EFFECT OF WORKING CAPITAL MANAGEMENT ON THE FINANCIAL PERFORMANCE OF LISTED CEMENT COMPANIES IN NIGERIA

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Abstract
The need to improve performance amid competition from both local and foreign firms has forced Nigerian cement companies to review their working capital management activity and hence this study which examined the effect of working capital management on the performance of listed cement companies in Nigeria. Ex-post facto research design was adopted and data for a period between 2013-2022 were collected from the annual financial report of three (3) cement companies: Dangote Cement Plc, BUA Cement Plc and Lafarge Cement Plc. Panel regression was employed and the result showed that inventory management has a significant negative effect on performance while account receivable management has a positive significant effect on performance. Thereafter, the study recommends that the firm must strive to reduce the number of days it allows for raw materials inventories to be converted into finished goods however, this must be done within the shortest possible period which could allow for adequate monitoring, cost reduction and quality control. Also, that more respite be given to debtors in form of additional time for them to be able to pay-off their debts. This will as well take off many bad debts off the records of the firm since debtors' now have adequate time to repay their debt. In addition, interest accrued will also be on the increase.
Keywords: *Account Receivables, Inventory Management, Performance, Working Capital Management.*

INTRODUCTION

Globally, the manufacturing sector has been a major contributor to growth and development. However, globalisation has led to increasing competitive challenges that have created an imminent need for manufacturing firms to approach its continuous existence from a completely different perspective (Ahmad, 2012). The antecedent reactions have overtime been different and the external and internal forces that organisation faces are increasingly making them understand that there is no absolute general method towards managing and surviving in a competitive, challenging business environment (Akinmulegun & Oluwole, 2014).In Nigeria, the situation has not been any different, as the manufacturing sector especially the cement sub-sector has been faced with enormous challenges. The Nigerian cement industry is a growing sector of the Nigerian economy, largely linked to the productivity and performance of the construction sector and increasing activity in the real estate sector. It has contributed to the Gross Domestic Product of the nation accounting for 1.5% in 2010 which rose to 7.9% by the end of 2020 (National Bureau of Statistics, NBS, 2021). Therefore, the increase in the performance of the Nigerian cement industries will have a remarkable impact on the economic value that the sector gives out to the country's economy (Olayinka & Mustapha, 2022). Akinmulegun and Oluwole (2014) held that aside from the external challenges which are beyond the control of individual firms, the internal challenges have been a major setback to the growth of the country's cement firms as such, firms desirous of improving financial performance ought to review their internal operations hence the area of working capital management.

Working capital include the management of inventory, payables, receivables and cash (Owolabi & Alu, 2012).A positive working capital indicates the ability of the business to pay off its short-term obligations at most when request comes from suppliers, but a negative working capital indicates the inability of the business organization to pay short term obligations. As such, excessive working capital indicates an accumulation of idle current assets, which does not contribute in generating income for the firm during the operating period. Inadequate working capital on the other hand harms the credit worthiness and the day-to-day activities of firms, which may lead to insolvency (Singh &Asress, 2010). However, the focus of this study is on inventory management and account receivables dimensions of working capital management.
Inventory management according to Napompech (2012) especially in a manufacturing firm consist of three components: raw material, work in progress and finished goods. He further explained that the holding of

excessive stocks will lead to tied up capital in stocks while the holding of inadequate stock may lead to stock out costs such as lost profitability and goodwill from customers. A firm therefore needs to set an optimal level of stock to hold using standard methods such as the economic order quantity. According to Manoori and Muhammad (2012) Accounts Receivables Management (ARM) involves achieving an optimal average time taken by debtors to settle their accounts. Moreover, since the purpose of offering credit is to maximise profitability, the costs of debt collection should not be allowed to exceed the amounts recovered. Therefore, this study seeks to examine the effect of working capital management on the performance of listed cement companies in Nigeria.

Statement of the Problem

In a bid to improve financial performance amid stiff competition, firms engage in numerous activities, among which is the management of her internal activities. The Nigerian cement companies have recorded impressive gains in the last decade which has seen its contribution to GDP rise from 1.5% in 2010 to 7.9% in 2020 (NBS, 2021). The influx of foreign cement companies such as Lafarge Holcim and Cemex poses a significant threat in competition towards the local cement companies especially in the area of competitive pricing, cost reduction, production capacity enhancement, market share and existence. However, despite the existence of this challenge accompanied by several other external factors, for local cement industry to strive and survive, they ought to review their internal activities among which could be the area of working capital management. Studies were conducted on the effect of working capital management on performance, but majority were not conducted within Nigeria and those conducted were in Nigeria were outside the cement sector. In addition, none of such study was conducted using dataset up to 2022 and hence the gap which this study covered by investigating specifically the effect of inventory management and account receivables on performance of listed cement companies in Nigeria.

Research Hypotheses

Ho_1: Inventory management has no significant effect on performance of listed cement companies in Nigeria.

Ho_2: Account receivables has no significant effect on performance of listed cement companies in Nigeria.

LITERATURE REVIEW

Working Capital Management

Biger, et al. (2019) defined working capital management as the administration of current assets in the name of cash, marketable securities, receivables and staff advances, and inventories. They demonstrated that good working capital management must ensure an acceptable relationship between the different components of a firm's working capital so as to make an efficient mix, which will guarantee capital adequacy. Therefore, working capital management should make sure that the desirable quantities of each component of the working capital are available for management.

Burt and Abbate (2009) refers to working capital management as the management of the investment in current assets and the financing of the current assets, it also involves setting working capital management policies and carrying out those policies in a business's daily operations, to achieves its goals and objectives, such as shareholder wealth maximization, Competitive advantage, and growth. Working capital management in view of Cuthbertson and Gasparro (1993) based on purpose of working capital ensures the effective and efficient utilization of the business's investment in fixed assets. According to Deloof, (2003), if performance criteria such as liquidity, solvency/ bankruptcy, efficiency, profitability and Economic Value Added are considered, it will be clearly apparent that the business must hold and manage the different levels of working capital which are appropriate to its performance criteria.

Inventory Management

Adamu, et al. (2018) opined that inventory management is concerned with regular updating inventory records and accounts at any time when inventory Items are collected, traded from inventory, transported as of one area to alternative, retrieved from inventory, and discarded. They are also chosen to because they are considered fast an accurate in capturing inventory on continual basis when they are, they are properly utilized

and managed. Inventory control performs better when used together with a database of inventory amounts by storeroom staffs using barcode scanners. In spite of the importance, they have for the better performance of the organization, perpetual inventory control systems have observed short comings.

Eneje, et al. (2019) state that inventory management entails a frequent review of existing inventory against anticipated future demands. The stock review process is manually, yet in certain cases an automated stock review is used to calculate the minimum stock level in order to assure continual inventory checks and supply reordering to satisfy minimal levels. Its only demerit is that it is labour intensive and also prone to errors; therefore, it needs much care in its application. Stock review is construed to be the easiest inventory control system management technique which is found to be more favourable in small- scale organizations.

Account Receivables

Kumaraswamy (2020) asserted that accounts receivable is a financial accounting term used to define the amount of money outstanding against customers or clients to whom a company has sold goods or rendered services to on credit. When companies make sales to their customers on credit basis, accounts receivables are created meaning that there will be a future cash flow as a result of present transaction. Accounts receivables or trade debtors are normally listed on a company's statement of financial position (balance sheet) as current assets hence it is used to measure a firm's liquidity.

Iyewumi et al. (2019) stated that accounts receivable management (ARM) is a systematic process of making sure that trade debtors and clients settle their debts on time. Effective and efficient ARM enables a company to predict and manage its cash flow and helps in guarding against inadequate working capital at any point in time. further lists the benefits of effective ARM to include helping to reduce incidence of bad and doubtful debts, strengthening a company's liquidity and financial position, and helps to mitigate non-payment of long outstanding debts of customers. A good ARM does not only entail reminding and collecting money from customers but also involves investigating and identifying the reasons for such delays in effecting payment and finding ways to remedy such issues. The average collection period (ACP) is an accounting system of measurement that serves as an indicator of the average number of days each time a credit sale is executed and the date the customers' effects payment. It is usually measured in days, weeks or months.

Concept of Financial Performance

Akyuz and Opusunju, (2021) defined performance as how an enterprise is doing in terms of an increase in profit, market share, product quality, and expansion about other enterprises in the same industry. Performance is in two forms which are financial performance and non-financial. Performance is a general structure that refers to the operations of the enterprise. They noted that performance is a reflection of the productivity of members of an enterprise measured in terms of revenue, profit, growth, development, and expansion of the organisation. The indicators of performance are revenue, return on investment, profitability and market share. Hence, whenever the key performance indicators are in favourable states, it indicates efficiency (Lyndon &Timi, 2019).

Farah et al. (2016) opined that performance is an act of performing, implementing, achieving, and fulfilling of the given tasks that needs to be measured against defined sets of precision, money, fullness and timing. In finance, it refers to the measurements of the company's policies, activities and operational results in financial terms. It is used to check a company's success, compliance and financial position. They argued that a superior level of job performance improves operational efficiency and productivity, leading to higher overall results in an organization. These results are reflected in the firm's return on investment, assets, equity, capital employed and profitability.Nguyen (2020) reports that the primary measures of financial performance include return on assets (ROA) and return on equity (ROE). This study adopts the ROA to measure performance.

Inventory Management and Financial Performance

Edwin and Florence (2019) examined the effect of inventory management on profitability of cement manufacturing companies in Kenya. A cross-sectional data from 1999 to 2014 was gathered for the analysis

of the annual reports for the three sampled firms listed at Nairobi Securities Exchange (NSE). The ordinary least squares (OLS) stated in the form of multiple regression models was applied in the data analysis to establish the relationship between inventory management and firm's profitability. The variables used include inventory turnover, inventory conversion period, Inventory levels, storage cost, size of firm, gross profit margin, Return on assets and growth of the firm. The results show a negative relationship between inventory turnover, inventory conversion period and storage cost with the profitability of the company. In addition, inventory level was found to be directly related to firm's size and storage cost. The study recommends that the Cement manufacturing firms in Kenya should strive to ensure that the right stock is kept in their warehouses to hedge against excessive holding cost and stock-outs. The study was however restricted to 2014 which differs in scope to the current study which extended to 2022. Similarly, Koin et al. (2014) conducted a study on the effect of inventory management on supply chain effectiveness in the manufacturing industry in Kenya. The study employed a descriptive research design. The study population is 459 employees and a sample of 56 employees was obtained from the target population the data was collected from the company's supply chain department in liaison with the various integrated functions in the chain using questionnaires. The collected data was compiled and analyzed using descriptive statistics, using a Statistical Package for Social Sciences (SPSS). The findings indicate that inventory management system, supplier relation affects the supply chain effectiveness in the manufacturing sector to a great extent while order management and warehouse management affects it to a moderate extent. The study also was limited to the year 2014 and used primary data which differs from the current study.

Account Receivables and Performance

Dan and Patrick (2020) examined the effect of account receivable period on Corporate Performance of quoted manufacturing firms in Nigeria. The population of this study is made up of listed manufacturing firms in Nigeria for the period of 2010 to 2019. In order to obtain a homogenous sample, the study further screened the population from possible sample bias. In achieving this we removed seven consumer goods companies that did not provide all related and relevant information necessary for this study. Therefore, the final population of the study becomes nineteen (19) consumer goods companies. The study employed secondary data extracted from published financial reports of the sampled companies and ordinary least square (OLS) regression technique was used as econometric tool employed in testing the hypotheses. Return on Asset is used as the proxy for corporate performance while the explanatory variable is account receivable period. Furthermore, the study is controlled by firm size and leverage. Findings from the study confirm that there is a positive effect between account receivable period and return on asset of listed manufacturing firms in Nigeria.

Kilonzo et al. (2016) study effect of accounts receivable management on financial performance of firms funded by Government venture capital in Kenya. The study's objective was to determine the effect of accounts receivable management on firms' financial performance and explore the moderating effect of political environment on a firm's financial performance. The target population comprised all firms (24) funded by government venture capital in Kenya. The study adopted a census approach because of the small number of firms. Based on the conceptual framework, a questionnaire was formulated and used to collect primary data for the independent variables while a record survey sheet was used to collect secondary data for the dependent variable. Out of 72 respondents, 51 responded, being 71%. Both descriptive and inferential analyses were done. Statistical package for social sciences (SPSS) version 20.0 was used as the statistical tool for analysis of the study. Analysis for variance (ANOVA) and regression analysis were used to test the hypothesis. The results show there is a positive relationship between accounts receivables and financial performance of firms funded by government venture capital in Kenya (0.038). Accounts receivable explain 25.7% of the financial performance of firms funded by government venture capital in Kenya while the variation of 74.3% is explained by other factors. The study recommends that managers in the firms funded by government venture capital should put in place good credit policies to enhance efficient management of accounts receivable thereby improve on their financial performance. The study however, was conducted in Kenya of which the findings may not be applicable to the Nigerian cement industry.

Theory of Working Capital Management

The theory of working capital management was propounded by Sagan (1955) and the theory provides the basis for working capital management research. The theory of working capital management emphasizes the need for the management of working capital accounts and warns that it could vitally affect the health of the company. Sagan (1955) as cited in Arabahmadi and Arabahmadi, (2013) pointed out the money manager's operations are primarily in the area of cash flows generated in the course of business transactions. However, the money manager must be familiar with what is being done with the control of inventories, receivables and payables because all these accounts affect cash position. Thus, Sagan (1955) advocated that the management of accounts receivable, accounts payable, inventories and cash is vital for the operational functions of a firm. Further, the theory of working capital management argues that the major task of a money manager is to provide funds as and when needed and to invest temporarily surplus funds as profitably as possible in view of his particular requirements of safety and liquidity of funds by examining the risk and return of various investment opportunities. Thus, a money manager should take his decisions on the basis of cash budget and total current assets position rather than on the basis of traditional working capital ratios (Arabahmadi & Arabahmadi, 2013).

METHODOLOGY

The study adopted an ex-post facto research design. The population of the study is all the three (3) cement companies listed on the Nigerian Exchange Group (NEG) as at the year 2022. They are Dangote Cement Plc, BUA Cement Plc and Lafarge Cement Plc. The study adopted census sampling whereby all the three firms were used as the sample size. Secondary data for the period between 2013-2022 were obtained from their annual financial reports and analysed using panel regression analysis with the aid of STATA software.In applying the panel regression, we first test the fixed effect model before testing the random effect model after which the hausman specification test was conducted to choose between the fixed and the random effect. Post-estimation test of heteroskedacity and normality were then conducted.

Measurement of Variables

The study variables are measured based on existing literatures as described below:

Table 1: Measurement of Variables

S/N	Variable	Measure	Measurement	Source
1	Financial Performance	Return on Asset (ROA)	$ROA = \frac{\text{Net profit}}{\text{Average Total Assets}}$	Sahari et al. (2012)
2	Inventory Management (IM)	Inventory Turnover in days (ITV)	***ITV =*** (Inventories × 365) /Cost of Goods Sold	Sahari et al. (2012)
3	Accounts Receivables Management (ARM)	Average Collection Period (ACP)	ACP = (Accounts Receivables × 365) / Sales	Pikeet al. (2014).

Therefore, the model for the regression analysis is specified thus:

$$ROA_{it} = \beta_0 + \beta_1 ITV_{it} + \beta_2 ACP_{it} + e_{it}$$

Where;

ROA_{it} = Return on Assets of firm i in year t, β_0 = Constant term, $\beta_1$and β_2= coefficient of independent variable,ITV_{it} = Inventory turnover of firm i in year t, ACP_{it} = Average collection period of firm i in year t, e_{it} = is the error term (of firm i in year t).

RESULTS AND DISCUSSIONS

Table 2: Descriptive Statistics

	ITP	ACP	ROA
Mean	109.964	23.153	0.110
Std. Dev.	53.104	27.582	0.069
Min.	65.306	0.018	-0.067

Max.	263.517	53.924	0.268
Skew.	1.201	3.229	-0.264
Kurt.	2.069	13.167	0.910
Obs	30	30	30

Source: STATA Output, 2023.

Table 2 presented the descriptive statistics of the behaviour of the variables under study. The table revealed that inventory turnover period (ITP) recorded a minimum and maximum values of 65 and 263 respectively suggesting that it takes the companiesa minimum of 65 days and a maximum of 263 days to convert raw materials into finished goods while on the average, it takes 109.964 days. Average Collection Period (ACP) also showed a minimum and maximum duration of 0.018 days and 53.924 days respectively for the companies' debtors to payoff existing debts accrued to the company. However, on an average scale, it takes them 23.153 days to pay off their debts as indicated by the mean value with a standard deviation of 27.582 days.

Return on Assets (ROA)recorded a minimum value of -0.067 and maximum value of 0.268 implying that within the cement companies and the study period, the least return on asset recorded was -0.067 while the highest return on assets recorded was 0.268. The mean value for return on assets was 0.110 within the study period with a standard deviation of 0.069.

Table 3: Correlation Matrix

	ITP	**ACP**	**ROA**
ITP	1.0000		
ACP	0.4486*	1.0000	
	0.0147		
ROA	-0.6067*	-0.2591	1.0000
	0.0005	*0.1747*	

Source: STATA Output, 2023

Return on Assets (ROA) recorded a negative and moderate relationship with inventory turnover period (ITP) which stood at -0.6067and is significant at 5% level of significance. Also, ROA recorded a negative, weak and insignificant relationship with Average Collection Period (ACP) which stood at -0.259. ITP indicated a positive and moderate relationship with ACP which stood at 0.4486 and is statistically significant at 5% level of significance (0.0147< 0.05). This shows absence of multi-collinearity going by 0.80 which is the most popular and reliable threshold for measuring multi-colinearity (Berry & Feldman, 1985).

Regression Analysis

Due to the nature of the data being a panel data, the study was obliged to run both fixed effect and random effects regression test. Sequence to the above, the hausman fixed test revealed a chi-square probability of 0.2942 which is greater than 0.05 (see appendix) and hence necessitated the choice of the random effect model over the fixed effect model. In addition, the Langranger Multiplier (LM) test was conducted to aid the selection between the random effect and the pooled OLS. The LM test showed a chi-square probability greater than 0.05 (0.00<0.05) and hence the choice of the pooled OLS model (see Appendix). Subsequently, post estimation tests were conducted to support or not, the choice of the OLS model. The heteroscedasticity test revealed an insignificant value signifying absence of autocorrelation among the independent variables (0.2388 > 0.05) thus supporting the interpretation of the OLS model (See Appendix). However, skewness and kurtosis test for normality of residuals revealed that the residuals are not normally distributed (0.0319<0.05). Also, the Shapiro Wilk W test revealed a probability value of 0.0005 which is less than 0.05 which also indicates that the data were not normally distributed. (See appendix).

One of the basic assumptions of a linear regression model is that of normality of residuals, absence of heteroscedastic, as well as absence of serial correlation amongst others which have not been reflected by the OLS model. Scholars such as Gujarati, (2004); Stromberg, (2004) and Dawes, (1979) contended that, robust regression analysis accommodates and resolves all the problems associated with the basic

assumptions of the OLS model and such, the study interprets the results of the robust regression analysis as seen below:

Table 4: Robust Regression Output

ROA	Coefficient	t-value	p>|t|
ITP	-2.12	-2.31	0.021
ACP	6.65	0.23	0.816
Constant	0.153	6.52	0.000
R-Square	0.368		

Source: STATA Output, 2023

From the table above we can see that the value of r-square stood at 0.368 which indicates that approximately 37% of the variation in return on assets (ROA) could be explained by the combination of ITP and ACP while the remaining 63% could be explained by other variables not included in the study. The prediction value of r-square appears low but doesn't connotes that the model is bad (Gujarati, 2004).

Test of Hypotheses

The regression line ROA = .153-2.12ITP indicates that an increase in inventory turnover period (ITP) will lead to a decrease in ROA. The t-value stood at -2.31 with the probability of the t-statistic pegging at 0.021, the study therefore lacks sufficient ground to accept the null hypothesis leading to the acceptance of the alternate hypothesis which states that inventory management has significant effect on performance of listed cement companies in Nigeria.

The regression line ROA = .153+6.65ACP indicates that increase in Average Collection Period (ACP) leads to anincrease in ROA. The t-value stood at 0.23 with the probability of the t-statistic pegging at 0.816, the study therefore accepts the null hypothesis which states that account receivables has insignificant effect on performance of listed cement companies in Nigeria.

Discussion of Findings

The study found a negative and significant effect of inventory management on financial performance of listed cement companies in Nigeria. This implies that increase in the inventory turnover period would lead to a substantial decrease in the performance of the understudied firms. This could also mean that an increase in ITP will create unnecessary delay in processing due to the believe that there is adequate time thereby resulting into higher holding costs and increased product defects. This finding aligns with the finding of Edwin and Florence (2019) who found negative effect of inventory management on performance.

The study also found account receivables to have positive and insignificant effect on financial performance of listed cement companies in Nigeria. This is an indication that increasing the time allowed for debtors to repay their debt would lead to increase in financial performance. This could be because increase in time allowed could yield additional interest on the initial amount and also could boost debtors' morale to make full payment as a result of the additional time allowed instead of risking it as bad debt. However, the effect is not very concrete as revealed by the insignificant value. This finding agrees with the findings of Dan and Patrick (2020) and Kilonzo et al. (2016) who found positive effect of account receivables on performance.

CONCLUSION AND RECOMMENDATIONS

Based on the finding, the study conclude that inventory turnover period can decrease financial performance of cement firms as seen in its negative and significant effect. Also, it is concluded that increase in average collection period to debtors to pay could lead to increase in accrued interest and lessen the risk of having bad or doubtful debts. Therefore, the study recommends thus:

i. The firm must strive to reduce the number of days it allows for raw materials inventories to be converted into finished goods however, this must be done within the shortest possible period which could allow for adequate monitoring, cost reduction and quality control. In addition, raw materials for production should be bought at the point that they are ready to be used.

ii. More respite be given to debtors in form of additional time for them to be able to pay-off their debts. This will as well take off many bad debts off the records of the firm since debtors' now have adequate time to repay their debt. In addition, interest accrued will also be on the increase.

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Appendix

Fixed Effect

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Fixed-effects (within) regression               Number of obs      =        29
Group variable: ID                              Number of groups   =         3

R-sq:  within  = 0.0538                         Obs per group: min =         9
       between = 0.9925                                        avg =       9.7
       overall = 0.3683                                        max =        10

                                                F(2,24)            =      0.68
corr(u_i, Xb)  = 0.7895                         Prob > F           =    0.5147

------------------------------------------------------------------------------
         ROA |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   INVENTORY |  -1.04e-09   9.43e-10    -1.11   0.280    -2.99e-09    9.03e-10
  RECEIVABLE |   3.40e-11   7.32e-10     0.05   0.963    -1.48e-09    1.54e-09
       _cons |    .1318228   .0202898     6.50   0.000     .0899468    .1736988
-------------+----------------------------------------------------------------
     sigma_u |   .03229167
     sigma_e |   .05727183
         rho |   .24122056   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(2, 24) =     1.20                 Prob > F = 0.3200
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Random Effect

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Random-effects GLS regression                   Number of obs      =        29
Group variable: ID                              Number of groups   =         3

R-sq:  within  = 0.0538                         Obs per group: min =         9
       between = 0.9925                                        avg =       9.7
       overall = 0.3683                                        max =        10

                                                Wald chi2(2)       =     15.16
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0005
```

ROA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
INVENTORY	-2.12e-09	6.01e-10	-3.52	0.000	-3.29e-09	-9.38e-10
RECEIVABLE	6.65e-11	7.10e-10	0.09	0.925	-1.33e-09	1.46e-09
_cons	.1525832	.0150672	10.13	0.000	.1230521	.1821143
sigma_u	0					
sigma_e	.05727183					
rho	0	(fraction of variance due to u_i)				

Hausman

```
. hausman fe
```

	Coefficients			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
INVENTORY	-1.04e-09	-2.12e-09	1.07e-09	7.27e-10
RECEIVABLE	3.40e-11	6.65e-11	-3.25e-11	1.77e-10

```
                b = consistent under Ho and Ha; obtained from xtreg
     B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =        2.45
            Prob>chi2 =      0.2942
```

Langranger Multiplier

```
Breusch and Pagan Lagrangian multiplier test for random effects

        ROA[ID,t] = Xb + u[ID] + e[ID,t]

        Estimated results:
                         |       Var      sd = sqrt(Var)
                ---------+------------------------------
                     ROA |    .0048937        .0699552
                       e |    .0032801        .0572718
                       u |          0                0

        Test:   Var(u) = 0
                                 chibar2(01) =      0.00
                              Prob > chibar2 =    1.0000
```

OLS Regression

```
. reg ROA INVENTORY RECEIVABLE
```

Source	SS	df	MS	Number of obs =	29
				F(2, 26) =	7.58
Model	.050462227	2	.025231114	Prob > F =	0.0026
Residual	.086562273	26	.003329318	R-squared =	0.3683
				Adj R-squared =	0.3197
Total	.1370245	28	.004893732	Root MSE =	.0577

ROA	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
INVENTORY	-2.12e-09	6.01e-10	-3.52	0.002	-3.35e-09	-8.80e-10
RECEIVABLE	6.65e-11	7.10e-10	0.09	0.926	-1.39e-09	1.53e-09
_cons	.1525832	.0150672	10.13	0.000	.1216122	.1835542

Shapiro Test, Skewness and Kurtosis

```
. swilk residual

                    Shapiro-Wilk W test for normal data

    Variable |   Obs        W           V         z       Prob>z
-------------+--------------------------------------------------
    residual |    29     0.84125      4.920     3.288     0.00051

. sktest residual

                     Skewness/Kurtosis tests for Normality
                                                       ------- joint ------
    Variable |   Obs   Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-------------------------------------------------------------
    residual |    29        0.2024         0.0137         6.89         0.0319
```

Robust Regression

```
Random-effects GLS regression                   Number of obs      =        29
Group variable: ID                              Number of groups   =         3

R-sq:  within  = 0.0538                         Obs per group: min =         9
       between = 0.9925                                        avg =       9.7
       overall = 0.3683                                        max =        10

                                                Wald chi2(1)       =         .
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =         .

                                    (Std. Err. adjusted for 3 clusters in ID)
```

ROA	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
INVENTORY	-2.12e-09	9.16e-10	-2.31	0.021	-3.91e-09	-3.21e-10
RECEIVABLE	6.65e-11	2.86e-10	0.23	0.816	-4.93e-10	6.26e-10
_cons	.1525832	.0233853	6.52	0.000	.1067489	.1984176
sigma_u	0					
sigma_e	.05727183					
rho	0	(fraction of variance due to u_i)				