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Review paper

PROFITABILITY OF INSURANCE COMPANIES IN GHANA: Panel Co-Integration and Causality.

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ABSTRACT

There are several factors that affect working capital management on profits of insurance companies in Ghana. The main objective of the study is to use principal component analysis to extract a smaller set of variables from the 17 variables that have an effect on working capital management on profit of 10 insurance companies listed on the Ghana Stock Exchange from 2008 to 2014 with a reduced loss of information. Five factors namely Cash Conversion Cycle, Debt Ratio, Current Ratio, Sales Growth Rate and Accounts Collection Period were extracted using principal component analysis which were used as regressors to identify the source of causation for profitability by testing the causal effect between working capital management and profitability in the insurance companies in Ghana over the period 2008-2014. The findings from a unit root test for all the extracted variables from principal component analysis showed that all variables were stationary at first difference, thus all the five variables were used for the panel co-integration test. A co-integration panel test revealed that there was a long run relationship between the extracted variables from principal component analysis. A two-step procedure generated a panel-based error correction and a Granger causality test revealed that there is a bi-directional causal relationship between working capital management and profitability.

Keywords: Principal Component Analysis, Insurance Company, Ghana Stock Exchange, Profitability, Panel Co-Integration, Panel Unit Root Test, Granger Causality

1. INTRODUCTION

The main aim of every company is to maximize its profits, hence factors that have an effect on profit have been a major concern to managers or analyst over the years. Two factors that have been identified to have a direct impact on profit are liquidity and working capital management.

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According to ([17]), working capital management concerns with handling of current liabilities, current assets and make sure that every variable attain an optimal level by managing cash, accounts liabilities, inventory and account receivables.

The association between efficient working capital management and profitability has currently become an important concern for many analyst and researchers. This is due to the impact of working capital management on profits. Recently, researchers are continuously searching for the causality relations between liquidity or working capital management and profitability. There are several findings on the association between the factors of working capital management and profitability but few studies have been conducted on causality relationships between working capital management and profitability.

Several empirical analysis have been conducted to determine the impact of working capital management on in Africa especially in Ghana and Nigeria.

In Ghana, ([14]) used principal component analysis to extract four factors out of 15 variables that have an effect on working capital management of Ghanaian manufacturing and industrial firms listed on the Ghana Stock Exchange. They identified that Economic factors, short term liquidity, convertibility and operational factors are significant determinants of how a manufacturing company manages its working capital.

Also, ([19]) used panel regression models to assess the working capital management of Ghanaian banks on profitability during the period 2005– 2010 and found that there is an inverse relation between cash conversion cycle and bank's profitability while the leverage of banks show a positive significant impact on banks' profitability.

In Nigeria, ([15]) applied Pearson Correlation and multiple regression to examine the impact of working capital management on the market valuation of a firm for the period of 1995-2009. They used Tobin Q as a measure of market value, ROA and ROI as dependent variables and cash conversion cycle; current liabilities to total asset ratio; current ratio; current asset to total asset ratio and debt to asset ratio as independent variables and found that there is a significant relationship between components of working capital management and profitability and consequently market valuation. They also identified a strong negative correlation between working capital management measured by cash conversion cycle and profitability. This confirms the conclusion of ([7], [17]) which states that profit is maximized by reducing a firm's cash conversion period.

This paper uses the same approach of ([2]) who examines the long run association between working capital measured by cash conversion cycle and profitability and the direction of the causality between those variables in 66 firms in Nigeria for the period 1999-2007. He found that the data was stationary after first difference when he applied LLC, IPS and Hardi panel unit root test. His study identified a long run steady state association between working capital management and profitability for a cross section of firms after allowing for a firm specific effect when he run the Pedroni ([16]) panel regression. He finally employed a panel based error correction model to account for the long run association using Engle and

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Granger ([8]) the two step procedure. The findings revealed a long run and short run causal association moving from working capital to profitability. This findings supports the need for managers to make efficient use of working capital in other to increase the profits of firms.

The main aim of this study is to assist policy makers and managers of insurance companies in Ghana with the needed information about the directional effect of working capital management on profitability and vice versa. Specifically,

(a) To examine the factors that affect the management of working capital of insurance companies listed on the Ghana Stock Exchange (GSE) and to extract the most significant variables from the larger pool of measurable characteristics of insurance companies;

(b) To predict the direction of causality between working capital management and profitability;

2. METHODOLOGY

2.1 Sample Size

Audited annual financial reports collected from 12 Life and Non-Life Insurance companies listed on Ghana Stock Exchange (GSE) over a period of five years from 2008-2014 are used in the study.

2.2 Variables Selection

Seventeen independent variables that have an impact on working capital management on profits of both life and non-life insurance companies are selected for the study ([1], [14]). The variables are selected because they are mostly used in most companies to forecast financial performance. The categories they belong to and their definition are shown in Table 1 below. The Variables grouped under five main categories which represent the insurance companies' short term liquidity and movement of Debtors and Creditors, convertibility of assets into cash, Risk, operating asset efficiency and the policy of the firm is shown below ([14], [3])

A. **Policy Factor**

A1. Debtors Collection Period (DCP)

A2. Creditors Payment Period (CPP)

A3. Accounts Payable Period (APP)

A4. Accounts Collection Period (ACP)

B. **Short Term Liquidity**

B1. Cash Conversion Cycle (CCC)

B2. Sales Growth Rate (SGR)

B3. Quick Ratio (QR)

B4. Cash Flow (CF)

B5. Working Capital Ratio (WCR)

C. **Convertibility**

C1. Company Size (SIZE)

C2. Current Ratio (CR)

C3. Current Assets to Total Assets (CATA)

C4. Current Liabilities to Total Assets (CLTA)

C5. Current Assets to Total Sales (CATS)

D**. Operational**

D1. Debt Ratio (DR)

D2. Inventory Conversion Period (ICP)

D3. Total Assets Turnover (TATO)

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2.3 Principal Component Analysis

Principal component analysis whose main aim is data reduction and interpretation involves using linear combinations of variables $X_1, X_2, ..., X_P$ to elucidate the variance-covariance structure of these variables. Here, the structure of the data set is reduced when there are several variables which are interrelated and the Principal component accounts for the greatest variance in the original data.

Suppose each of the insurance companies with an observed variable $Y_i (i = 1, 2, ..., \mathrm{p})$ has mean μ_i and the standard deviation σ_{ii}. Then the transformed standard variables $Z_i (i = 1, 2, ..., \mathrm{p})$ is given by

$$Z_i = \frac{Y_i - \mu_i}{\sigma_{ii}} \tag{1}$$

where $E[Z_i] = 0, Var[Z_i] = 1, i = 1, 2, ..., \mathrm{k}$ and the variance-covariance matrix and correlation matrix are $\sum$ and ρ respectively.

Suppose the $Cov(\mathrm{Y}_i, \mathrm{Y}_k) = b_i^{'} \sum b_k, i, k = 1, 2, ..., \mathrm{p}$ where $b_i^{'} = b_{i1}, b_{i2}, ..., b_{ip}$ are the weights, then

$$\begin{aligned} &b_i^{'}.b_i = 1 \\ &b_i^{'}.b_j = 0 \text{ for all } i \neq j \end{aligned} \tag{2}$$

The first principal component is the linear combination $b_1^{'}Y$ that maximizes $Var(\mathrm{b}_1^{'}\mathrm{Y})$ subject to $b_1^{'}b_1 = 1$ which takes into consideration the greatest variance in the data. The second principal component is also a linear combination $b_2^{'}Y$ that maximizes $Var(\mathrm{b}_2^{'}\mathrm{Y})$ subject to $b_2^{'}b_2 = 1$ and $Cov(b_1^{'}\mathrm{Y}, b_2^{'}\mathrm{Y}) = 0$ which takes into consideration the greatest of the remaining variance in the data. Hence, i^{th} principal component is the linear combination $b_i^{'}Y$ that maximizes $Var(\mathrm{b}_i^{'}\mathrm{Y})$ subject to $b_i^{'}b_i = 1$ and $Cov(b_i^{'}\mathrm{Y}, b_j^{'}\mathrm{Y}) = 0$, for all $i \neq j$ which takes into consideration the greatest of the remaining variance in the data ([11]).

The k principal components of Z are obtained from the eigenvectors of the correlation matrix of ρ of Y given by $Y = B'Z$ where $B = [e_1, e_2, ..., e_k]$ and the $e_i s, i = 1, 2, ..., k$ are the eigenvectors of ρ.

The proportion of total variance in the data explained by the kth principal component of Z is given by the

$$\text{Proportion} = \frac{\lambda_j}{p} \tag{3}$$

This is called communality.

Where $j = 1, 2, ..., \mathrm{k}$ and the λ_j's are the eigenvalues of ρ.

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The loading of the standardized variable Z_j which is a correlation between each principal component X_i and its corresponding standardized variable Z_j is given by

$$Corr(\mathrm{X}_i, Z_j) = e_{ij}.\lambda_j^{(1/2)} \quad (4)$$

Where the loading of the standardized variable Z_j is between -1 and 1 inclusive. Sharma ([18]) recommended a loading of magnitude which is more than or equal to 0.50.

The Kaiser-Meyer- Olkin (KMO) statistic is used to select adequate number of factors to be extracted and when the value is greater than or equal to 0.5, the sample is said to be adequate.

Also, the Principal component analysis can be used for the analysis when the probability value of Bartlett's Test of Sphericity is less than the significance level. The orthogonal rotation method called Varimax is used to help in the interpretation of analysis. The rotation of factors have no significant effect on the factors extracted and amount of variance.

2.4 Panel Autoregressive Distributed Lag Model

The factors extracted using Principal Component was analyzed using an autoregressive distributed lag model which is a multiple regression model used for forecasting the dependent variable. Return on Assets was used as the dependent variable with the extracted factors as regressors.

Most recent researches conducted uses panel based unit root test developed by ([6], [9], [10], [13]) which have been proven to be more powerful than unit root tests applied to single series. This is because the panel based unit root test is less likely to commit a Type II error and the information in the time series is improved by that contained in the cross-section data. This test is based on the assumption that there is no correlation among the cross-sectional data and also there is restriction on the assumption that all individuals are identical with respect to the presence or the absence of a unit root.

Baltagi ([5]) stated that the statistic of the limiting distribution of panel unit root test is normal as compared to the complicated limiting distributions of individual unit root. The Levin, Lin and Chu test (LLC) was used to test the stationarity of the data. For a panel on N cross sections observed over T time periods, the LLC test is based on the following model:

$$\Delta y_{it} = \rho y_{i,t-1} + \sum_{L=1}^{p_i} \theta_{iL} \Delta y_{it-L} + x_{it}\delta + \varepsilon_{it}, i = 1,2,...,N; t = 1,2,...,T \quad (5)$$

Where y_{it} and x_{it} refer to the dependent and independent variables for each cross section observation *i* at time *t*, δ and ρ are vector of deterministic variables and the optimal lag of the dependent variable respectively and ε_{it} are the error term. The selection of the optimal lag of the dependent variable is based on the model selection criteria such as Akaike Information Criterion (AIC). $\Delta y_{it} = y_{it} - y_{i,t-1}$. The null hypothesis of LLC unit root test states that each individual time series contains a unit root, and the alternative hypothesis states that each individual time series is stationary. That is, according to ([4])

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$$H_0 : \rho_i = \rho = 0 \text{ for all } i$$
$$H_1 : \rho_i = \rho < 0 \text{ for all } i$$

Im, Pesaran and Shin (IPS) unit root test was used after applying LLC. IPS test also depends the augmented Dickey-Fuller (ADF) regressions for each cross-section just like LLC even though the test depends on averaging individual unit root test statistics. The null hypothesis of IPS unit root test states that each individual series in the panel contains a unit root, and the alternative hypothesis states that some of the individuals' series (but not all) have a unit root. According to ([4])

$$H_0 : \rho_i = 0 \text{ for all } i$$
$$H_1 : \rho_i < 0 \text{ for all } i$$

([4]) stated that for small samples, Monte Carlo experiments showed that IPS *t*-bar test is proved to be generally better and satisfactory than the LLC test.

Several economic times series have been identified to be nonstationary when there exist a linear combination of them which is integrated of order greater than or equal to one.

The study employed a co-integration panel test proposed by Kao (1999) which is residual-based DF and ADF test because of the sample size of the study which is made up of financial ratios of 10 insurance companies between the periods 2008-2014. According to ([4]), Kao ([12]) developed four DF- and one ADF-test for testing the null hypothesis of no co-integration. It begins with the regression:

$$\gamma_{it} = \alpha_i + \beta x_{it} + e_{it} \tag{6}$$

where γ_{it} and x_{it} are the dependent and independent variables respectively for each cross section observation *i* time *t*, α_i and e_{it} are the intercept and error term respectively. Also γ and x are assumed to be integrated of order one (I (1)). The DF is based on the following regression which is an estimate of the fixed effect residuals written as:

$$e_{it} = \rho e_{it-1} + v_{it} \tag{7}$$

Testing the null hypothesis of no co-integration, the null hypothesis can be written as $H_0 : \rho = 1$. The Ordinary Least Squares is used to estimate ρ .

ADF test is based on the following regression which is the correction for serial correlation in the estimates of OLS estimates and t-statistic in DF regression (7):

$$e_{it} = \rho e_{it-1} + \sum_{j=1}^{\rho} \theta_j \Delta e_{it-j} + v_{it\rho} \tag{8}$$

where the residuals $v_{it\rho}$ are serially uncorrelated.

Also, the study assesses the direction of the long-term causality association between variables by testing Granger causality at the third and final step of estimation using Engle and Granger ([8]) proposed two-step procedure since our sample size is small and the data are panel. The first step estimates the

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residual from the long-term association to be ECT_{it} and the second step estimates the short run error correction model. Hence, the Granger causality test will depend on the regression model below

$$\Delta Y_{it} = c_t + \sum_{k=1}^{\rho} c_k \Delta Y_{t-k} + \sum_{j=1}^{m} \sum_{i=0}^{q_j} b_{ji} \Delta X_{j,t-i} + \lambda_t ECT_{it-1} + \varepsilon_t \quad (9)$$

Where Δ is a difference operator; ρ and q_j represent the optimal lags of the dependent variable and j^{th} independent variables respectively, ECT is the lagged error-correction term derived from the long-run co-integration relationship; λ_t is an adjustment coefficient; *k* is the lagged length (in the study k=1 due to the relatively short time period covered by the data) and ε_t is the uncorrelated disturbance term with mean zero.

Testing the significance of the coefficients on the lagged variables in equation (5) can be used to find the sources of Granger causation. The short run causality is tested by testing $H_0 : b_{ji} = 0 \text{ for all } i$ and the long run causality is also tested by testing $H_0 : \lambda_t = 0$

3. RESULTS AND DISCUSSION

3.1 Principal Component Results

Twenty one variables are analyzed from the SPSS with principal component analysis (PCA) as the extraction method and Varimax as the rotation method. The Sample adequacy was measured by Kaiser-Meyer -Olkin with a p-value of 0.657 and the Bartlett's Test of Sphericity was significant at 0.00 showing that Principal Component analysis can be performed on the data.

The SPSS output of variables selected, the categories they belong, the eigen value, Communalities of each variable and their factor loadings after using the Principal Component Analysis and Varimax as the rotation method are shown in Table 2 below.

Table 2: Selected Variables with their Eigen values, Communalities and Factor Loadings after Principal component analysis

Variables	Category	Eigen Values	% Variance of Initial Eigen values	Factor Loadings	Communalities
ACP	Policy factor	6.514	38.319	0.859	0.780
CR	Convertibility	2.497	14.686	0.928	0.920
SGR	Short term Liquidity	2.279	13.406	0.960	0.953
CCC	Short term Liquidity	1.325	7.795	0.851	0.757
DR	Operational	1.018	5.989	-0.814	0.733

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The variables are categorized into five factors from the following categories: Short-term liquidity, convertibility factor, Policy factor and operational factor. From table 2, all the eigen values above 1.00 which explains over 80.196% of the total variance in the data are shown. This enables us to conclude that five Principal components will be adequate. Also table 2 shows the Communalities of each variable indicating that the extracted factors accounts for the variability in the variables .For instance, over 92% of the variance in CR is explained and accounted for while over 95.3% of the variance in SGR is also explained and accounted for. The factor loadings of the selected variables in Table 2 was resulted from Varimax rotation of the 17 independent variables that have an impact on working capital management on insurance companies as shown in Table 3 below;

Table 3: Rotated Component Matrix

Factors	1	2	3	4	5
APP	0.290	0.450	-0.243	0.736	0.018
CATA	0.193	0.923	-0.042	0.181	-0.057
DR	-0.250	-0.069	0.060	-0.020	**-0.814**
DCP	0.725	0.066	-0.239	0.215	-0.225
TOTA	0.801	-0.079	0.093	0.064	-0.159
ICP	0.851	0.368	0.028	0.003	0.190
CR	0.124	**0.928**	-0.046	0.188	-0.077
FCF	0.850	0.378	0.046	0.010	0.167
FFR	-0.045	-0.018	0.955	-0.057	-0.103
SIZE	0.843	0.346	0.023	-0.014	0.245
CCC	0.050	0.100	-0.028	**0.851**	-0.137
QR	0.837	0.293	-0.012	-0.14	0.235
CATS	0.282	0.833	-0.056	-0.165	-0.015
ERR	-0.024	-0.181	-0.131	0.622	0.390
SGR	0.051	0.008	**0.960**	-0.166	0.021
ACP	**0.859**	-0.064	-0.031	0.094	0.168
CLTA	0.042	0.649	0.094	0.007	0.181

3.2 Panel Autoregressive Distributed Lag Model results

The factors such as ACP, CR, SGR, CCC and DR which are extracted using Principal Component from the 17 variables were analyzed using a panel autoregressive distributed lag model. Return on Assets was used as the dependent variable with the extracted factors as regressors. The analysis begins by testing the stationarity between all the variable extracted using Principal component analysis in the study and employing two different panel unit root tests; LLC and IPS tests to ensure that no series exceeds integration of order I(1). According to Schwarz info criterion, we choose a maximum lag length based on

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Bartlett kernel because we want to estimate and the exogenous variables are specified as individual effects. The panel unit root test results for LLC and IPS are shown in table 1 below.

Table 4: Panel unit root tests results.

Variable	LLC	IPS
ROA	-5.41215(0.000)***	-3.12411(0.1401)
CCC	-7.20054(0.000)***	-0.84620(0.0002)***
CR	-0.94582(0.12211)	-0.74773(0.5510)
ACP	-6.83527(0.000)***	-4.21551(0.771)
DR	-9.57412(0.000)***	-3.72251(0.066)*
SGR	-12.73112(0.000)***	-5.58544(0.0311)**
Difference(ROA)	-6.553260(0.000)***	-2.23323(0.0455)**
Difference(CCC)	-7.658010(0.000)***	-3.60067(0.0001)***
Difference(CR)	-4.155219(0.000)***	-2.32256(0.0006)***
Difference(ACP)	-6.991251(0.000)***	-2.00232(0.0002)***
Difference(DR)	-11.03526(0.000)***	-6.33617(0.000)***
Difference(SGR)	-13.44244(0.000)***	-4.20114(0.000)***

*, **, *** denote the 10%, 5%, 1% significance levels respectively

From table 4, all the variables except CR was found to be stationary at their levels using LLC test and also the first difference of CR using LLC test was found to be stationary. Whereas CCC, SGR and DR were found to be stationary at 1%, 5% and 10% level of significance respectively using IPS test but a unit root was not found for the other three variables at their levels. Also except ROA, all the variables are stationary at first difference with 1% level of significance using IPS test.

We construct a model to assess the long run equilibrium relationship among ROA and working capital management using Kao ([12]) test for testing the null hypothesis of no co-integration between variables. The results of co-integration gave a t-statistics of ADF to be -1.96882 with P-value of 0.0044 showing that there exist a co-integration relationship between the measure of profitability, ROA and working capital management.

Testing the causality between profitability and working capital management, Granger causality test will depend on the following regressions from equation (9):

$$\begin{aligned}\Delta ROA_{it} = c_{1i} &+ \sum_{k=1}^{\rho} c_{11ik}\Delta ROA_{it-k} + \sum_{k=1}^{\rho} c_{12ik}\Delta CCC_{it-k} \sum_{k=1}^{\rho} c_{13ik}\Delta SZ_{it-k} + \sum_{k=1}^{\rho} c_{14ik}\Delta DR_{it-k} \\ &+ \sum_{k=1}^{\rho} c_{15ik}\Delta CR_{it-k} + \sum_{k=1}^{\rho} c_{16ik}\Delta SGR_{it-k} + \lambda_{1t} ECT_{it-1} + \varepsilon_{1t}\end{aligned} \tag{10}$$

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$$\Delta CCC_{it} = c_{2i} + \sum_{k=1}^{\rho} c_{21ik}\Delta CCC_{it-k} + \sum_{k=1}^{\rho} c_{22ik}\Delta ROA_{it-k} \sum_{k=1}^{\rho} c_{23ik}\Delta SZ_{it-k} + \sum_{k=1}^{\rho} c_{24ik}\Delta DR_{it-k} + \sum_{k=1}^{\rho} c_{25ik}\Delta CR_{it-k} + \sum_{k=1}^{\rho} c_{26ik}\Delta SGR_{it-k} + \lambda_{2t} ECT_{it-1} + \varepsilon_{2t} \quad (11)$$

Table 5: Panel Causality test: Profitability (ROA) and Working Capital Management (CCC)

	Source of Causation (Independent variable)				
Dependent Variable	Short	Run	Long Run	Joint(Short run	and long run)
	D(CCC)	D(ROA)	ECT	D(ROA),ECT	D(CCC),ECT
D(ROA)	1.46(0.21)		2.98(0.04)**		7.37(0.02)**
D(CCC)		4.63(0.02)**	8.54(0.00)***	6.40(0.00)***	

*, **, *** denote the 10%, 5%, 1% significance levels respectively

Table 5 above displays the results of panel causality test between working capital management and profitability based on Equations (10) and (11).The results of the F-statistics on the independent variables in equations (10) shows no short run causality from working capital management to profitability but shows a significant long run and joint causation effect running from working capital management to profitability. Also from **Table 5,** the F-statistics on the independent variables in equations (11) shows a significant short run, long run and joint causation effect running from profitability to a working capital management. The results indicate that during the period of 2008-2014, there were two directional Granger causality between working capital management and profitability which shows the essence of working capital management to yield more profits.

4. CONCLUSION

There are several factors that affect working capital management on profits of insurance companies. The main objective of the study was to use principal component analysis to extract a smaller set of variables from the 17 variables that have an effect on working capital management on profit of 10 insurance companies listed on the Ghana Stock Exchange from 2008 to 2014 with a reduced loss of information. Five factors namely CCC, DR, CR, SGR and ACP were extracted using principal component analysis which were used as regressors to identify the source of causation for profitability by testing the causal effect between working capital management and profitability in the insurance companies in Ghana over the period 2008-2014. The findings from a unit root test for all the extracted variables from principal component analysis showed that all variables were stationary at first difference, thus all the five variables were used for the panel co-integration test. A co-integration panel test revealed that there was a long run relationship between the extracted variables from principal component analysis but the direction of the relation was not shown. Using a two-step procedure developed by ([8]), a panel-based error correction

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model was generated. The granger causality test revealed that there is a bi-directional causal relationship between working capital management and profitability which is in conformance with the study of ([4]).

The authors recommend that managers of life and non-life insurance companies in Ghana should focus on efficient management of the companies' working capital in order to maximize the companies' profits since working capital management was revealed to be the cause of the profitability of insurance companies. In conclusion, the study reveals the impact of working capital management on profitability of Ghanaian insurance companies.

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