Capital Markets Review Vol. 29, No. 1, pp. 1-16 (2021)

Interaction Impact of Monetary Policy and Inflation on Corporate Debt in Developing Nations

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Abstract: Research Question: Several firms in developing countries are increasing debt capital to take advantage of debt interest tax-shield but they are also exposed to bankruptcy, especially during this recent coronavirus pandemic period. **Motivation:** After 60 years of scholarly research, the determination of firms' capital structure is still a puzzle and is unending. Modigliani and Miller (1963) theory incorporates taxes and it allows for usage of 100 percent debt capital because of absence of bankruptcy costs; but Myers (1984) theory argues for the existence of an optimal capital structure that maximize firms' value. This study provides empirical validation to the effectiveness of monetary policy to lower corporate debt in the firms' capital structure. **Idea:** The article examines the moderating role of monetary policy on the relationship between corporate debt ratios and inflation rate in developing countries, and the moderating role of monetary policy on the relationship between corporate debt ratios and interest rate. **Data:** Monetary policy rate data are obtained from the official website of each country and from the Economics Trading Websites. Other macroeconomic data are obtained from the World Bank Databases. Institutional quality data are obtained from World Governance Indicators. The firm-level data are obtained from the Datastream databases. We use a total of 3,827 listed firms covering 2007 to 2015 periods. **Method/Tools:** The study applies the two-step system generalized method of moments which mitigate endogeneity problem. **Findings:** The findings reveal that monetary policy weakens the positive effect of inflation rate on corporate debt ratios. Conversely, monetary policy strengthens the negative effect of interest rates on corporate debt ratios. These findings suggest that that monetary policy appears effective to lower corporate debt ratios. Moreover, firms should take monetary policy signals into consideration when formulating capital structure decisions. **Contributions:** First, the article extends earlier studies by introducing new variable – the money market rate as a proxy for monetary policy and examine the issue of whether monetary policy moderate the relationship between inflation rate and corporate debt. Second, the article examines the issue of the moderating role of monetary policy on the relationship between interest rate and corporate debt.

Keywords: Corporate debt ratio, policy rate, interest rate, inflation rate, international evidence.
JEL classification: G32, G33, G37

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Received 9 Nov 2020; Final revised 26 Mar 2021; Accepted 16 May 2021; Available online 15 June 2021.
To link to this article: https://www.mfa.com.my/cmr/v29_i1_a1/

1. Introduction

Monetary policy is the first line of defense against economic slowdowns, especially when there is a need to take immediate action to restore stability in the economy (Kaplan *et al.*, 2018). The Central Bank monetary policy seems to affect interest rate; for example, a contractionary monetary policy appears to raise the policy rate which in turn affects the interest rate banks lend to firms (Tillmann *et al.*, 2019) and such policy may lower excessive corporate debt usage. Likewise, in periods of high inflation, interest rates may increase to compensate for inflation rate risk, and an increase in interest rate could discorage firms from borrowing debt capital, which may result in lower debt usage.

Several firms in developing countries are increasing debt capital to take advantage of debt interest tax-shield; but they are also exposed to bankruptcy. This bankruptcy problem is more noticeable during the recent coronavirus pandemic which has halted economic activity, hurting firms and pushing them further into bankruptcy (Didier *et al*., 2020). From Asia to Africa to Latin America, the pandemic is confronting firms in developing countries with threat of economic crisis leading to bankruptcy problem.

Besides, several developing countries are facing rising inflation problems. The inflation rate in Sub-Saharan Africa is on average 10.4 percent in 2018 compared to 7.3 percent and 7.1 percent in 2015 and 2012, respectively (International Monetary Fund, 2018). Furthermore, during most of the 20th century, several South American countries were marked by high and volatile inflation and failed attempts to control inflation (Marcel, 2018; Naudon and Vial., 2016). Moreover, inflation rose in the Association of Southeast Asian Nations [ASEAN-5] countries (Organisation for Economic Co-operation and Development, 2018). Inflation influence firms' desires to obtain debt capital. The tradeoff theory predicts positive effect of inflation on corporate debt because the real value of debt interest tax-shield increases when inflation expectation is high.

Moreover, the interaction between corporate debt and macroeconomic factors is an underexplored research area (Katagiri, 2014) and macroeconomic factors instability may affect corporate debt (Demirgüç-Kunt *et al.*, 2020); the moderating role of monetary on the relationship between interest rate and corporate debt, and the relationship between inflation rate and corporate debt remain unexplored. Additionally, many studies (e.g. Antoniou *et al.*, 2008; Demirgüç-Kunt *et al.*, 2020; Frank and Goyal, 2009; Khémiri and Noubbigh, 2018; Kumar *et al.*, 2017) focus on interest rate and inflation rate as macroeconomic determinants of capital structure but overlooked the indirect effect of monetary policy variable through interest rate and inflation on capital structure.

This study builds on capital structure literature in four main ways. First, the article extends earlier studies on the macroeconomic factors that influence corporate debt or capital structure. Precisely, the article introduces new variable – the money market rate as a proxy for monetary policy and examine the issue of whether monetary policy moderate the relationship between inflation rate and corporate debt. This issue is important as firms' operating in developing countries with higher inflation rates may use more debt because the real value of tax deductions on debt seems higher when inflation is expected to be high. However, a monetary policy that raises the policy rate may reduce the increasing effect of inflation on corporate debt. As inflation is a sign of an overheated economy, the monetary authority may slow this overheating by raising interest rates to make lending more expensive to firms which in turn lower their corporate debt usage.

Second, the article examines the issue of the moderating role of monetary policy on the relationship between interest rate and corporate debt. We provide empirical validation to the effectiveness of monetary policy to lower corporate debt in the firms' capital structure. This is important as monetary authorities may rely on raising the policy rates to curtail firms' excessive borrowing behaviour. Third, we use two proxies of capital structure in a single

study, controlling for the 2007/2008 financial crisis years, and use adequately large firm-level and country-level datasets of developing countries to enhance the robustness of our conclusion. Precisely, the sample consisted of annual firm-level and country level data of 3,827 listed firms from 21 developing countries.

Our findings reveal that monetary policy moderates the relationship between inflation rate and corporate debt ratio. Put differently, monetary policy weakens the positive effect of inflation on corporate debt in developing countries. The results suggest that contractionary monetary policy appears effective to combat the rising inflation rate effect on corporate debt ratio. Furthermore, the results reveal that monetary policy moderates the relationship between interest rate and corporate debt ratio. Specifically, monetary policy strengthens the negative effect of interest rates on corporate debt ratio. The results suggest that a contractionary monetary policy (i.e., raising the policy rate) is effective in constraining the ability of companies to raise debt capital in developing countries. Moreover, in a robustness check, the findings reveal that financial crisis is negatively related to corporate debt ratio, suggesting that when compared to non-financial crisis period, in a period of financial crisis firms are reluctant to raise their corporate debt level for fear of inability to repay the debt capital plus interest. The empirical findings also show that firms make adjustments to their target debt when there is a deviation from the target debt level; this is consistent with the dynamic version of trade-off theory.

The rest of the article is organized as follows. Section 2 reviews relevant literature. Section 3 presents the model and data. Section 4 analyzes the results. Section 5 is the conclusion.

2. Literature Review

2.1 Theoretical Framework

After the publication of the Modigliani and Miller (1958) capital structure (debt) irrelevance theory, the choice of corporate debt depends on two competing theories, namely the tradeoff and pecking order theories[2]. The tradeoff theory implies that the choice of corporate debt depends on the tradeoff between the costs and benefits of debt (Bradley *et al.*, 1984; Khoo *et al.*, 2017). The major benefit of debt is the debt-interest tax-shield. Modigliani and Miller (1963) incorporate taxes into their theoretical model and argues that corporations can use debt to take advantage of the debt-interest tax-shield benefits. Within the framework of the tradeoff theory, it is possible to observe an optimum debt level that maximizes the debt interest tax-shield. The trade-off theory supports the moderate use of debt by a firm paying taxes.

The trade-off theory states important predictions that are intuitively reasonable. Firstly, an increase in costs of bankruptcy decreases the optimal debt level. Secondly, increase in taxes raises the optimal debt level. Third, when capital structure is at an optimal level, a rise in marginal bondholder tax rate reduces the optimal debt level (Myers, 1984). Nonetheless, the main challenge of the trade-off theory is that the optimal debt level is not observable and a proxy is needed (Frank and Goyal, 2009). The usual practice is to express the optimal debt level as a function of firm-specific factors (e.g. fixed assets, profits, size, non-debt tax shield, and growth opportunity etc.) and macroeconomic factors (e.g. interest rate and inflation).

The tradeoff theory predicts expected inflation to be positively related to corporate debt. The reason is that the real value of tax deductions on debt (i.e., debt interest tax-shield) is higher when inflation is expected to be high (Taggart, 1985). Moreover, monetary policy should moderate the positive relationship between inflation rate and corporate debt. One of the main goals of monetary policy is to keep inflation low. Monetary policy that raises the

[2] The pecking order theory postulate that a firm prefer to use internally generated profits. Internally generated profit is the first in the pecking-order, then debt, and equity issue is the last (Myers, 2001). The market timing theory states that external finance-weighted average of the historical market to book ratio has negatively impact current debt via net equity issues (Baker and Wurgler, 2002).

policy rate increases lending rates, which in turn makes firms borrow and expand less and less business expansion lower inflation. Low inflation discourages usage of more debt capital. Therefore, we hypothesized (H1) that an increase in policy rate should weaken the positive effect of inflation rate on corporate debt ratio.

As interest rate changes, the firm would adjust their capital structure accordingly in response to favorable or unfavorable changes in interest rate. For instance, higher interest rate increases the costs of debt financing and discourages the firms to use more debt (Antoniou *et al.*, 2008). Therefore, interest rate is negatively related to corporate debt ratio. Monetary policy that raises the policy rate should increase the interest rate banks lend money to firms, lowering corporate debt usage. Thus, we hypothesized (H2) that increase in policy rate should strengthen the negative effect of interest rate on corporate debt ratio.

2.2 Empirical Review

2.2.1 Inflation Rate and Corporate Debt Relationship

Bajaj *et al.* (2020) investigate the corporate debt dynamics of firms listed on the Indian National Stock Exchange and Shanghai Stock Exchange and how they adjust their capital structures based on trade-off behaviour focusing on different macroeconomic factors. The authors report positive effects of inflation on debt ratios of firms in India and China. Likewise, Khemir and Noubbigh (2018) examine the determinants of corporate debt ratio in five sub-Saharan African countries (i.e. South Africa, Ghana, Kenya, Nigeria and Zimbabwe). They find that inflation rate is positively related to book debt ratio, which is attributed to the real value of tax deductions (tax saving) that is high during inflationary periods. Belkhir *et al.* (2016) paper provides novel evidence on firm- and country-level (including inflation) determinants of corporate debt decisions in the Middle Eastern and North Africa (MENA) region. They find that firms located in countries with higher inflation rates operate with more debt. A one-unit increase in inflation is associated with an increase in the book debt of nearly 5.7 percentage points. Similarly, a one-unit increase in inflation is associated with an increase in the market debt of nearly 28.5 percentage points, ceteris paribus. In an earlier study, Frank and Goyal (2009) examine the relative importance of several factors in the debt decisions of publicly traded American firms over the 1950 to 2003 period. Inflation rate is identified as one of the six reliable factors that affect corporate debt in the United States. Inflation is also among the six core factors that provide a more powerful account of a market-based definition of debt than of a book-based definition of debt (Frank and Goyal 2009). They report positive effects of inflation on both the book debt and market debt ratios, which is consistent with the tradeoff theory. Frank and Goyal (2009) reason that when inflation is expected to be high, firms tend to have high debt. Also, Fan *et al.* (2012) examine the influence of macroeconomic factor on firms' debt and debt maturity choices by examining a cross-section of firms in 39 countries (25 developed and 14 developing countries). Fan *et al.*'s (2012) panel regression controls for industry dummies and their results indicate that inflation has a positive effect on market debt of developing countries, but it has insignificant effect on market debt of developed countries.

Unlike previous studies, we introduce a new variable – the money market rate as a proxy for monetary policy rate and examine the moderating role of monetary policy on the interest rate and corporate debt relationship. Moreover, we investigate the moderating role of monetary policy on the inflation rate and corporate debt relationship. Additionally, we use two different measures of corporate debt ratios in a single study, and in a robust check, we control for the 2007/2008 financial crisis years as well as the leftover cross-country differences via a dummy variable technique to enhance the validity of our findings.

2.2.2 Interest Rate and Corporate Debt Relationship

Délèze and Korkeamäki (2018) study the effects of the rapid growth in corporate debt financing attributed to the introduction of the euro. The move to euro has reduced firms' exposure to interest rate fluctuation. This reduction is consistent with the suggestion that deeper markets in home-currency corporate debt allow firms to better manage their interest rate exposures (Délèze and Korkeamäki 2018). At the firm level, they find that interest rate positively affects firms' debt (ratio of long-term debt to total assets), and firms entering the public debt markets experience a significant shift in their interest rate exposure. Conversely, Khemir and Noubbigh (2018) examine the determinants of corporate debt in five sub-Saharan African countries. They find that nominal interest rate is positively related to book debt ratio (ratio of long-term debt to total assets). Moreover, the positive relationship between the nominal interest rate and the debt emerges when loan rates include expected inflation increase. Likewise, Antoniou *et al.* (2008) investigate how firms operating in capital market oriented economies and bank oriented economies determine their corporate debt choice. The authors argue that it is important to control for the effect of interest rate on corporate debt. Interest rate effects are common to all firms and can change through time. Antoniou *et al.*'s (2008) panel generalized method of moment results reveal a significant negative effect of interest rates on both the book and market measures of debt of majority of the sample countries. Precisely, interest rate has a negative effect on corporate debt in France, Japan, United Kingdom, and United States, except Germany. The negative effect of interest rate on debt indicates that a higher interest rate increases the costs of debt and it discourages firms to use more debt (Antoniou *et al.*, 2008).

Unlike previous studies, we introduce a new variable – the money market rate as a proxy for monetary policy rate and investigate the moderating role of monetary policy on the inflation rate and corporate debt relationship. Moreover, we examine the moderating role of monetary policy on the interest rate and corporate debt relationship. Additionally, we use two different measures of corporate debt ratios in a single study, and in a robust check, we control for the 2007/2008 financial crisis years to enhance the validity of our findings.

3. Model and Data

3.1. Empirical Model and Estimation Strategy

Gungoraydinoglu and Oztekin (2011) have concluded that adjustment costs are nontrivial and that firm-fixed effects are important to capture unobserved firm-specific heterogeneity. This study follows Gungoraydinoglu and Oztekin (2011) and applies the standard partial adjustment model to capture the dynamic adjustment toward the target debt level. Rather than estimate a static panel model based on contemporaneous debt ratios, the study estimates a dynamic panel model that produce an estimate of the unobserved target debt as well as the adjustment speed to the target debt level, that is:

$$Debt^{*}_{ij,t} - Debt_{ij,t-1} = \lambda(Debt^{*}_{ij,t} - Debt_{ij,t-1}) + \mu_{ij,t} \quad (1)$$

where λ is the average speed of adjustment (SOA) to the target debt level each period for all the sample firms, $Debt^{*}_{ij,t}$ is the target debt level, while $Debt_{ij,t}$ and $Debt_{ij,t-1}$ are the current and lagged 1 period debt ratios, respectively. The study uses two measures of debt (market total debt ratio and book total debt ratio). The model assumes that firm has a target debt level and adjust if there is a deviation from the target debt level. Full adjustment occurs when λ =1 while λ =0 means there is no adjustment. In the partial adjustment model, the actual adjustment of debt should be between 0 and 1. The target debt level is unobservable, so, we proxy it with the fitted values from a regression of observed debt on a set of firms' specific

and macroeconomic determinants of the target debt (Gungoraydinoglu and Oztekin, 2011) shown in equation 2.

$$Debt^*_{ij,t} = \beta X_{ij,t} + \eta_i + \alpha_t + \mu_{ij,t} \quad (2)$$

where X_{ijt} represents the firm specific and macroeconomic determinants of debt ratios, η_i and α_t are firm-specific effects and year fixed-effects, respectively. After we substitute the target debt from Equation (2) into the partial adjustment model in Equation (1) and rearranging the terms, the estimation in a single equation becomes:

$$Debt^*_{ij,t} = (1-\lambda)Debt_{ij,t-1} + \lambda\beta X_{ij,t} + \eta_i + \alpha_t + \mu_{ij,t} \quad (3)$$

$$Debt^*_{ij,t} = (1-\lambda)Debt_{ij,t-1} + \lambda(\beta_1 + \beta_2 Int_{j_t} + \beta_3 Inf_{j_t} + \beta_4 Mmr_{jt} + \beta_5 (Int * Mmr)_{jt} + \beta_6 (Int * Mmr)_{j,t} + \psi Firm\_Control_{i\,j,t} + \varphi Macro\_Control_{jt} + \eta_i + \alpha_t + \mu_{ij,t} \quad (4)$$

Where

$Debt_{ij,t}$	=	debt for the i firm in country j and t time (using both the market debt [TDM] and book debt [TDB] ratios as proxy for capital structure)
$Debt_{ij,t-1}$	=	lagged 1 period debt ratios for the i firm in country j and t time
$ß_1$	=	the constant
Mmr_{jt}	=	monetary policy variable (proxy by money market rate) for the j country and t time
Int_{jt}	=	interest rate for the j country and t time
Inf_{jt}	=	inflation rate for the j country and t time
$(Int*Mmr)_{jt}$	=	the interaction of interest rate and money market rate for the j country and t time
$(Inf*Mmr)_{jt}$	=	the interaction of inflation rate and money market rate for the j country and t time
η_i	=	the unobservable firm-specific effects
α_t	=	the year fixed effects
$1-\lambda$	=	speed of adjustment to target debt level
μ_{ijt}	=	the residual term

Subscript 'i' 'j' and't' represents a firm, country and time period, respectively

The model is estimated with two-step system generalized method of moments (GMM) because debt displays persistence behaviour (Lemmon *et al.*, 2008). This suggests that previous year debt affects the current year debt. Moreover, the article uses two-step system generalized method of moments because of the possibility of endogeneity problem. Endogeneity problem arises in two ways and it biases the variable coefficients. Firstly, omitting and important explanatory variables which are correlated with the error-term would bias the variable coefficients in the model specification. Second, the possibility of reverse causality between variables. For example, causality may go from debt to inflation or from debt to any of the independent variables and not vice versa, and this would bias the estimated variable coefficient. If there is no exogenous variation in the independent variable of interest, it becomes impossible to isolate a causal effect from alternative hypotheses driven by omitted variables or reverse causality (Jiang, 2017). In order to overcome the problem of endogeneity, researchers mostly rely on instrumental variable technique. The researchers search for an instrument that is correlated with the independent variable of interest but uncorrelated with the error-term. However, it may be difficult to get good external instruments and the use of bad instruments would cause more problem (Jiang, 2017).

Application of traditional ordinary least squares method to estimate parameters in a dynamic model that include firm-specific effects and lagged debt variable would produce biased coefficients (Flannery and Hankins, 2013). Therefore, this study applies the two-step system generalized method of moments because it is recognized as one of the best methods to estimate parameters of the target debt in the presence of firm-specific-effects and lagged debt variable (Flannery and Hankins, 2013). Two-step system generalized method of moments combine level-equation and difference-equation. Moreover, the use of system generalized method of moments reduces the endogeneity problem using the lag levels and lag differences of the independent and dependent variables as internal instruments (Blundell and Bond, 1998). The two-step system generalized method of moments combine the difference generalized method of moments' conditions and additional moment condition to produce unbiased estimators. The study treats the firm-specific factors and institutional quality variables as endogenous variables and the two-step system generalized method of moments internal instruments are used to mitigate the endogenous problem. The lagged levels of the dependent variable (debt) used as instruments in the difference generalized method of moments become weak instrument if they are persistent (Blundell and Bond, 1998). Thus, the two-step system generalized method of moments adds additional moment conditions. In all estimations, the article uses two-step estimates because this method uses the first-step errors to construct heteroskedasticity-consistent standard errors or optimal weighting matrices (Blundell and Bond, 1998).

3.2 Sample and Data

The full sample data consist of 3,827 listed firms from 21 developing countries. The countries and number of firms selected in each country are India (795 firms), Malaysia (728 firms), Pakistan (93 firms), Philippines (103 firms), Bangladesh (10 firms), Srilanka (139 firms), Indonesia (319 firms), Ghana (17 firms), Kenya (38 firms), Nigeria (40 firms), Tunisia (32 firms), Mauritius (29 firms), Egypt (88 firms), Jordan (115 firms), South Africa (190), Mexico (98), Chile (144), Brazil (188), Peru (77), Poland (339), Turkey (245).. The article defines developing countries based on their income level following World Bank classification. The years covered are 2007 to 2015. The data start from 2007 and end in 2015 due to data availability for capital structure (debt) determinants. Monetary policy rate is our main moderating variable and it is obtained from the official website of each country and from Economics Trading website. Other macroeconomic data such as interest rate, inflation rate, bank credit to the private sector, market capitalization, and gross domestic product growth rate are obtained from the World Development Indicators (World Bank database) and are unbalanced panel data. Institutional quality (i.e. rule of law, regulatory quality and control of corruption) data are obtained from the World Governance Indicators.

The other firm-specific data were extracted from Datastream databases and are also unbalanced panel data. As part of the data-sampling process, financial firms are excluded because their financial statement differs significantly from that of non-financial listed firms. Furthermore, the article excludes regulated firms (e.g. real estate investment trusts) because their debt ratio is usually higher than in other non-financial firms (Rajan and Zingales, 1995). The final full sample comprises 28,558 firm-year observations. The article applies the winsorization technique as in Lemmon *et al.* (2008) to mitigate the effects of extreme values of some data on the estimated parameters. All the firm-level data used as control variables (e.g., fixed assets, profits, size, price-to-book ratio, non-debt tax-shield, firm age, dividend payout, ownership structure) are the traditional firm-level determinants of firms' debt ratios. Moreover, the article controls for other macroeconomic determinants of firms' debt ratios.

3.3 Variables Justification

Table 1 shows the variables unit of measurement. The dependent variable is debt ratios and the article uses two measures of firms' debt. The article uses market total debt ratio as the main dependent variable because firms actaully adjust their debt to market fluctuations. Ratio of total debt-to-market value of assets has been used in previous studies (e.g. Frank and Goyal, 2009; Matemilola *et al.*, 2018b), and it is reliable measure of capital structure (Frank and Goyal, 2009). Previous studies mostly use either book total debt ratio or market total debt ratio as proxy for the proportion of debt in firms' capital structure. But this article uses market total debt ratio as main proxy and book total debt ratio as a robustness tests. Specifically, the article measures debt ratio as the ratio of book value of total debt to market value of equity plus book value to total debt (TDM) and the ratio of book value of total debt to book value of total assets (TDB).

Table 1: Variables unit of measurement

Variables	Definition
TDB	The ratio of short-term debt plus long-term debt to total assets (property, plant and equipment).
TDM	The ratio of book value of total debt to market value of equity plus book value to total debt.
Mmr	Money market rate variable in percentage (proxy for the policy rate)
ROL	Rule of Law: reflects perceptions of the extent to which agents have confidence and abide by society rules (ranges from 0 to 100)
REGQ	Regulatory Quality: reflects perceptions of the ability of the government to formulate & Implement sound policies (ranges from 0 to 100)
CC	Control of Corruption: reflects perceptions of the extent to which public power is exercised for gain (ranges from 0 to 100).
Int	Interest rate: annual interest rate
Inf	Inflation: annual inflation rate. Growth in consumer price index
GDPGR	Annual growth in nominal gross domestic product (in percentage)
BC	Banking Credit: ratio of the domestic credit provided by the banking sector to gross domestic products (in percentages)
MC	Market Capitalization: ratio of stock market capitalization of listed firms to gross domestic products (in percentage)
FA	The ratio of property, plant and equipment to book value of total assets
PRF	The ratio of earnings before interest, tax and depreciation to book value of total assets
Size	The log of total assets
PB	The ratio of book value of debt plus market value of equity to book value of total assets
Ndts	Ndts is the ratio of depreciation to total assets
Fage	Firm-age: natural log of (one plus firm-age)
DPO	Dividend pay-out: natural log of (one plus percentage of dividend pay-out)
OWS	Ownership structure: dummy variable equal to 1 if managers own more than 5 percent Shares and zero otherwise

The moderating variable is monetary policy proxy by money market rate while the main independent variables are interest rate and inflation. Although, policy rate is the main monetary policy variable, but it is not easily available for several countries. Therefore, this article uses the money market rate as monetary policy variable beacuse it is closely related to the policy rate. Policy rate affects the money market rate, then lending rate (Matemilola *et al.*, 2018a) and inflation. Several researchers (e.g. Holton and Rodriguez d'Acri, 2018; Tang *et al.*, 2015; Petrevski and Bogoev, 2012) that conduct research on policy rate passthrough to lending rate and deposit rate rely on the money market rate as a proxy for policy rate because of difficulty in obtaining policy rate data and the general belief that the policy rate is closely related to the money market rate. To confirm this belief, we conduct a

correlation analysis between policy rate and money market rate for countries with policy rate data. The correlation coefficient between policy rate and money market rate is 0.85 (refer to appendix 1 to see the correlation matrix). Therefore, policy rate is closely related to money market rate in these countries, and would serve as a substitute for the policy rate. The tradeoff theory predicts expected inflation to be positively related to corporate debt because the real value of debt interest taxshield is higher when inflation is expected to be high (Taggart, 1985; Frank and Goyal, 2009). One of the main goals of monetary policy is to keep inflation low. Monetary policy that raise the policy rate increases lending rate which makes firms borrow and expand less, and less business expansion lower inflation. Low inflation would in turn discourage debt usage because the real value of debt interest taxshield is lower when inflation appears low. We expect monetary policy to weaken the positive effects of inflation rate on corporate debt. Moreover, as interest rate changes, firms adjust their capital structure in response to favorable or unfavorable changes in interest rate. A higher interest rate increases the costs of debt financing and discourages firms to use more debt (Antoniou *et al.*, 2008). This article expects monetary policy to strengthen the negative effects of interest rate on corporate debt because raising the policy rate increases the interest rate bank lend money to firms, thus lowering corportate debt usage. Moreover, the article controls for other firm-level and macroeconomic determinants of firms' debt ratios established in the literature (e.g. Khémiri and Noubbigh, 2018; Kumar *et al.*, 2017; Matemilola and Ahmad, 2015; Frank and Goyal, 2009). Industry factor via dummy variables approach are included in the model specification. The industries included are agriculture, construction, manufacturing, transportation and communications, services, retail trade, and wholesale trade. Wholesale trade are excluded during the data analysis to avoid dummy variable trap.

4. Results

Tables 2 shows the descriptive statistics. The monetary policy rate variable proxy by money market rate (MMR) has a minimum value of 0.1000 and a maximum value of 23.9400. The mean value of the money market rate variable is higher than the median, therefore, the data is positively skewed. Moreover, market capitalization (MC) has the highest standard deviation

Table 2: Descriptive statistics

Variables	Mean	Median	Max.	Min.	S.D.
TDB	0.3483	0.2879	1.0000	0.0000	0.2880
TDM	0.2708	0.2241	1.0000	0.0000	0.9063
MMR	6.2134	6.0000	23.9400	0.1000	2.9384
INT	4.7116	3.5734	41.3454	1.3102	7.3949
INF	5.9501	5.4408	26.2398	0.6782	3.7249
GDPGR	5.1230	5.1991	14.0460	4.8260	2.7310
BC	47.4853	40.7244	123.8840	0.0000	40.4134
MC	80.9110	61.9900	278.3920	7.8270	54.0940
ROL	53.9684	55.2885	89.4737	10.4265	15.1772
REGQ	55.8236	55.0239	93.3014	17.4757	16.4745
CC	49.9175	52.6829	91.3876	3.9024	17.5062
FA	0.3558	0.3377	1.8240	0.0000	0.2437
EBIT	0.0499	0.0671	21.0402	0.8818	1.9633
LSIZE	14.6227	14.1684	26.1749	0.0000	3.1439
PB	2.6244	1.0500	43.0000	3.900	52.2092
NDTS	0.0261	0.0212	5.4915	0.0000	0.0426
FAGE	3.2706	3.3673	5.5174	0.0000	0.9563
DPO	15.2125	0.0000	100.0000	0.0000	23.3018
OWS	0.5492	1	8	0	0.5026

value suggesting that it is the most volatile variable. Conversely, non-debt tax-shield has the lowest standard deviation value suggesting that it is the least volatile. We conduct panel unit root test to confirm if the variables are stationary[3].

Tables 3 contain the correlation results. The correlation results reveal that the degree of association between most of the variables is weak because the correlation coefficients are generally lower among the independent variables. Thus, there is little risk of multi-collinearity among the independent variables.

Table 3: Correlation results

Panel A	TDM	TDB	MMR	INT	INF	GDPGR	BC	MC	ROL	REGQ
TDM	1.00									
TDB	0.19[a]	1.00								
MMR	0.08[b]	0.02[b]	1.00							
INT	0.02[c]	0.01	0.27[a]	1.00						
INF	0.11[a]	0.03[b]	0.53[a]	-0.18[a]	1.00					
GDPGR	0.06[b]	0.02[c]	-0.01	-0.14[a]	0.22[a]	1.00				
BC	-0.13[a]	-0.04[a]	-0.42[a]	-0.04[a]	-0.48[a]	-0.34[a]	1.00			
MC	-0.05[a]	-0.03[b]	-0.39[a]	-0.04[a]	-0.35[a]	0.10[a]	0.50[a]	1.00		
ROL	-0.02[c]	-0.01	-0.35[a]	-0.09[a]	-0.42[a]	-0.09[a]	0.48[a]	0.42[a]	1.00	
REGQ	-0.14[a]	-0.03[b]	-0.45[a]	-0.01	-0.43[a]	-0.29[a]	0.49[a]	0.31[a]	0.43[a]	1.00

Panel B	TDM	TDB	CC	FA	EBIT	SIZE	PB	NDTS	FAGE	DPO	OWS
TDM	1.00										
TDB	0.19[a]	1.00									
CC	-0.09[a]	-0.02[c]	1.00								
FA	0.10[a]	0.03[b]	-0.06[a]	1.00							
EBIT	-0.02[c]	-0.41[a]	-0.01	0.01	1.00						
SIZE	0.11[a]	0.02[c]	-0.31[a]	0.06[a]	0.03[b]	1.00					
PB	-0.02[c]	-0.01	0.01	-0.01	0.02[c]	0.01	1.00				
NDTS	-0.01	0.05[a]	-0.01	0.24[a]	-0.04[a]	0.03[b]	-0.01	1.00	0.02[b]		
FAGE	0.03[b]	0.01	-0.03[b]	0.03[b]	0.05[a]	0.18[a]	-0.02[c]	0.02[c]	1.00		
DPO	-0.17[a]	-0.02[c]	0.03[b]	0.02[c]	-0.02[c]	0.10[a]	0.01	0.02[c]	0.10[a]	1.00	
OWS	0.05[a]	-0.01	-0.10[a]	0.04[a]	0.01	0.12[a]	-0.02[c]	0.02[c]	0.05[a]	0.03[a]	1.000

Notes: a, b, and c indicate that correlation coefficient is significant at 1%, 5%, and 10%, respectively.

Tables 4 report the two-step system generalized method of moment's results for the sample of 3,827 listed firms from 21 developing countries. The diagnostic checks on the two-step system generalized method of moments reveal that the models passed the AR (2) tests, as indicated by the insignificant p-values showing the absence of second-order serial correlation. Overall, we confirm the validity of the instruments and the additional instruments, as indicated by the insignificant p-values of the difference-in-Hansen tests in the models. Moreover, the number of cross-sectional observations exceeds the number of instruments and it gives support to the validity of the estimations. Additionally, the results reveal that there is absence of cross-sectional dependency (CD) problem in the data because the p-value of the CD test is insignificant. In the empirical results, the market total debt ratio is our main proxy for capital structure and the book total debt ratio is used to check the robustness of our findings to alternative measures of corporate debt ratio.

The lagged dependent variable is statistically significant at the 1% level in all the models and it supports the use of dynamic model to conduct the capital structure research.

[3] The article adopts the LLC (Levin *et al*., 2002), the IPS (Im *et al*., 2003), and PP-Fisher Chi-square (Phillips and Perron, 1988). Based on the results of the stationary test of each variable, the variables have stationary characteristics because the null of the unit root are rejected. The results are not reported to save space.

Table 4: System-GMM Two-step Estimation Results for 3,827 Listed Firms from 21 Developing Countries

	Model 1 (Market Debt)		Model 2 (Book Debt)	
TDM_{it-1} / TDB_{it-1}	0.5382***	(59.69)	0.2928***	(71.48)
Interest rate (Int)	-0.0026***	(-5.46)	-0.0003**	(-2.09)
Inflation rate (Inf)	0.0094***	(12.40)	0.0032***	(6.62)
Money Market Rate (Mmr)	-0.0066***	(-7.14)	-0.0018***	(-3.16)
Int*Mmr	-0.0001**	(-2.23)	-0.0001**	(-2.17)
Inf*Mmr	-0.0003***	(-4.29)	-0.0001***	(-3.12)
Rule of Law (ROL)	0.0011***	(5.55)	0.0008***	(5.12)
Regulatory Quality (REGQ)	0.0008***	(3.50)	0.0009***	(5.18)
Control of Corruption (CC)	0.0001*	(1.95)	0.0005***	(3.13)
FA (Fixed Assets)	0.0412**	(2.18)	0.0751***	(5.52)
PRF (Profits)	-0.0200***	(-8.83)	-0.5196***	(-23.52)
Size	0.0014*	(1.80)	0.0105***	(14.94)
PB (Price-to-book ratio)	-0.0001***	(-8.36)	-0.0001	(-0.97)
Ndts (Non-debt tax-shield)	-0.2944*	(-1.84)	-0.8561***	(-4.58)
Firm age (Fage)	0.0125***	(4.37)	0.0079***	(3.21)
Dividend payout (DPO)	-0.0031***	(-15.04)	-0.0010***	(-6.35)
Ownership structure (OWS)	0.0330***	(4.64)	-0.0030	(-0.99)
GDP Growth rate (GDPGR)	0.0007*	(1.92)	0.0007***	(2.80)
BC (Bank Credit)	0.0008***	(9.68)	0.0002***	(3.81)
MC (Market Capitalization)	-0.0004***	(-11.40)	-0.0001**	(-2.18)
AR2	0.7240		0.8373	
Difference Hansen Test (P-value)	0.1920		0.1740	
Instruments	249		249	
Variance Inflation Factor	3.6900		3.5600	
Cross-dependency test (p-value)	0.1490		0.1370	
Cross-sectional observation (N)	3,827		3,827	

Notes: [a] See Table 1 for the definition of variables and measurements. Asterisks indicate significance at 1% (***), 5% (**), and 10 (*). [b] T-statistics (in parenthesis) of the Two-step System-GMM model are based on Windmeijer-corrected standard errors. [c] 2nd order serial correlation in first difference is distributed as N (0, 1) under the null of no serial correlation in the residuals. [d] Difference-in-Hansen over identification test and null that instruments are valid. [e] TDM_{it-2}, TDB_{it-2}, FA_{it-2}, PRF_{it-2}, $Size_{it-2}$, $Ndts_{it-2}$, PB_{it-2}, Age_{it-2}, DPO_{it-2}, ROL_{it-2}, $REGQ_{it-2}$, and CC_{it-2} are used as instruments. [f] Industry dummies are included in all the estimations.

The dynamic results suggest that if firms deviate from their target debt, they make adjustments. This study's main focus is on the indirect effects of money market rate variable. We explore this indirect effect by interacting money market rate with inflation rate and interacting money market rate with interest rate to determine their effects on corporate debt ratios. For example, if monetary policy variable (proxy by money market rate) is important, the interaction terms (i.e. interest rate * money market rate and the inflation rate * money market rate) should be significant. Moreover, if the interaction terms coefficients are greater than zero (interaction term coefficients are less than zero) and if the interest rate and inflation rate positively (negatively) affect debt ratios, the money market rate strengthens the effects of the interest rate and inflation rate on debt, suggesting that the interest rate and money market rate as well as the inflation rate and money market rate factors complement each other. Conversely, if the interaction terms coefficients are less than zero (interaction terms coefficients are greater than zero) and if the interest rate and inflation rate positively (negatively) affect debt ratios, the money market rate moderates the effects of the interest rate and inflation rate on debt ratios, suggesting that the interest rate and money market rate as well as the inflation rate and money market rate factors are substitutes.

The empirical results show that the interaction terms of the money market rate and inflation rate are negative and statistically significant. These results reveal that money market

rate negatively moderates the relationship between inflation rate and firms' debt ratios. These results suggest that the money market rate weakens the positive effect of the inflation rate on the market debt ratio (Table 4, Model 1) and book debt ratio (Table 4, Model 2), suggesting that the inflation rate and the money market rate factors are substitutes. Moreover, the results support our reasoning that holding other factors constant, monetary policy that raises the policy rate increases lending rate, which in turn makes firms borrow and expand less and less expansion lower inflation. This reasoning is in accordance with Coibion and Gorodnichenko (2011) observation that increased focus on fighting inflation via raising the monetary policy rate help stabilized inflationary expectations and removed economic instability in the United States.

Likewise, the interaction term of the money market rate and interest rate are negative and statistically significant. These results reveal that money market rate negatively moderates the relationship between interest rate and firms' debt ratios. These results suggest that the money market rate strengthen the negative effect of the interest rate on the market debt ratio (Table 6, Model 1) and book debt ratio (Table 4, Model 2), suggesting that the interest rate and the money market rate factors are complement. Moreover, the results support our reasoning that holding other factors constant, monetary policy that raises the policy rate should increase the interest rates banks lend money to firms, thereby lowering corporate debt usage in developing countries.

The empirical results reveal that the inflation rate has a direct positive effect on market debt ratio (see Table 4, Model 1) and book debt ratio (Table 4, Model 2), but interest rate is statistically significant and has a direct negative effect on the market total debt ratio (Table 4, Model 1) and book debt ratio (Table 4, Model 2). Additional robust checks control for the 2007/2008 financial crisis years and the results are similar, but the magnitude of the coefficients of some variables change. The financial crisis has a negative effect on both the market total debt ratio (see Table 5, Model 3) and book total debt ratio (see Table 5, Model 4) of the firms. This result is consistent with Jermann and Quadrini (2012) simulation findings that the firms' ability to borrow in 2008-2009 worsen with a sharp economic downturn. Also, the results is consistent with Demirgüç-Kunt *et al.* (2020) findings that the impact of the global financial crisis of 2008–09 cause a widespread deleveraging of firms in developing countries and in developed countries. They noted that the deleveraging was associated with a reduction in the use of long-term debt finance, in both the developing country and developed country, including in countries that did not experience a financial crisis.

The tradeoff theory predicts expected inflation to be positively related to corporate debt. The reason is that real value of debt interest taxshield is higher when inflation is expected to be high (Taggart, 1985; Frank and Goyal, 2009). The negative effect of interest rate on firms' debt ratios is consistent with Antoniou *et al.*'s (2008) reasoning that higher interest rate increases the costs of debt financing and discourages the firms to use more debt. The result is also consistent with Délèze and Korkeamäki (2018) findings that interest rate is negatively related to firms' debt ratios. Conversely, the result is inconsistent with Khemir and Noubbigh (2018) findings that nominal interest rate is positively related to book debt ratio.

Regarding the inflation rate variable, the positive effect of inflation on firms' debt ratios is consistent with Khemir and Noubbigh (2018) findings that inflation rate is positively related to book debt ratio which is attributed to the real value of tax deductions (tax saving) that are high during inflationary periods. The result is also consistent with Frank and Goyal (2009) findings that inflation rate is positively related to both the book debt and market debt ratios which is consistent with the tradeoff theory. The empirical results also show that firms make adjustments to their target debt, especially the book debt ratio, when there is a deviation from the target debt level; this is consistent with the dynamic version of trade-off theory. The

speed of adjustment to the target debt level is calculated as 1-λ, where λ is the coefficient of the lagged debt variables. Previous researchers (e.g., Matemilola *et al.* (2018b), Flannery and Hankins (2013), Gungoraydinoglu and Oztekin (2011)) find evidence that firms adjust to their target debt level.

Table 5: System-GMM Two-step Estimation Results for 3,827 Listed Firms from 21 Developing Countries with financial crisis dummy (Robust check)

	Model 3 (Market Debt)		Model 4 (Book Debt)	
TDM_{it-1} / TDB_{it-1}	0.5527***	(61.14)	0.2948***	(71.42)
Interest rate (Int)	-0.0027***	(-5.63)	-0.0004*	(-1.89)
Inflation rate (Inf)	0.0067***	(8.68)	0.0023***	(4.48)
Money Market Rate (Mmr)	-0.0064***	(-7.04)	-0.0017***	(-2.95)
Int*Mmr	-0.0001**	(-2.49)	-0.0001**	(-2.12)
Inf*Mmr	-0.0003***	(-3.61)	-0.0001**	(-2.64)
Rule of Law (ROL)	0.0013***	(6.45)	0.0008***	(4.90)
Regulatory Quality (REGQ)	0.0007***	(3.24)	0.0008***	(4.64)
Control of Corruption (CC)	0.0007***	(2.94)	0.0003***	(2.10)
FA (Fixed Assets)	0.0458**	(2.44)	0.0804***	(5.93)
PRF (Profits)	-0.0197***	(-8.87)	-0.5235***	(-23.55)
Size	0.0020**	(2.52)	0.0104***	(14.68)
PB (Price-to-book ratio)	-0.0003***	(-8.15)	-0.0001	(-1.06)
Ndts (Non-debt tax-shield)	-0.2400	(-1.66)	-0.2658*	(-1.92)
Firm age (Fage)	0.0150***	(5.34)	0.0090***	(3.65)
Dividend payout (DPO)	-0.0030***	(-14.59)	-0.0009***	(-5.94)
Ownership structure (OWS)	0.0158*	(1.98)	-0.0028	(-0.63)
GDP Growth rate (GDPGR)	0.0012***	(3.23)	0.0007***	(3.12)
BC (Bank Credit)	0.0007***	(9.34)	0.0003***	(4.48)
MC (Market Capitalization)	-0.0002***	(-6.38)	-0.0001**	(-4.14)
Financial Crisis Dummy_07&08	-0.0367***	(-11.00)	-0.0098***	(-4.84)
AR2	0.8139		0.8338	
Difference Hansen Test (P-value)	0.1870		0.1690	
Instruments	250		250	
Variance Inflation Factor	3.4700		3.5100	
Cross-dependency test (p-value)	0.1380		0.1460	
Cross-sectional observation (N)	3,827		3,827	

Notes: [a] See e 1 for the definition of variables and measurements. Asterisks indicate significance at 1% (***), 5% (**), and 10 (*). [b] T-statistics (in parenthesis) of the Two-step System-GMM model are based on Windmeijer-corrected standard errors. [c] 2nd order serial correlation in first difference is distributed as N (0, 1) under the null of no serial correlation in the residuals. [d] Difference-in-Hansen over identification test and null that instruments are valid. [e] TDM_{it-2}, TDB_{it-2}, $FA_{it-2,}$ PRF_{it-2}, $Size_{it-2}$, $Ndts_{it-2}$, PB_{it-2}, Age_{it-2}, DPO_{it-2}, ROL_{it-2}, $REGQ_{it-2,}$ and CC_{it-2} are used as instruments. [f] Industry dummies are included in all the estimations.

5. Conclusion

Our paper adds to the growing literature on capital structure-macroeconomic factors relationship by introducing the monetary policy variable (proxy as money market rate) as new variable that moderate the inflation rate and corporate debt relationship, and the interest rate and corporate debt relationship. Moreover, we use large firm-level and country-level dataset from 21 developing countries, and we account for the effects of the 2007/2008 financial crisis years to strengthen the robustness of our conclusion.

This article examines the moderating role of monetary policy on the relationship between inflation rate and corporate debt and the relationship between interest rate and corporate debt for a panel of 3,827 listed firms from 21 developing countries. Our findings reveal that monetary policy weakens the positive effect of inflation rate on corporate debt ratios. Conversely, monetary policy strengthens the negative effect of interest rate on corporate debt

ratios. Our results are robust after controlling for the financial crisis years. The results suggest that contractionary monetary policy (i.e., raising the policy rate) appears effective to combat rising inflation and lower corporate debt ratios. Also, interest rate has direct negative effects on corporate debt ratios. Conversely inflation rate has a direct positive effect on corporate debt ratios, consistent with previous findings in the literature. The empirical results also show that firms in developing countries make adjustment to their target debt level.

These results have several policy implications. Firstly, the findings that monetary policy weakens the positive effect of inflation on corporate debt ratio in developing countries suggest that contractionary monetary policy appears effective to combat rising inflation rate effect on corporate debt. As inflation is a sign of overheated economy, the monetary authorities should slow down economic growth by raising interest rate to make lending more expensive to firms, thereby reducing firms' ability to borrow debt capital to finance business expansion. Secondly, the findings that monetary policy strengthens the negative effect of interest rate on corporate debt suggest that a contractionary monetary policy (i.e. raising the policy rate) is effective in constraining the ability of firms to raise debt capital in developing countries. Moreover, monetary authorities may rely on contractionary monetary policy to reduce firm excessive growth during the economic boom period in order to restore economic stability in developing countries. Third, the additional findings that financial crisis is negatively related to corporate debt suggest that firms should plan ahead to minimize the effect of future financial crisis (as financial crisis has become a repeated cycle) that may reduce their borrowing capacity.

One limitation of our work is that we use money market rate as proxy for the policy rate because the policy rate variable is not available for several developing countries. Nevertheless, money market rate is closely related to the policy rate and it is widely regarded as a substitute for the policy rate. An avenue for future research is to explore whether monetary policy is effective to reduce costs of capital and stimulate firms' investments in both the developed and developing countries. Another avenue for future research is to explore the impact of the money market rate on the speed of adjustment to the target debt ratios. It is possible that the money market rate like other established macroeconomic factors also impact the speed of adjustment to the target debt ratios.

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Appendix

Table A1: Correlation result

	Pr	Mmr
Pr	1.00	
Mmr	0.85*	1.00

Notes: * indicate correlation is significant at 1%. Pr is the policy rate and Mmr is the money market rate. Policy rate data is available for Kenya and Nigeria.