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## FINANCIAL ECONOMICS | RESEARCH ARTICLE

# Determinants of working capital requirement in listed firms: Empirical evidence using a dynamic system GMM

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**Abstract:** Working capital management is a critical element in the survival of every firm. While the effective management of working capital leads to value creation in firms, ineffective management of working capital, on the other hand, does not only destroy value but can lead to the eventual solvency of the firm. The search for the factors that influence working capital management has, therefore, become a worthwhile exercise embarked upon by both managers and scholars. The main aim of this study is thus to empirically investigate the determinants of working capital requirement on the listed firms in Ghana. In examining the determinants of working capital requirements, 28 firms listed on the Ghana Stock Exchange were used for a time period of 8 years, spanning from 2007 to 2014. The study employed a dynamic panel system of General Methods of Moments (GMM) to test the hypotheses. This estimator has the ability to produce consistent and unbiased results when even there is an endogeneity in the model. This, therefore, makes our results more efficient and reliable. First, the study suggests that working capital in Ghanaian firms is determined by profitability, age, sales growth, GDP growth, operating cycles and leverage. Second, it is realized that while age, profitability and operating cycle strongly impacts positively on working capital, GDP growth, sales growth and leverage inversely correlate with working capital.

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### PUBLIC INTEREST STATEMENT

This paper investigates empirically the determinants of working capital management requirement in a developing country context. It is critical to know what drives working capital management in firms especially in developing country context where access to finance in most cases is a serious challenge to most firms. Knowing these determinants paves way for managers of firms to be able to make informed decisions regarding the day-to-day management of their organisations without running out of cash and also at the same time not holding on with so much cash to the detriment of investing for future growth of the firm. This paper has, therefore, shed more light on the key determinants of working capital management in the Ghanaian economy. The work is thus very useful to both academic and policy-makers in general.

**Subjects: Economics; Finance; Business, Management and Accounting**

**Keywords: working capital requirement; GMM; operating cycle; and Ghana**

### 1. Introduction

Working capital management plays a vital role in a firm's profitability, risk management and value enhancement (Smith, 1980; Padachi & Howorth, 2014). Managers can increase a firm value by setting the capital ratio to its optimal level as noted by Rahman and Nasr (2007). Thus, maximization of shareholder wealth is achieved by carefully controlling short-term obligations as well as reducing investments in liquid assets. Additionally, working capital is an important indicator of risk of creditors. Effective management of working capital does not only help firms to withstand the impact of economic turbulence but it also plays a crucial role in firms during booming economic seasons (Kesimli & Gunay, 2011; Reason, 2008). It is very crucial and important element in every organisation that wants to survive and maximize wealth for its stakeholders. The effective management of working capital is noted by Baker (1991) to be important for the reasons stated below: first, working capital constitutes a greater proportion of total assets of a firm. Second, working capital consumes huge amount of time of managers. It deals with the day to day decision-making of managers in the smooth running of the firm.

Third, it directly impacts on the long-term growth and survival of the firm and finally, it affects directly the firm's liquidity and profitability. Low levels of current assets may lead to lower levels of liquidity and stock outs, resulting in difficulties in maintaining smooth operations whereas excessive levels of current assets may lead to a negative effect on a firm's profitability (van Horne & Wachowicz, 2004). Apart from these reasons, inefficient management of working capital has been cited as a major cause of failures in businesses (Altman, 1968; Dunn & Cheatham, 1993; Shin & Soenen, 1998). Also, ineffective working capital management in the form of overinvestment can destroy the value of firms (Moussawi, La Plante, Kieschnick, & Baranchuk, 2006). This implies that inadequate management of working capital is very injurious to shareholders' wealth creation in a firm. Again Moussawi et al. (2006) argue that where adequate management of working capital exist, companies incur low financial expenses and thus maintain stable growth. Efficient working capital management assists a firm to avoid financial distress, maintain solvency and crucial for a firm's long-term survival (Padachi & Howorth, 2014).

Thus, the mismanagement of working capital can lead a firm into losing a lot of profitable investment prospects (Narendre, Menon, and Shwetha (2009). On the other hand, the availability of more current assets at the disposal of management can lead to imprudent decisions taking by managers. For instance, with availability of cash, managers may go into the purchase of luxury assets for their own usage or for the usage of the firm. A part from that, management may be complacent in their performance and hence do not take investment decisions with critical minds.

From the above literature, it is realized that the abundance or the scarcity of liquidity in a firm is not the problem but how to manage either of them. Most managers of firms are aware of this fact and hence have engaged financial managers who have the technical know-how to set the optimum working capital levels for their firms. In Europe for instance, 74% of leading companies that participated in a survey conducted by KPMG acknowledged that capital management is very important and thus managers have developed policies to improve on it in their firms (KPMG, 2005). However, many financial managers have difficulties in identifying the important drivers of working capital and hence their inability to set optimum levels (Lamberson, 1995). This has, therefore, made the identification of factors influencing working capital management not only a critical issue for academics but also a very important issue to managers of firms. As a result of this many studies in recent times have gone into the issue trying shedding more light on it in the advanced continents to the neglect African countries (see for instance Abbadi & Abbadi, 2012; Afrifa et al. 2016; Lyngstadaas & Berg, 2016; Mongrut, O'shee, Zavaleta, & Zavaleta, 2014; Nazir 2009). In

Africa, just a few studies have ventured into the establishment of factors determining working capital management (see: Agyei, Oduro, & Ansong, 2013; Akinlo, 2012 Kwenda & Holden, 2014).

Meanwhile, it has been established empirically that though working capital management is crucial for all firms, it is relatively more important to the performance of small firms than big firms (Afrifa, Tauringana, & Tingbani, 2016). It is thus intuitive to argue that more studies to establish the factors that influence working capital in Africa are needed since majority of firms in Africa are small firms in relative to the other continents. Apart from that country-specific context matters a lot when it comes to firm-level studies as African countries vary greatly in economics and population dynamics and thus the factors that are found in one country in Africa may not be applicable in another country and that is why this study is centred on the Ghanaian economy. All previous known studies on the subject matter in Ghana have been carried out on the banking sector which is just one of the numerous sectors of the country (see: Agyei & Yeboah, 2011; Agyei et al., 2013; Asare-Kumi, Darkwah, Nortey, & Chapman-Wardy, 2016). In our study, we have included all sectors that have got their firms listed on the Ghana stock exchange since no sector is immune to the challenges of managing working capital. Besides, our study departs from other studies by using GMM estimators in establishing our factors. GMM unlike other estimators, has the power not only to overcome heteroscedastic problems in estimation, but it is able to overcome endogeneity problems which when not checked leads to biased results. This, therefore, makes our results more robust and consistent.

The remainder of the study is structured in the following way. Section 2 reviews the theories and the empirical literature on the determinants of working capital management while Section 3 focuses on the data and methodological issues. Section 4 presents the discussions on the regression results while Section 5 delved with the conclusion and recommendations of the study.

## 2. Literature review

This section is devoted to the review of literature relevant to working capital management. We first reviewed the theoretical literature on working capital management followed by empirical literature on the determinants of working capital management.

### 2.1. Theories on working capital management

Working capital is the money firms used in their day-to-day operations. It is hence the excess of current assets over current liabilities. Theoretically working capital does not have direct theories explaining its management. It can, however, be explained in the context of capital structure hence theoretical underpinnings of capital structure can be used in explaining working capital management. Thus we have explained below two of the theories of capital structure which have bases for working capital management. These theories are the agency cost and the pecking order theories.

#### 2.1.1. Agency cost

One feature of any company is the separation of ownership from management where managers who are agents enjoy substantial autonomy with regards to the day to day affairs of the firm while ownership rests in the hands of the shareholders who are the principals of the firm. Arising from the existence of different ownership from managers, conflicts of interest are bound to occur where managers may carry out activities for their own interest to the disadvantage of the owners (Jensen & Meckling, 1976). Arising from the conflict of interest between owners and managers, this could affect the investment and liquidity decision-making of managers. Where there is weak supervisory mechanism, manager in pursuit of their individual interest can invest cash into negative net present value (NPV) projects or refuse to invest money into positive NPV projects. In such cases, managers are likely to invest in negative NPV projects either for self-gratification purposes or personal gains (Chung, Firth, & Kim, 2005). With such excess cash flow, Agyei et al. (2013) argue that managers could be very careless in their investment decisions, keeping a lot of inventories and giving more credit payment periods than normal to their debtors. From the afore literature,

the working capital policy that is adopted by a firm in these situations would be depended heavily on the monetary and cash levels of the firm.

### 2.1.2. *Pecking order*

This theory was propounded by Myers and Majluf (1984) and Myers (1984). The theory places emphasis on information asymmetry as a basis for the choice of capital structure by a firm. Conditions upon which this theory is based are, that managers are acting in the interest of the shareholders and that managers are more informed than outsiders about the prospects of the firm. Given that these conditions are met, firms will prefer to use retained earnings over debt if available and will prefer taking on debt also over issuing of new equities. New equities are seen as a last resort that firms will go in for as financing instrument. Thus firms that generate more profit will prefer to use internal funds and hence will use less debt. Pecking order theory also posits that with information asymmetry, higher growth opportunities in a firm means higher risks and hence such firm has the chance in raising debt. However, Smith and Watts (1992) and Pratheepan and Banda (2016) argue contrary that firms with higher growth opportunities will have low debt as capital.

## 2.2. *Determinants of working capital management and hypotheses development*

Following the theoretical debates on working capital based on capital structure ignited by Modigliani and Miller (1958), several empirical studies have delved into the determinants of working capital management. As identified by most of the empirical studies, we have reviewed the following as the determinants of working capital management requirements: firm size, sales growth, profitability, leverage, level of economic activities, operating cycle and the nature of the business.

### 2.2.1. *Firm size*

Theoretically, the relationship between the size of a firm and working capital requirements is mixed. Large firms are expected to have a greater investment in working capital due to their huge day-to-day operational needs. Empirically this relationship has been established (see: Akinlo, 2012; Agyei et al., 2013; Fatimatuzzahra & Kusumastuti, 2016; Lyngstadaas & Berg, 2016; Onaolapo & Kajola, 2015). Contrary to the above view and findings, larger firms are expected to have a large pool of suppliers with more favourable terms than smaller firms thus will need smaller working capital as it has the ability to hold its creditors for long. Empirical there exist studies that support this (Mongrut et al., 2014; Nazir 2009). We, therefore, hypothesis that:

$H_1$ . Firm Size is positively related to working capital requirements

### 2.2.2. *Sales growth*

Sales expansion is one of the critical determinants of working capital requirements in every firm. It affects working capital because the level of working capital of every firm depends on its sales volume (Kwenda & Holden, 2014). Firms that have growth opportunities are seen as firms that have proper investment opportunities and hence will make available working capital to take advantage of their opportunities. Nunn (1981) demonstrated this positive relationship between growth and working capital by indicating that firms that anticipate growth is likely going to increase its investments in inventory. Akinlo (2012) findings on 66 firms in Nigeria using both OLS and fixed effect estimators go to support this view. It is however noted that the relationship between sales growth and working capital can suffer from endogeneity problems as sales growth does not only stimulate working capital but working capital, on the other hand, can influence sales growth too (Hill, Kelly, & Highfield, 2010). This means that the findings of Akinlo (2012) could be biased by possible endogeneity in the model as his studies failed to control for possible endogeneity. The pursuit of favourable long-term credit policies to customers and higher commitments in inventories will lead to high sales while the deliberate commitment to sales increase will also call for more commitment in inventories as well as other current assets. Based on this we hypothesized that:

$H_2$ . Sale Growth is negatively related to working capital requirements

### 2.2.3. Profitability

Following the prediction of Pecking Order Theory (Myers & Majluf, 1984), an inverse relationship between profitability and working capital requirement is expected. Firms that have higher profits are likely going to plough that profit back into long-term positive NPV projects. On the contrary, Nazir (2009) argue that firms with more profit do give greater attention to efficient working capital management hence they end up with more current assets. Most of the empirical evidence has established positive significant relationship between profit and working capital (see: Abbadi & Abbadi, 2012; Lyngstadaas & Berg, 2016; Nazir 2009; Onoalapo and Kajola 2015). A few number of studies also discovered negative relationship between profitability and working capital management (see: Fatimatuzzahra & Kusumastuti, 2016). Based on this we established the following hypothesis for testing:

$H_3$ . Profitability is positively related to working capital requirements

### 2.2.4. Leverage

Gearing is one of the factors that influence the working capital requirement of a firm. It is believed that already geared firms are always very careful not to increase their gearing level thus they try as much as possible to keep investment on current asset to lower limits. Due to their extra care put in the management of their working capital in order not to increase their risk, they tend to have low investment in current assets. Empirical evidence is abound in supporting the negative relationship between leverage and working capital (Abbadi & Abbadi, 2012; Agyei et al., 2013; Akinlo, 2012; Elbadry, 2018; Nazir 2009; Onoalapo & Kajola, 2015). We formulated the following hypothesis:

$H_4$ . Leverage is negatively related to working capital requirements

### 2.2.5. Level of economic activities

Firms do not operate in a vacuum but in economies and hence the activities of the particular economy certainly have an impact on the operations of the firm. Thus economic activities viewed as either booming economy or slowdown economy is a key determinant of working capital requirements. For instance, firm's liquidity is expected to increase during booming times and the vice versa during down times. It is further argued that during the economic boom, firms do not only spend more on fixed assets so as to increase their productivity, but they spend more also on inventories and debtors as sales will increase automatically (Akinlo, 2012). On the other hand, during economic decline, sales fall and so will the levels of inventories and debtors. This further make firms to reduce their short-term borrowing thus reducing the need for working capital. This means that during better economic times, working capital is expected to be high while the expectations are for a low working capital during down times. Studies have found evidence in support of this (Lamberson, 1995; Akinlo, 2012; Lyngstadaas & Berg, 2016). On this background, we formulated this hypothesis:

$H_5$ . Gross Domestic Product correlates positively with working capital requirements

### 2.2.6. Operating cycle

This measures the period it takes for a firm to be able to collect its receivables and sell its inventory. The longer the period of time it takes for the firm to collect its debt or sell out its inventory, the higher will be its working capital requirements. Many empirical studies have established support for this assertion (see: Abbadi & Abbadi, 2012; Akinlo, 2012; Nazir 2009; Onoalapo & Kajola, 2015). Thus we hypothesized that:

$H_6$ . Operating Cycle correlates positively with working capital requirements

### 2.2.7. Nature of business (industry)

Working capital requirements of a firm are basically related to the conduct of the business. Hence, the nature of the business influences the working capital requirements. Manufacturing firms, for instance, invest in fixed assets as well as in current assets, when compared with trading firm. Trading firms by their nature have to maintain sufficient amount of cash, inventories and accounts receivables. Retail stores will need to carry large stock of a variety of goods to satisfy their customers' need whereas utility firms will have low need for working capital because they may only have cash sales and services and thus do not lock up any cash in stocks and on debtors. Similarly, as noted by Akinlo (2012), trading and financial firms will need a huge sum of money to be invested in working capital requirements will be depended heavily on the type of industry that the firm is operating. He further observed that every manufacturing firm has a manufacturing cycle which is the period of time the raw materials are taken to be turned into final product. Thus, the longer the manufacturing cycle the more working capital that will be required by the firm. For instance, firms that manufacture detergents have a short manufacturing cycle and thus will need less working capital than those manufacturing automobile which will take a long period to get it manufactured and hence will need more working capital.

## 3. Data and methodology

### 3.1. Source of data

To determine the variables that influence the working capital requirements of firms in Ghana, we used the Ghana Stock Exchange (GSE) as our source of data. Currently, the GSE has 40 firms listed on it. However, some of the firms listed do not have complete financial statements. Based on this, we used 28 firms that have complete financial information needed for our investigation. This number constitutes 70% of the total number of firms listed on the GSE. The firms cut across all sectors, ranging from the financial services sector to the extractive and manufacturing sector of the economy as shown in Table 1. Our data span from 2007 to 2014 thus giving us a total number of 224 as our panel observations. The data were extracted from Mc Gregor dataset which hosts the financial statements of all African listed firms while the GDP data was sourced from the IMF website.

**Table 1. Industry composition**

Industry	Mining and oil	Manufacturing	Health	Financial services	Goods and services	Total
Number of firms	3	10	2	10	3	28

### 3.2. Variables

Following our review of literature, we have got our dependent variables which represent working capital to be working capital ratio and cash conversion cycle. Our independent variables used here are the determinants of the working capital requirements which we have examined above in the literature. Full description of all the variables is found on Table 2 below. All the definitions of our variables follow previous empirical works (see: Agyei et al., 2013; Akinlo, 2012; Nazir 2009; Onaolapo & Kajola, 2015).

### 3.3. Empirical model of estimation

Our basic panel model is in the form:

$$Y_{it} = \phi + X_{it}\alpha + \varepsilon_{it} \tag{1}$$

where  $\phi$  is a constant,  $X_{i, t}$  is a K-dimensional vector of explanatory variables and  $\varepsilon_{i, t}$  is the error term which is further decomposed into the following disturbance terms;

**Table 2. Definitions of variables**

Variables	Code	Definition
<i>Dependent variables</i>		
Y Working capital ratio	WCR	It is defined as working liquid assets less working liquid liabilities. It is calculated as <b>[(Current Assets)- (Current Liabilities)]/Total Assets</b>
<i>Independent variables</i>		
X <sub>1</sub> Size	SIZE	This is defined as the natural log of Total Assets
X <sub>2</sub> Sales growth	SGR	It is the annual percentage change in sales. It is calculated as <b>(Total Sales<sub>t</sub>—total Sales<sub>t-1</sub>)/total Sales<sub>t-1</sub></b>
X <sub>3</sub> Profitability	ROA	It is the return on assets. <b>It is calculated as Profit before Interest and Tax divided by Total Assets</b>
X <sub>4</sub> Leverage	LEV	It is calculated as <b>total debt/(total debt + total equity)</b>
X <sub>5</sub> Economic activities	GDP	This refers to the change in natural log of GDP
X <sub>6</sub> Operating cycle	OC	This is the sum of days in inventory and days in accounts receivables. It is calculated as <b>inventory conversion period (ICP) + Receivables Conversion Period (RCP)</b> . Where ICP = (Average inventory/Annual Cost of goods sold) *365 RCP = (Average Accounts Receivables/Annuals Sales) *365

$$\varepsilon_{it} = \mu_{it} + V_i \tag{2}$$

Following the works of Akinlo (2012), Agyei et al. (2013), Nazir (2009) and Onaolapo and Kajola (2015) with modifications, we modelled our study as follows:

$$WCR_{i,t} = \beta_0 + \beta_1 SIZE + \beta_2 SGR_{i,t} + \beta_3 ROA_{i,t} + \beta_4 LEV_{i,t} + \beta_5 GDP_{i,t} + \beta_6 OC_{i,t} + \varepsilon_{it} \tag{3}$$

where

$$\varepsilon_{it} = \mu_{it} + V_i \tag{4}$$

$V_i$  = individual firm effects

Several panel estimators including OLS, fixed effect, random effect, PSCE, 2SLS and GMM could be employed in testing our hypotheses. However, in estimating our model, we first of all considered the possibility of endogeneity existence as the expected determinants of working capital requirements could also be impacted by the working capital itself. For instance, it is highly plausible that variables such as profitability and sales growth could also be influenced by the working capital thus there are a possibility of bidirectional causality and hence endogeneity caused by simultaneity is envisaged. The presence of endogeneity would make OLS, fixed effect, random effect and PSCE estimations inconsistent and produce bias results. In this instance, we were left with 2SLS and GMM to use. With the absence of valid instruments which are cardinal requirements of the 2SLS, we adopted the General Method of Moments (GMM) in our estimation. Following the works of Alhassan, Kyereboah-Coleman, and Andoh (2014) which indicates that difference GMM introduced by Arellano and Bond (1991) as argued by Blundell and Bond (1998) has lower predictive ability in small sample with small-time period as ours we have adopted the system GMM. The system GMM of Arellano and Bover and Blundell and Bond (1998) arguably has a higher predictive ability in small-time period data like our data and thus is more efficient than the difference GMM. To obtain robust results using the system GMM, the lagged values of the explanatory variables are used as instruments. The validity of the instruments in our model is checked using the Sargan test for over-identified restrictions.

### 3.4. Panel unit root test

Due to the time series dimension of our panel, we first test for the existence of unit roots. When time series have unit roots or they are non-stationary, results generated from such series normally tend to be spurious and hence leads to inconsistent outcomes. To check this, there are a number of unit root panel tests (Harris & Tzavalis, 1999; Im, Pesaran & Shin, 2003 and Levin, Lin & Chu, 2002). All these test have their null hypothesis that all the panels contain a unit root while the alternative is that the panels are stationary. All these tests assumed cross-sectional dependence and therefore are not so much suitable to panels of second and third generation (Nell & Zimmermann, 2011). There are some recent tests that can deal with cross-sectional dependence. For instance, Choi (2001), Chang (2002, 2004) and Pesaran (2007). However, these recent tests that can overcome any cross-sectional dependence problems are not readily available in software to be used. Thus, we have employed the Levin-Chin-Chu test to examine whether our series are contain unit root. As indicated earlier, the null hypothesis is that the series contain a unit root and the alternative is that the series is stationary. This test assumes a common autoregressive parameter for all panels so it does not allow for the possibilities of some firms variables containing unit roots while others do not. The Levin-Chin-Chu test involves fitting an augmented Dickey-Fuller regression for each panel. Due to the fact that Levin-Lin-Chu test requires that the ratio of the number of panels to time periods tend to zero asymptotically, it is not well suited to datasets with a large number of panels and relatively few time periods. According to the authors, the test performs well when N lies between 10 and 250 and when T lies between 5 and 250. If the T is very small the test is undersized and has low power. In our case, our T is 8 while N is 28 thus the suitability of the test to our dataset.

From our results as presented in Table 3, it is realised that while sales growth, leverage and size of firm are stationary at level hence have no unit roots, working capital ratio, return on assets, gross domestic product growth and operating cycle have been found to be non-stationary. Non-stationary time series can, however, be made stationary by differencing the series (Johannes, Njong, & Clement, 2011). Thus after differencing these non-stationary variables, we obtain all our series to be stationary as we reject the null hypotheses that the series are non-stationary.

## 4. Empirical results

### 4.1. Descriptive statistics

Presented below in Table 4 are the summary statistics of our variables. The mean working capital requirement is -0.096. This implies that most of the firms have their current liabilities exceeding their current assets. This reflects heavily on the leverage rate which is about 51% of the firm assets. The average growth rate of the firms stands at 23% while the average ROA is 1.9%. From Table 5 is shown our correlation matrix. Results from this table show that it is only ROA and Leverage that have a significant high negative correlation among all the independent variables at 82%. Based on this, we constructed two models by not putting both variables in the same equation so as to avoid multicollinearity issues that bias our findings. In model 1, leverage is excluded with all other independent variables captured. Similarly, ROA is excluded in model 2.

**Table 3. Levin, Lin and Chu panel unit root test results**

Variable	T. Statistics	p-Value	Status
WRC	209.3137	0.0000	1 <sup>st</sup> Difference
SGR	274.4842	0.0000	Level
ROA	168.9374	0.0000	1 <sup>st</sup> Difference
LEV	153.5048	0.0000	Level
GDPG	122.1000	0.0000	1 <sup>st</sup> Difference
Logsize	218.0126	0.0000	Level
Logoc	209.3137	0.0000	1 <sup>st</sup> Difference

**Table 4. Descriptive statistics**

Variable	Obs.	Mean	Std. Dev.	Min	Max
WCR	223	-0.096	1.378	-20.167	0.681
Log (SIZE)	224	12.315	2.629	5.778	21.001
SGR	196	0.231	0.677	-1.000	7.558
ROA	223	0.019	0.214	-2.533	0.390
LEV	223	0.513	0.947	0.000	13.173
GDPG	224	7.504	3.223	3.992	15.009
Log OC	215	5.366	1.799	2.001	10.396

**Table 5. Correlation matrix**

	WCR	SIZE	SGR	ROA	LEV	GDPG	OC
WCR	1.000						
CCC	0.028						
SIZE	0.008	1.000					
SGR	0.005	0.003	1.000				
ROA	0.822*	0.039	-0.001	1.000			
LEV	-0.932*	-0.018	0.068	-0.816*	1.000		
GDPG	0.068	-0.020	-0.008	0.101	-0.061	1.000	
OC	0.015	-0.006	0.073	-0.066	0.094	0.054	1.000

#### 4.2. Discussion of regression results

In determining the factors that influence working capital requirements, we employed a robust system GMM estimator which has the ability to produce unbiased results. In establishing the validity of our results, we conducted Sargan test of validity. As shown in all our models, all our results are valid with AR (1) and AR (2) greater than 10%. We further separated manufacturing firms alone to investigate as to whether the results will vary significantly. From the results shown in Tables 5 and 6 below, size is found to be significantly positive at 1% significant level. The level of working capital required is determined by the assets of the firm. This is in tandem with previous findings that support the view that larger firms have greater investment prospects thus need more current assets daily than smaller firms (see; Akinlo, 2012; Agyei et al., 2013; Onaolapo & Kajola, 2015). It, however, contradicts the findings of Nazir (2009) that large firms will need small working capital since they have the ability to hold credit for long. This positive link between size and working capital persist when the manufacturing firms have been separated from the rest of the firms. The only difference in the results is that the coefficient of firm size is greater in the manufacturing firms alone than in the overall sector. It implies that any change in size of firm in manufacturing sector leads to a greater change in working capital than in the overall sector. It, therefore, suggests that in the case of Ghana, size of a firm is a strong determinant of working capital irrespective of the sector in which a firm operates.

Growth correlates inversely with working capital thus supporting the null hypothesis that growth relates to working capital negatively. Our findings do not support earlier studies (Akinlo, 2012; Nunn, 1981). The negative link between sales growth and working capital in Ghana can be attributed to higher current liabilities incurred by firms in order to increase sales. This is because working capital is equated to current assets less current liabilities deflated by total assets. Thus if the increase in current liabilities exceeds the current assets accumulated as a result of sales growth, it will obviously lead to low working capital. It can also be influenced by higher commitment into long-term investments during higher sales by firms. The higher sales realized by firms

**Table 6. System GMM regression results for all firms.**

<b>Independent variables</b>	<b>(1) WCR</b>	<b>(2) WCR</b>
L.WCR	1.581*** (0.133)	0.359*** (0.0834)
Log of size	0.436*** (0.0606)	0.0492*** (0.0174)
SGR	-0.0425** (0.0170)	-0.00878 (0.0130)
ROA	4.709*** (0.205)	
GDPG	-0.0127*** (0.00307)	0.00166 (0.00122)
Log of OC	0.362*** (0.0118)	0.0526*** (0.0103)
LEV		-1.415*** (0.0104)
Constant	-7.458*** (0.756)	-0.249 (0.202)
Wald $\chi^2$	7035.90[0.000]	50417.11[0.000]
Sargan Test:		
Prob> $\chi^2$	0.2996	0.3920
AR(1) p-value	0.3149	0.1171
AR(2) p-value	0.9580	0.2995
Observations	156	156
Number of firm	28	28

Standard errors in parentheses  
 \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

can be a motivator for firms to invest more into long-term positive investment thus reducing short-term assets while increasing long-term investment. In manufacturing firms as seen in Table 7, growth of firms does not influence the working capital requirement of such firms. It thus suggests that the general results in our findings are influenced heavily by the financial service firms which have the highest number of firms in the sample after manufacturing firms.

Profitability on the other hand strongly influences working capital positively at 1% in both the combined data and the manufacturing data alone. This supports our a priori expectations and previous studies (Abadi & Abadi, 2012; Nazir 2009) but contradict the celebrated Pecking order theory of Myers and Majluf (1984) which posit that firms that have higher profits will plough back into long-term investment with positive NPVs. This implies that higher profits from Ghanaian firms are either shared to shareholders as dividends or put into short-term investments. This also means managers in Ghanaian firms are more interested in achieving short-term goals so as to get their promised bonuses but not necessarily focusing on the holistic interest of the firm.

Our findings also show that leverage has a strong negative correlation with working capital in Ghana. The more geared a firm is, the less current asset it will like to keep. This gives supports not only to our a priori expectation but to earlier findings (Akinlo, 2012; Nazir 2009 etc). It shows that highly geared firms are very careful in managing resources so as to enable them come out from their financial distress. Similarly, GDP growth which measures the economic activities of a host firm economy has an inverse relationship with working capital. In the Ghanaian economy, when the

**Table 7. System GMM regression results for manufacturing firms only.**

<b>Independent variables</b>	<b>(1) WCR</b>	<b>(2) WCR</b>
L.WCR	2.509*	-0.130
	(1.487)	(0.489)
Log of size	0.903**	0.156
	(0.432)	(0.313)
SGR	0.163	-0.0796
	(0.201)	(0.0690)
ROA	5.216***	
	(0.414)	
GDPG	0.0233	0.00222
	(0.0175)	(0.00716)
Log of OC	0.172*	0.00568
	(0.101)	(0.0536)
LEV		-1.489***
		(0.0525)
Constant	-10.58***	-1.330
	(3.989)	(3.162)
Wald $\chi^2$	489667.23[0.000]	2.47e+06[0.000]
Sargan Test:		
Prob> $\chi^2$	0.9986	0.9948
AR(1) p-value	0.5537	0.5506
AR(2) p-value	0.1372	0.8883
Observations	56	56
Number of firm	10	10

Standard errors in parentheses  
 \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

economy is booming, it avails a lot of opportunities and confidence to firms so these firms are able to invest their assets into long-term prospects instead of holding the assets in short-term investment due to fear. In the manufacturing firms, however, GDP growth is realized to have no impact on working capital requirement. Operational cycle is established from our findings to correlates positively with working capital requirements. The longer the operational cycle, the more working capital required. This is in agreement with our a priori expectations and earlier studies.

### 5. Conclusion

The study investigated empirically the determinants of working capital requirement on Ghanaian listed firms. Using a robust dynamic panel system GMM, the study established that all our independent variables are important elements in determining the working capital requirement of a listed firm in Ghana. First, we realized that size, age, profitability and operating cycle impacts significantly positive on the working capital of listed firms in Ghana. Second, we noted on the contrary that sales growth, GDP growth and gearing have a significant inverse relationship with working capital. After separating the manufacturing firms from the other sector firms, we found virtually the same results with only the exception of sales growth and GDP growth that have been found to have no significant impact on working capital in Ghana. The study shows that it is not only internal factors that affect the working capital of a firm. External factors such as the level of the economic activities of a country are also important determinants. The study thus shed more light on the factors to examine when managers want to set optimum working capital for their firms.

The study has several benefits to policymakers especially managers of firms in Ghana. First, it serves as a reference point for managers in determining the variables that affect working capital in their firms. This very important to every manager of a firm in Ghana as most of the firms operating in Ghana are small firms which are noted to be more prone to liquidity or working capital challenges (Afrifa et al., 2016). Second, it provides firm managers with information on liquidity needed to operate firms efficiently. The study has made known that any increase in size, age, profit and operating cycles in Ghana will lead directly to increment in working capital in a firm and the reverse is true when there is a decrease in any of these variables while increase in sales, GDP growth and leverage will lead to a decrease in working capital if a firm. Finally, the results from this work can be very helpful to managers in determining the optimum level of working capital so as to avoid waste in firm operations.

Notwithstanding the robustness of this work, certain limitations could not be avoided. The study is conducted on only 28 firms operating in the Ghanaian economy using only 8 years of time frame hence generalization of the results to other economies could be problematic. Due to the limited scope of our data too, other variables such as inflation, Tobin's Q, corporate governance mechanisms, sectorial dynamics and other alternative measures of working capital could not be explored. For future research direction, we recommend an expansion on the number of firms and increase in the time period. This will make it possible to be able to use other panel estimators like difference GMM and Augmented Mean Group (AMG). We further recommend that future research on the subject matter should include all the possible variables and increase the coverage to include other economies especially those in the developing economies so as to make findings generalizable across economies.

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