impacts capital structure (i.e. debt ratio). This study follows Memon et al. (2018) and Saif-Alyousfi et al. (2020) by using the ratio of depreciation to total assets as a measure of the non-debt tax shield.

3.2.4. Market-specific control variables

Turning to market-specific variables, such factors are typically uncontrollable by firms, yet they can impact the capital structure of firms. Market-specific factors are established in the literature and linked to the association between capital structure and cash flow management (Shaheen et al., 2021). Li and

Islam (2019) state that market-specific factors directly affect financing choice of firms. The market-specific factors considered are economic growth, interest rate, market liquidity, and stock market growth.

Generally, higher GDP growth is an indication of improvement in economic and investment growth opportunities. Economic growth (i.e. GDP growth rate) is an important market-level factor that explain capital structure (Shaheen et al., 2021). Based on the pecking-order theory, economic growth lowers debt financing of firms because of the preference for internal funds (Saif-Alyousfi et al., 2020). Trade-off theory posits a positive association between debt and economic growth because firms are encouraged to use more debt to embark on viable investments and increase tax-shield benefits when the economic growth prospect is good. Therefore, economic growth is expected to be positively associated with capital structure (Myers & Majluf, 1984). This study follows Shaheen et al. (2021), Guizani and Ajmi (2021), and Keefe and Yaghoubi (2016) by using the percentage change in annual real GDP to measure economic growth.

Interest rate is an important factor in the capital structure and cash flow management literature because it represents the cost of borrowing. Nkoa (2018) confirms that real interest rate impact on borrowing costs and financial liberation. Typically, lower interest rates encourage firms to borrow to embark on viable investments and stockpile cash-reserves. This study follows Shaheen et al. (2021) and use a real interest rate adjusted for inflation to measure interest rate.

Financial system is a major factor in economic growth and health is a country (Nkoa, 2018). Domestic credit to private sector (i.e. market liquidity) consists of all financial resources offered to private firms (i.e. loans and trade credit). A high domestic credit to private sector indicates high market liquidity and better access to financing. Higher domestic credit to private sector increases the stock market growth in the long term and economic growth in the short term (Al Samman & Jamil, 2018). This study follows Al Samman and Jamil (2018) and Nkoa (2018) by using domestic credit to private sector to GDP ratio to measure market liquidity.

The stock market is an integral part of the capital market and its development. A developed stock market makes easy access to equity funds possible to fund profitable investments. In the case of a developed stock market, Myers and Majluf (1984) believe firms consider more equity financing when cash flow volatility and cash need arise. The stock market capitalization to GDP ratio (i.e. stock market growth) is positively associated with long-term financing (Nkoa, 2018). Therefore, stock market growth should be positively associated with debt ratio. In accordance with Al Samman and Jamil (2018) and Nkoa (2018), this paper uses the market capitalization (i.e. total market value of all publicly traded stock) to GDP ratio as proxy for stock market growth.

4. Empirical results

4.1. Descriptive statistics

Table 1 reports the descriptive statistics illustrate the data characteristics of the dependent, independent, and control variables. As reported in Table 1, a summary of the descriptive statistics revealed valuable observations. First, stock market growth has the highest mean (71.501), followed by market liquidity

Table 1. Descriptive statistics.

Variable	Observations(N*T)	Mean	Std dev	Min	Max
SDEBITDTA	10,890	0.333	10.00	0	109.520
TDEBT	10,890	0.608	0.880	0	0.89
FA_TA	10,890	0.851	19.980	0.100	42.700
Ln_TA	10,890	7.786	1.900	0	11.112
D_TA	10,890	0.031	1.801	0.009	18.850
MBR	10,890	9.471	31.24	0	71.00
SMG	10,890	71.50	88.834	0	345.353
MLD	10,890	54.605	40.081	0	138.857
IR	10,890	2.661	7.103	0.803	40.860
GDP_G	10,890	2.713	3.757	−4.900	19.675

Notes: SD_EBITDTA is the standard deviation of earnings before interest, tax, and depreciation scaled by total assets. TDEBT is the ratio of total debt to total assets. FA_TA is the ratio of fixed assets to total assets. Ln_TA is the natural logarithm of total assets. D_TA is the depreciation to total assets ratio. MBR is the ratio of market value of total assets to book value of total assets ratio. SMG is the ratio of market capitalization to GDP. MLD is the ratio of credit of private sector as a percentage of GDP. IR is the annual real interest rate adjusted to inflation. GDP_G is the percentage change in annual real GDP.

(54.605), and investment growth opportunities (9.471). The total debt to total assets ratio (i.e. capital structure) is (0.698), which indicates that developing market firms such as MENA and African markets use above-average debt levels.

The highest reported standard deviation is stock market growth (88.834) followed by market liquidity (40.081). On average, this indicates that listed firms have more variation in stock market growth. Cash flow volatility mean is (0.333) while its disparity ranged from a minimum of (0.000) for some firms, to a maximum of (109.520) for others. This indicates that some developing market firms, such as MENA and African markets, have some challenges in stabilizing their cash flows.

Turning to the moderating variable (fixed assets) has a mean value of (0.851), its disparity ranges from a minimum of (0.100) for a few firms to a maximum of (42.700) for others. This indicates that there is some disparity in fixed asset holdings in the sample of developing market firms, such as MENA and Africa markets.

4.2. Correlation

Table 2 presents the correlation results show a bivariate association between all associated variables in the study, which aims to detect the presence of multicollinearity problems. The correlation coefficient between cash flow volatility and capital structure (i.e. debt ratio) indicates a statistically significant and positive correlation (0.795). The correlation results indicate that capital structure tends to increase with higher cash flow volatility. Similarly, the correlation coefficient between fixed assets (i.e. fixed assets ratio) and debt ratio is negative (–0.001) but statistically insignificant.

Regarding the control variables, the correlation coefficient between firm size and debt ratio indicates a statistically significant and negative correlation (–0.026). The correlation results indicate that debt ratio tends to decrease for larger firms. Similarly, the correlation coefficient between investment growth opportunities and debt ratio indicates a statistically significant and positive correlation (0.883). The correlation result indicates that debt ratio tends to increase with higher investment growth opportunities.

The correlation coefficient between economic growth (i.e. GDP growth rate) and capital structure (i.e. debt ratio) indicates a statistically significant and negative correlation (–0.046). The correlation results indicate that debt ratio tends to decrease with an increase in the economic growth rate. The correlation coefficient between interest rate and debt ratio indicates a positive (0.002), but statistically insignificant. Likewise, the correlation coefficient between stock market growth and debt ratio indicates a positive (0.002) but statistically insignificant correlation. Similarly, the correlation coefficient between market liquidity and debt ratio indicates a positive (0.010) but statistically insignificant correlation. However, the correlation between the fixed assets and non-debt tax shield (i.e. depreciation to total assets ratio) is (0.895), suggesting that the two independent variables should not be included in the same regression

Table 2. Correlation matrix.

	TDEBT	SD_EBITDTA	FA_TA	Ln_TA	D_TA	MBR	IR	MLD	SMG	GDP_G
TDEBT	1									
SD_EBITDTA	0.795	1								
	(0.000)									
FA_TA	−0.001	0.025	1							
	(0.976)	(0.010)								
Ln_TA	−0.026	−0.034	−0.015	1						
	(0.005)	(0.004)	(0.125)							
D_TA	−0.000	0.020	0.895	−0.013	1					
	(0.984)	(0.033)	(0.000)	(0.161)						
MBR	0.883	0.884	0.194	−0.045	0.193	1				
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)					
IR	0.002	−0.003	0.002	0.016	0.002	0.004	1			
	(0.651)	(0.738)	(0.827)	(0.089)	(0.829)	(0.656)				
MLD	0.010	0.011	−0.015	0.112	−0.012	0.023	0.121	1		
	(0.24)	(0.275)	(0.115)	(0.000)	(0.204)	(0.015)	(0.000)			
SMG	0.002	0.001	−0.009	0.168	−0.008	0.016	0.072	0.580	1	
	(0.81)	(0.880)	(0.342)	(0.000)	(0.408)	(0.097)	(0.000)	(0.000)		
GDP_G	−0.046	−0.045	0.020	−0.169	0.019	−0.045	0.071	−0.213	−0.333	1
	(0.000)	(0.000)	(0.033)	(0.000)	(0.046)	(0.000)	(0.000)	(0.000)	(0.000)	

Notes: Refer to Table 1 for the definition of variables. The numbers in parentheses are *p* values.

Table 3. Regression results for the direct effect of cash flow volatility on capital structure.

	Pooled OLS (Model 1a)	Random effects model (Model 1b)	Fixed effects model (Model 1c)	OLS with correction of auto & hetero. (Model 1d)	Two-step system GMM (Model 1e)
Variables	TDEBT	TDEBT	TDEBT	TDEBT	TDEBT
Lag of debt ratio (L.TDEBT)	Nil	Nil	Nil	Nil	0.531***
					(190.90)
Cash-flow-volatility (SD_EBITDTA)	0.916***	0.914***	0.905***	0.916***	0.983***
	(54.00)	(53.00)	(45.70)	(49.80)	(29.00)
Fixed-assets (FA_TA)	−0.012***	−0.014***	−0.014***	−0.013***	−0.198***
	(−33.29)	(−35.02)	(−35.60)	(−3.80)	(−35.49)
Log-of-total-assets (LN_TA)	0.063***	0.073***	0.088***	0.063***	0.188***
	(7.70)	(8.40)	(8.80)	(5.31)	(86.20)
Market-to-book-ratio (MBR)	0.001***	0.002***	0.002***	0.001	−0.003***
	(11.71)	(13.90)	(16.10)	(1.07)	(−99.00)
Interest-rate (IR)	0.016***	0.014***	0.012***	0.016***	0.003***
	(9.70)	(8.50)	(6.70)	(4.00)	(30.63)
Market-liquidity (MLD)	0.001	−0.001	−0.001	−0.001	0.001***
	(−1.56)	(−1.19)	(−0.58)	(−1.60)	(6.01)
Stock-market-growth (SMG)	−0.0003	−0.0003	−0.0004	−0.003***	−0.001***
	(−1.43)	(−1.60)	(−1.18)	(−2.70)	(−12.03)
Economic-growth-rate (GDP_G)	−0.014***	−0.013***	−0.012**	−0.014	−0.019***
	(−3.30)	(−3.10)	(−2.60)	(−3.10)	(−48.26)
Constant	−0.174	−0.273	−0.234**	−0.174	–
	(−1.13)	(−1.30)	(−2.30)	(−0.70)	–
Observations (N*T)	10,890	10,890	10,890	10,890	9,900
R-squared	0.663				
No. of firms					
No. of Instruments	Nil	Nil	Nil	Nil	114
Breusch-Pagan LM test (*p* value)		0.000			
Hausman test (*p* value)			0.000		
Multi-collinearity (VIF)			2.13		
Hetero-skedasticity (*p* value)			0.000		
Serial correl. (*p* value)			0.000		
Autocorrel. (AR 1) (*p* value)	Nil	Nil	Nil	Nil	0.100
Autocorrel. (AR 2) (*p* value)	Nil	Nil	Nil	Nil	0.580
Sargan/Hansen test (*p* value)	Nil	Nil	Nil	Nil	0.198

Notes: Refer to Table 1 for the definition of variables. Asterisks (***), (**), and (*) indicate significance at the 1%, 5%, and 10% levels, respectively. T-statistics numbers are in parentheses.

model. Apart from the correlation between fixed assets and non-debt tax shield, the correlation between the independent variables is generally lower which indicates a low risk of multicollinearity problem.

While correlation analysis is considered vital in detecting the degree of association between variables, it is insufficient to establish a causa relationship. Therefore, this study adopts the two-step system generalized method of moments (GMM) model to establish a causal relationship between cash flow volatility and capital structure, and the moderating effect of fixed assets on this relationship. Moreover, the presence of multicollinearity problem was detected using the variance inflation factor test (VIF). As shown in Tables 3 and 4, the VIF value is (2.13) which supports the absence of multicollinearity in the data.

4.3. Generalized method of moments results

4.3.1. Two-step GMM results for the direct effect of cash flow volatility on capital structure

Table 3 shows the results for the direct effect of cash flow volatility on capital structure. This study mainly uses a dynamic panel model, based on pecking order theory (Myers & Majluf, 1984) and cash flow sensitivity theory (Fazzari et al., 1988). In the first model, the dependent variable is capital structure (i.e. total debt to total assets ratio), while the independent variable is cash flow volatility (i.e. standard deviation of earnings before interest, tax, and depreciation scaled by total assets). Öztekin and Flannery (2012) stated that the GMM model is recognized as one of the most competent dynamic panel models, considering firm-specific factors and the endogeneity problem of explanatory variables. Flannery and Hankins (2013) also support the GMM model as the most reliable estimation model for dynamic panel model parameters when explanatory variables are expected to be endogenous.

The validity of the GMM model results depends on the first-order and second-order serial correlation of residual tests as post-estimation tests. Considering a null hypothesis of the absence of serial

Table 4. Results of moderating effect of fixed assets on cash flow volatility-capital structure link.

	Pooled-OLS (Model 2a)	Random-effects model (RE) (Model 2b)	Fixed-effects model (FE) (Model 2c)	OLS correct for auto & hetero, (Model 2d)	Twostep system GMM (Model 2e)
Variables	TDebt	TDebt	TDebt	TDebt	TDebt
Lag of debt ratio (L.TDebt)	Nil	Nil	Nil	Nil	0.534***
					(190.39)
Cash-flow-volatility (SD_EBITDTA)	0.920***	0.916***	0.909***	0.919	0.989***
	(51.12)	(55.09)	(43.90)	(60.61)	(41.67)
Fixed-assets (FA_TA)	0.214***	0.208***	0.203***	0.213	−0.029***
	(38.47)	(34.60)	(31.22)	(1.30)	(−99.01)
SD_EBITDTA*FA_TA	−0.004***	−0.004***	−0.004***	−0.003	−0.002***
	(−36.67)	(−36.22)	(−37.09)	(−1.59)	(−35.01)
Log-of-total-assets (LN_TA)	0.049***	0.053***	0.070***	0.049	0.189***
	(6.10)	(6.59)	(7.59)	(3.16)	(81.03)
Market-to-book-ratio (MBR)	0.001***	0.001***	0.001***	0.001	0.003***
	(9.49)	(12.49)	(14.99)	(1.09)	(−96.11)
Interest-rate (IR)	0.015***	0.013***	0.011***	0.016***	0.005***
	(10.16)	(9.78)	(6.69)	(4.18)	(29.60)
Market-liquidity (MLD)	−0.001*	−0.001	−0.003	−0.001	0.001***
	(−1.59)	(−1.29)	(−0.59)	(−168)	(5.99)
Stock-market-growth (SMG)	−0.001	−0.002	−0.001	−0.002**	−0.009***
	(−1.25)	(−1.49)	(−1.17)	(−2.23)	(−11.02)
Economic-growth rate (GDP_G)	−0.009***	−0.011***	−0.010**	−0.014***	−0.019***
	(−2.99)	(−2.97)	(−2.39)	(−3.02)	(−44.00)
Constant	−0.149	−0.238	−0.220**	−0.151	
	(−1.14)	(−1.29)	(−2.29)	(−0.68)	
Observations (N*T)	10,890	10,890	10,890	10,890	9,900
R-squared	0.667				
No. of firms					
No. of instruments	Nil	Nil	Nil	Nil	115
Breusch-Pagan LM test (*p* value)		0.000			
Hausman test (probability value)			0.000		
Multicollinearity (VIF)			2.13		
Heteroscedasticity (*p* value)			0.000		
Serial correl. (*p* value)			0.000		
Autocorrel. (AR 1) (*p* value)	Nil	Nil	Nil	Nil	0.119
Autocorrel. (AR 2) (probability value)	Nil	Nil	Nil	Nil	0.596
Sargan/Hansen test (*p* value)	Nil	Nil	Nil	Nil	0.209

Notes: Refer to Table 1 for the definition of variables. Asterisks (***), (**), and (*) indicate significance at the 1%, 5%, and 10% levels, respectively. T-statistics numbers are in parentheses.

correlation in the error term, the results of the second-order serial correlation are accepted because the *p* value is high and statistically insignificant. Therefore, the second-order serial correlation problem was not present in the model residual. As predicted, there is a first-order serial correlation problem because the error terms are typically correlated with lagged dependent variables. The *p* value of the Hansen/Sargan test is insignificant indicating that the model is correctly specified.

The two-step system GMM results (model 1e) show that cash flow volatility is significantly and positively related to debt ratio (with a coefficient of 0.983*** and t-statistics of 29.00) at the 1% level. As a robustness check, this result is supported by the pooled OLS (model 1a) and the random effects model (model 1b) which also show that cash flow volatility is significantly and positively related to debt ratio at the 1% level. Likewise, as a robustness check, the fixed effects model (model 1c), and OLS model with correction of autocorrelation and heteroskedasticity (model 1d) reveal that cash flow volatility is significantly and positively related to debt ratio at the 1% level. Overall, all the models (models 1a to 1e) confirm that cash flow volatility is a significant determinant of capital structure. The evidence of a positive association between cash flow volatility and debt ratio suggests that higher cash flow volatility increases the debt ratio.

This can be justified by the fact that unexpected changes in cash flow or the persistence inability to generate positive operating cash flows result in firms being incapable of creating satisfactory cash flows to cover their financial needs (Harris & Roark, 2019). Hence this drives firms to use external sources of finance (debt capital as a primary source) to satisfy such needs. Harris and Roark (2019) also conclude that firms facing higher risk of cash deficits in certain periods are likely to raise more debt compared to firms with no cash flow risk. Accordingly, this result is consistent with the mainstream capital structure

empirical literature that reported positive relationship between cash flow volatility and debt ratio (e.g. Memon et al., 2018). This result is also consistent with the pecking order theory which posits a positive impact of cash flow volatility on debt ratio. When firms experience persistent cash flow losses, this generates liquidity problems to meet the short-term needs. To satisfy such needs, firms tend to use internal financing sources, such as cash reserves or retained earnings, and then use other external sources, beginning with debt and equity as the last financing option (Myers & Majluf, 1984). All things being equal, the line of positive coefficient evidence of volatile cash flow indicates that an increase in cash flow risk increases the probability of low cash levels; hence, firms are driven to use more debt finance. However, the established positive results are not consistent with Keefe and Yaghoubi (2016), who concluded an inconclusive association between cash flow volatility and debt ratio.

The model includes firm-specific determinants which consistently explain the capital structure of firms in developing markets (e.g. firm size, fixed assets, and investment growth opportunities). As a control variable, the two-step system GMM which is the major results (model 1e) confirm significant positive impact of firm size on debt ratio. Likewise, in the robustness check results (models 1a to 1d), firm's size is positively related to debt ratio. Moreover, the two-step system GMM which is the major results (model 1e) reveal that investment growth opportunity has significant negative impact on debt ratio. But in the robustness check results (model 1a to 1c, except model 1d), investment growth opportunity is significantly and positively related to debt ratio.

The results suggest that firm size, investment growth opportunities, and fixed assets are important determinants of the capital structure for firms in developing market. The positive association between firm size and debt ratio is supported by the trade-off theory analogy, which posits that larger firms are more diversified, have lower default risk, and higher debt capacity, which can be utilized to maximize the benefits of the debt tax shield. Flannery and Hankins (2013) and Öztekin and Flannery (2012) also found a positive association between firm size and debt ratio. The negative association between fixed assets ratio and debt ratio also indicates a lower efficiency of capital market in supporting the increase in debt. Moreover, the negative association between investment growth opportunities and debt ratio in the two-step system GMM result is supported by the trade-off theory argument that higher investment growth opportunities increase agency problems associated with debt and financial distress costs, which establishes a negative relationship between investment growth opportunities and debt ratio (Kraus & Litzenberger, 1973).

The models also include market-specific determinants to explain capital structures in developing markets. The interest rate is statistically significant and positively associated with debt ratio in all results. This result opposes the mainstream literature which typically posits that lower interest rate encourage more debt usage by firms. Stock market growth is significantly and negatively related to debt ratio in the major result – the two-step system GMM model (model 1e) and is supported by the OLS model with correction of autocorrelation and heteroskedasticity (model 1d). This finding implies that firms use less debt when there is higher stock market growth. Equity is easily raised in efficient and developed stock markets, thereby decreasing debt borrowing attractiveness. This result contradicts the findings of Awartani et al. (2016), who reported a positive association between stock market growth and debt ratio.

Market liquidity is significantly and positively associated with debt ratio in the major result – the two-step system GMM (model 1e) but it is not significantly related to debt ratio in the robustness check results (models 1a to 1d). The two-step system GMM result (model 1e) indicates that more liquid markets tend to increase firms' debt borrowing, thereby increasing debt ratio. The findings support the notion that well-developed financial markets and financial intermediaries facilitate asset trading (Awartani et al., 2016) and liquidate it for investors to invest in debt. Economic growth (i.e. GDP growth ratio) is negatively associated with debt ratio in the robustness check model of the two-step system GMM model and is supported by the pooled OLS, random effects, and fixed effects models. This indicates that, in a well-structured and developed economy, the capital market becomes more attractive for firms to raise more equity than debt, thereby decreasing firms' debt ratio. Consistent with the pecking order theory, lower debt is used during economic growth due to the availability of sufficient internal funds (Saif-Alyousfi et al., 2020). This is consistent with Etudaiye-Muhtar et al. (2017), who found a negative association between GDP growth and debt ratio. However, the results contradict Awartani et al. (2016), who found a positive effect of GDP growth on debt ratio. The lagged total debt to total assets ratio is statically significant at the 1% level in the two-step system GMM model (model 1e). This result

suggests that debt decisions are dynamic, and firms adjust to target debt level. The results confirm that conventional determinants are significant in explaining capital structure decisions. Moreover, cash flow volatility emerges as potential determinant of capital structure decisions.

4.3.2. Two-step GMM results for the moderating effect of fixed assets in the association of cash flow volatility and capital structure

Table 4 reports the results for the moderating effect of fixed assets on the association of cash flow volatility and capital structure. To test the moderating effect of fixed assets on the association between cash flow volatility and capital structure (i.e. Hypothesis 2), this study also specifies a dynamic panel model based on pecking order theory and trade-off theory. In this model, the dependent variable is capital structure (i.e. debt ratio), the independent variable is cash flow volatility (i.e. standard deviation of earnings before interest, tax, and depreciation scaled by total assets), and the moderating variable is fixed assets (i.e. the ratio of fixed assets to total assets).

The second-order serial correlation that has a null hypothesis of absence of serial correlation in the error-terms report a statistically insignificant *p* value which confirms the absence of second-order serial problem in the model residuals. As projected, a first-order serial correlation exists because the error terms are typically correlated with the lagged dependent variable. Moreover, the post-estimation results show that the Hansen/Sargan test is satisfactory because its *p* value is statistically insignificant; hence, the model is specified correctly.

The moderating variable coefficient, the interaction between cash flow volatility and fixed assets is significantly and negatively associated with debt ratio (with a coefficient of –0.002*** and t-statistics of –35.01) at the 1% level in the major result – the two-step system generalized method of moment (model 1e). The robustness check results of the pooled OLS model (model 1a), random effects model (model 1b), and fixed effects model (model 1c) also confirm that the interaction of cash flow volatility and fixed assets is significantly and negatively affects debt ratio. Therefore, the results confirm that fixed assets are a significant moderating variable and have a negative moderating effect on the association between cash flow volatility and capital structure.

Accordingly, the moderating negative effect indicates that fixed assets weaken the evidence for the positive impact of cash flow volatility on capital structure. The negative moderating association of fixed assets can be explained by the fact that volatile cash flows tend to have a lower effect on firms with higher fixed assets held as collateral. However, holding more fixed assets may not necessarily lead to more debt, particularly in developing countries with low fixed asset quality (Harris & Roark, 2019). Hence, when cash flow problems arise, which lead to short-term cash needs, firms are unlikely to have attractive debt borrowing options if their fixed assets are low in quality. As a direct impact, fixed assets are significantly and negatively associated with debt ratio based on the two-step GMM results (model 2e), but fixed assets are significantly and positively associated with debt ratio in the pooled OLS (model 2a), random effects model (model 2b), and fixed effects model (model 2c). The result of the two-step system GMM suggest that the functioning of fixed assets as collateral in developing countries, such as MENA and African markets appear inefficient.

The conventional firm-specific determinants of capital structure, such as investment growth opportunities explain capital structure decisions in developing markets in the robustness check results (models 2a to 2c) and the major results (model 2e). Firm size is significantly and positively associated with debt ratio in the major results – the two-step system GMM (model 2e) and the robustness check results (models 2a to 2d).

Moreover, market-specific factors seem to reliably explain capital structure decisions in developing markets. Precisely, interest rate is significantly and positively associated with debt ratio in the major result – the two-step system GMM (model 2e) and the robustness checks results (models 2a to 2d). These results indicate that as interest rates increase, debt ratio increases which contradict the conventional notion that increasing interest rates discourage firms to use of debt. Stock market growth is significantly and negatively associated with debt ratio in the major model results – the two-step system GMM and the OLS with correction for autocorrelation and heteroscedasticity (model 2d). The results suggest that as stock market growth increases, debt ratio decreases. A well-developed stock market facilitates equity funding and discourages debt financing.

However, Awartani et al. (2016) find that stock market growth has a positive impact on debt ratio. The major result of the two-step GMM model reports a positive association and is statistically significant between market liquidity and debt ratio. This indicates that liquid markets tend to motivate firms to use debt. The findings support the notion that well-developed financial markets and financial intermediaries facilitate asset trading (Awartani et al., 2016) and liquidate it for investors to invest in debt. Economic growth (i.e. GDP growth ratio) is significantly and negatively associated with debt ratio in the major results – the two-step system GMM (model 2e) and the robustness check results (models 2a to 2d). These results indicate that, in a well-structured and developed economy, the stock market becomes more attractive for firms to raise more equity than debt, thereby decreasing firms' debt ratio. This is consistent with Etudaiye-Muhtar et al. (2017), who found a negative association between the GDP growth and debt ratio. However, the results contradict Awartani et al. (2016), who found a positive effect of GDP growth ratio on debt ratio. The lagged total debt to total assets ratio is statically significant at the 1% level in the two-system GMM results (model 2e) which suggest that debt decisions are dynamic, and firms adjust to target debt level in developing MENA and African countries. The results confirm the conventional determinants of capital structure; and cash flow volatility appears to be a potential determinant of firms' capital structure in developing MENA and African countries.

5. Conclusion

5.1. Findings and implications

The insights of the pecking order theory support our findings on the direct positive impact of cash flow volatility on capital structure (i.e. debt ratio). In addition, the negative moderating impact of fixed assets on the relationship between cash flow volatility and debt ratio supports a strain of empirical literature that proposes that the positive direct effect of volatile cash flow on debt ratio is weakened by higher fixed assets. Harris and Roark (2019) found that cash flow volatility tends to be lower when firms hold fixed assets as collateral, but this does not necessarily lead to a higher debt ratio, particularly in developing markets with low fixed assets quality.

The results of this study point to considering unexpected cash flow changes as an important factor in a firm's risk management and strategic decisions. Thus, managers are encouraged to consider cash flow stability as a major factor in corporate risk management and strategic decision making. Moreover, fixed assets are easier to assess by creditors than intangible assets, which contributes to lowering financial distress (Frank & Goyal, 2009). Hence, managers are encouraged to consider fixed asset investment decisions and the quality of fixed assets as significant factors in debt choice.

The literature on capital structure agrees on the positive effect of the use of debt on the performance and value of firms. However, the capital structure literature also links increased debt with negative financial implications, including financial distress, agency costs, and default risk. The implications of the study findings support the significance of efficient risk management, including investment diversification and leverage downsizing, to promote cash flow stability in developing markets, such as African and MENA nations. Leverage decisions are made at the firm level, but high leverage might increase financial distress. Hence, policymakers should formulate efficient capital structure policies that consider cash flow stability factors and encourage fixed asset investments.

5.2. Contributions and limitations of the study

Recent literature has focused on investigating the direct impact of cash flow volatility on capital structure, this study contributes to the literature by introducing fixed assets as a moderating factor in the association between cash flow volatility and capital structure (i.e. debt ratio). This study draws insights from different theories, such as the pecking order theory, trade-off theory, and cash flow sensitivity theory. The study also expands these theories by introducing fixed assets as a moderating factor. Moreover, this study used a large sample of 10,890 listed firm-year observations to represent African and MENA markets.

Unlike previous studies that investigated the impact of cash flow volatility on capital structure concentrating on developed markets with relatively stable cash flows, this study contributes to the literature

by studying African and MENA markets. Awartani et al. (2016) stated that developing markets are characterized by economic instability, capital market inefficiency, and financial systems that are dominated by the banking system. The literature on cash flow volatility and capital structure in developing markets, such as MENA and Africa, is indecisive and limited.

This study has several limitations that limit the generalization of its results despite offering valuable insights. The range of data used is 10-years due to data availability limitations, which limit the validity of the results to the sample period. Moreover, MENA and African markets have distinctive financial characteristics as developing markets, which offers a basis for comparative research between developing markets.

5.3. Recommendations for future studies

This study investigates the impact of cash flow volatility on capital structure and the moderating effect of fixed assets. Future research could consider introducing other significant moderating factors, such as investment growth opportunities. Future studies can draw insights from recent literature and integrate finance theory to examine the relationship between cash flow volatility and financing choice and extend it to other factors such as investment decisions.

Authors' contributions

The authors confirm contribution to the paper as follows: study design and conception: Abdulrahman Naser, Bolaji T. Matemilola, and Bany-Ariffin A.N collect the data: Abdulrahman Naser analyse and interpret the results. Abdulrahman Naser and Bolaji T. Matemilola draft the manuscript. Abdulrahman Naser, Bolaji T. Matemilola, and Bany-Ariffin A.N prepare the final draft. All authors reviewed the results and approved the final version of the manuscript.

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Data availability statement

The data that supports the study results are available from the corresponding author, Abdulrahman Naser, upon reasonable request.

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