Effect of Working Capital Management on the Profitability of Listed Beverages Firms in Nigeria

[1]Onumoh Ahmed, [2]Lateef Olumide Mustapha, [3]Samuel EniolaAgbi

[1,2&3] Department of Accounting, Nigerian Defence Academy, Kaduna-Nigeria

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ABSTRACT

The cash conversion cycle (CCC) is a potent indicator of how effectively a firm manages its working capital. A firm with a low CCC is more effective since it may make more sales with the money it invests by frequently reinvesting its working capital each year. Management of working capital is still a big problem for some firms as they continue facing working capital challenges that affect their profitability. This paper therefore focused on the effect of working capital management on the profitability of listed beverage firms in Nigeria. The study used secondary data from audited financial statements of listed four beverage firms in Nigeria between 2013 to 2021. Census sampling method was used in this study. The financial information from the firms was analyzed to determine the effect of the inventory conversion period (ICP), account receivable period (ARP), account payable period (APP), and cash conversion cycle (CCC) on profitability measured by return on assets (ROA). We employed a panel corrected standard errors model to meet the study's objectives, and it was effective in explaining how working capital management affects the profitability of listed beverages firms in Nigeria. The results revealed a negative statistically significant association between APP and CCC; and profitability while ARP and ICP have insignificant relationship with profitability of listed beverage firms in Nigeria. The study therefore recommends that managers could make worth for shareholders by decreasing APP and CCC and maintaining ICP and ARP.

Keywords: Inventory Conversion Period, Account Receivable Period, Account Payable Period, Cash Conversion Cycle, Return on Assets

1. INTRODUCTION

The fundamentals of corporate finance revolve around how an organization can raise and distribute cash in order to maximize its financial performance, market value, and shareholder wealth and fulfil its responsibilities to other stakeholders. Effective finance decisions, successful investment selections, and sensible payout decisions are necessary for maximizing firm's worth. Working capital was linked to financing choices that the company should manage in relation to the cash conversion cycle, receivable turnover, inventory turnover, and the tenure of current liabilities. The business should also select the appropriate type of debt that is corresponds to the tenure of its assets. A company needs working cash to run its daily operations. Working capital, also known as gross working capital, is the total value of a company's current assets, which include cash, receivables, inventory, and other liquid assets. Networking capital is the difference between current assets and current liabilities. The quantity of items produced and sold to consumers are significantly influenced by working capital. Receivables are made since sales proceeds don't always come in cash but might also be on credit. A company's inability to maintain effective everyday operations will also be hindered by insufficient current assets (Ademola & Omolara, 2023). The quantity of raw materials and supporting items in the inventory, which can be bought with cash or credit, also affects sales. It is important to balance current assets and current liabilities since credit purchases of materials from suppliers will result in accounts payable, which will have both advantages and disadvantages.

The time interval between the cost of purchasing raw materials and the revenue from sales of finished items is known as the cash conversion cycle, and it is used to measure working capital management. Thiago, Sensini, and Maria (2021) claimed that the longer this time lag, the greater the working capital investment and the higher the sales and profitability, but that the likelihood of declining profitability occurs if the costs of higher working capital investment rise faster than the advantages of holding more inventories and/or granting more trade credit to customers.

When done correctly, working capital management is a critical component of success. The ability to respond to market changes, such as changes in raw material costs and interest rates, will enable a firm to have strong economic fundamentals, which will ultimately allow them to compete in the market (Panda & Nanda, 2018). In the end, effective working capital management can give businesses a competitive edge. They emphasized that ineffective working capital management is the primary factor in business failure. A company's operational activities will be hampered if it has too few current assets, which make up a portion of working capital, Low inventory turnover is a sign of weak sales or a large amount of unsold inventory for a business. Working capital and liquidity are related; high liquidity might hinder the possibility of high earnings while inadequate liquidity can lead to bankruptcy.

The cash conversion cycle (CCC) is a potent indicator of how effectively a firm manages its working capital. A firm with a low CCC is more effective since it may make more sales with the money it invests by frequently reinvesting its working capital each year. Management of working capital is still a

big problem for some firms as they continue facing working capital challenges that affect their profitability. Muhammad, Rehman, and Waqas (2016) asserted that working capital management plays a vital role in both firm performance and risk management, as well as in terms of the value of the company. Some financial managers still fails to take into cognizance the essential components of working capital and what is a reasonable level for a company. Amélia and Miguel (2015) observed that working capital management is regarded as one of the major challenges in the organization. According to him, financial managers can reduce risk and increase firm profitability by identifying the positions and working capital factors. In the word of Wasiuzzaman (2015), maintaining the optimal balance between each component of working capital is a key goal of working capital management which include account receivable, account payable and inventory holding period.

Unfortunately, the results of the previous research like Ademola and Omolara (2023), Thiago, Sensini, and Maria (2021), Panda and Nanda (2018), Muhammad, Rehman, and Waqas (2016), and Wasiuzzaman (2015), are in conflict with one another and different variables were employed to quantify working capital management. Also, some researchers' approaches weren't acceptable for using with panel data analysis. Controversies are an indicator that a topic needs more study. It is against background that the effect of working capital management on profitability of listed beverage firms in Nigeria was embark to fills up these gaps.

Is account receivable period has effect on profitability of listed beverage firms in Nigeria?

Is account payable period has effect on profitability of listed beverage firms in Nigeria?

Is inventory holding period has effect on profitability of listed beverage firms in Nigeria?

Is the cash conversion cycle has effect on profitability of listed beverage firms in Nigeria?

The rest of this essay is organized as follows. A list of pertinent sections of the published literature is provided in the next section. The development of the hypotheses is shown in portion 3. The study approach used to evaluate our hypotheses and the data sample is discussed in portion 4. The empirical findings and analyses are presented, and in the last portion is the conclusion and recommendations.

2. LITERATURE REVIEW

Conceptual Issue

Onumoh, Binta, and Hassant (2021) and Onumoh, Bulus, and Halima (2022) sees profitability as a financial measure that various businesses have diverse perspectives on. In a business enterprise, the condition or quality of profitability is represented by the ratio of net income to total assets. The company's profitability can be expressed as percentages or decimals of net income to total assets or net income to equity as the case may be. Profitability is the amount of revenue that remains after all costs incurred to produce that revenue have been paid. Profitability measures a company's ability to use its resources to generate revenues that are greater than its outlays (Morshed, 2020). Working capital management is very important in this regard, to ensure firms achieves their profitability objective.

Making decisions on the quantity, make-up, and financing of current assets falls under the very complicated category of working capital management (Şamiloğlua&Akgün, 2016). The primary goal of financial management for every firm is to maximize profits. However, the company must also pay particular attention to another crucial goal (maintaining liquidity). There is a concern here since growing profits at the expense of liquidity could have a negative impact on the company (Saona, 2016). The profitability and liquidity of the company enterprise must therefore be traded off. Unless a corporation doesn't care about producing a profit, such a firm organization cannot survive for an extended period of time. But, if a business doesn't care about its liquidity, it could fail or become insolvent. For capital factor management from acquisition through use, decision-making on resources observed in their sources and uses, both statistically and qualitatively, is necessary (Boţoc & Anton, 2017).

Working capital management is a managerial accounting technique that aims to maintain an adequate level of working capital (current assets and current liabilities) with respect to each other to ensure that the business has enough money to handle daily operations and satisfy pressing demands from the debt holders (Gill, Biger, & Mathur, 2010). Moreover, Yahya and Bala (2015) assert that businesses need to use resources that support working capital management's importance in today's cutthroat business environment. The WCM concept focuses on how organizations manage their current assets and liabilities, and this management approach has two parts: the amount invested in current assets and the financing plan for those assets. Businesses aim to achieve an ideal amount of working capital while selecting the optimum policy, depending on the trade-off between risks and return (Jaworski & Czerwonka, 2022). Due to a shortage of liquid assets, the corporation cannot fulfill its financial obligations on time (Yang, Jaafar, Al Mamun, Salameh, & Nawi, 2022)

Empirical review

This portion presents empirical reviw of previous scholars. Ademola and Omolara (2023) investigate the effect of working capital management on the profitability of listed manufacturing firms in African nations from 2014 to 2019. The study found that account receivables days and cash conversion cycle have a favorable and significant link with financial profitability. The length of the inventory period and account payment period have a favorable but little impact on profitability. Jaworski and Czerwonka (2022) also studied the correlations between working capital management metrics using 326 companies between 1998 and 2016. The analysis showed a strong non-linear association between profitability and the inventory holding duration, the account paying period, and the account receivable period. Profitability, on the other hand, has a linearly negative connection with the cash conversion

circle. Using the primary theoretical framework recommended by the literature, Thiago, Sensini, and Maria (2021) conducted another study on the effect of working capital management on the profitability of Argentine manufacturing enterprises. A stratified sample strategy was used to choose the companies for analysis based on an economic criterion. The information was gathered via a questionnaire during a three-year period. A fixed effects regression model was employed in the study to attain its goals and it was found to be a valid way to explain how working capital management affects profitability. The findings showed a favorable and statistically significant correlation between profitability and all aspects of working capital. This suggests that an improvement in performance as measured by ROA and ROE is determined by an increase in each variable taken into account. Yet, there is a statistically significant inverse link between profitability and leverage. Moreover, the long-term effects on accounts receivable days, inventory holding days, account payable days, and cash conversion cycle on profitability from 1990 to 2017 was examine by Boisjolya, Conine, and McDonald (2022), working capital (accounts receivable days, inventory holding days, account payable days, and cash operating cycle) was found to be statistically significant and positively correlated with profitability. In a related development, Wasiuzzaman (2015) uses 192 firms over ten years (1999-2008) using the ordinary least squares regression method to assess the relationship between working capital efficiency and firm value as well as the impact of financing limitations on this relationship. The study discovered that raising company value arises from increases in working capital efficiency through a decrease in working capital investment. Empirical data on the effects of working capital management on the profitability of small and medium scale enterprises in Portuguese businesses were investigated by Pais and Gama (2015) using panel regressions (fixed effects) and instrumental variables to model a sample of 6,063 Portuguese SMEs for a period of 2002–2009. According to the findings, lower inventories and a shorter period of time for businesses to pay their debts to customers and fulfill their commercial obligations are linked to higher corporate profitability.

On contrarily, a sample of 135 listed on the Indonesia Stock Exchange (IDX) were study from each sector, including plantation, pharmaceutical, telecommunication, investment, retail, and the cement and metal industries Basyith, Djazuli, and Fauzi (2001) on the impact of working capital management on profitability for a period from 2000 to 2019. The study utilized ordinary least squares (OLS) in data analyzed. The outcomes showed that, while not significantly, the working capital financing technique (cash conversion cycle, days sales outstanding, days inventory outstanding, and days payments outstanding) had a negative impact on ROA. Also, the influence of working capital management rules on manufacturing SMEs in the Czech Republic is examined in the study by Novak, Roscigno, and Zhang (2021). A questionnaire was used to gather the information required for the study. The sample was picked based on probabilities. The study used an economic discriminant to narrow down the reference population's most significant businesses. The analysis took 105 manufacturing enterprises into account over the course of five years, from 2014 to 2018. According to empirical findings, increasing customer extensions does not affect profitability. Also, the results of the other factors revealed a bad correlation with the profitability of the businesses, indicating that purchasing inventory and requesting extensions from suppliers result in extra expenses that have a bad impact on profitability. It is also known that days of inventory holding period, days of payment period, and cash conversion period have a negative relationship with firms' profitability, implying that purchasing more inventory and asking suppliers for longer extensions results in additional costs that are insufficient to balance the benefits that follow. This came about as a result of the Sensini and Vazquez (2021) study on the impact of working capital management practices on the profitability of Argentine agro-industrial businesses. The study examined a sample of 326 businesses chosen using a stratified random technique based on an economic criterion to test the hypothesis. This claim is supported by the research of Nwude, Agbo, and Ibe-Lamberts (2018), who examined the impact of the cash conversion cycle on the return on assets (ROA) of a sample of Nigerian quoted insurance firms for the years 2000–2011. They used multiple regression analysis to analyze the model and test their hypotheses. The effect of working capital management on performance was investigated by Amilolua and Akgün (2016) such as profitability between the accounts payable days and account receivable days and the cash conversion cycle on the Istanbul Stock Exchange (ISE) over the past ten years, sampled 120 Turkish manufacturing firms listed on ISE for a period of ten years from 2003 to 2012, and used multiple linear regression models; also discovered a significant and adverse relationship. It was anticipated that managers may increase value for shareholders by lowering the cash conversion cycle, the account payable period, and the account receivable period. Based on their investigation into the relationship between working capital management and profitability of the Pakistani tobacco industry using secondary data gathered from financial statements of chosen companies for the years 2005–2014, Muhammad, Rehman, and Waqas' (2016) study also discovered a strong negative relationship between working capital management variables and profitability of the industry.

Afrifa and Padachi (2016) study the link between the profitability of Small and Medium Businesses and working capital level as determined by the cash conversion cycle. The empirical results show that there is a concave relationship between working capital level and firm profitability and that there is an optimal working capital level at which firms' profitability is maximized. Panda and Nanda (2018) evaluate the relationship between working capital financing and firm profitability in six key manufacturing sectors of Indian economy using a sample of 1,211 firms from 6 key manufacturing sectors from 2000 to 2016. The study found a insignificant relationship between working capital financing and profitability among firms in chemical, construction, and beverages sectors. Putting the results of these studies in perspective, we put forward the following hypotheses:

H1: There is no significance effect of account receivable on profitability of listed leverage firms in Nigeria.

H2: There is no significance effect of account payable on profitability of listed leverage firms in Nigeria.

H3: There is no significance effect of inventory holding on profitability of listed leverage firms in Nigeria.

H4: There is no significance effect of cash conversion cycle on profitability of listed leverage firms in Nigeria.

The Theory of Operation and Cash Conversion (CCC)

Richards and Laughhin (1980) created the CCC theory approach. The team realized throughout their study that working capital management and each of its component parts needed to be examined critically. They believed that despite the fact that financial managers spend a significant amount of time making decisions relating to short-term assets and liabilities, the majority of the literature and researchers have paid little attention to this area. Accordingly, they define the components of the cash conversion cycle model as receivables, inventories, and payables.

The cash conversion cycle theory is focused on describing a cycle that starts with the payment for the purchase of raw materials, continues through its transformation and the emergence of new product, and ends with the collection of receivables from the buyers and potential debtors of the interaction as a result of the stock sale. Financial managers and all other related financial analysts unquestionably understand, at least intuitively, that not all working capital investments have the same life expectancy and that the rate at which they convert into usable flows of liquidity varies over time (Richards & Laughhin, 1980). Because it addresses all concepts and elements, from raw materials to finished goods, outputs representing inventory levels, to receivables and payments representing the cash aspect, it is convenient to say that the cash conversion cycle theory is the most important one for explaining working capital management and its effect on profitability. This theory therefore used to anchor this study.

METHODOLOGY

In order to evaluate the impact of working capital management on the profitability of listed beverage firms in Nigeria, the current study utilised archive data, which calls for an ex-post facto research approach. Entire four of Nigeria's listed beverage companies are used in this analysis. Implies that census sampling was employed in the study. The financial statements utilized were for 2013 - 2022 (9 years following the mandated implementation of IFRS). Return on assets (ROA), which calculates profitability as a dependent variable by dividing period profit by total assets, served as a proxy for profitability. Accounts Receivable Period (ARP), Accounts Payable Period (APP), Inventory Conversion Period (ICP), and Cash Conversion Cycle (CCC) are the explanatory variables. ARP is measured by account receivable divided by revenue multiply 365 days, APP is measured by account payable divided by cost of sales multiply 365days, ICP also measured by inventory divided by cost of sales multiply by 365 days and CCC is measured by ICP plus ARP minus APP. The entire of these variables were extracted from the audited financial annual report of Listed beverage firms in Nigeria. This study employed Stata 13 version for analysis of data.

Model specification

From the objective and hypotheses of the study the following model was developed:

$liq = f(bp + bm + bf)$

$ROA = \beta_0 + \beta_1 ARP_{it} + \beta_2 APP_{it} + \beta_3 ICP_{it} + \beta_4 CCC_{it} + \varepsilon_{it}$

Where

ROA = Return on assets

β_0 = Intercept of the regression

$\beta_1 - \beta_4$ = Coefficients of determination

ARP = Account Receivable Period

(APP) = Accounts Payable Period

ICP = Inventory Conversion Period

CCC = Cash Conversion Cycle

i = firm

t = year (1-10)

ε = error term

DISCUSSION OF RESULT

Table 1: Descriptive Statistics

Variable	observation	mean	Std. Deviation	Min.	Max,
roa	36	.0346235	.0591088	-.128919	.17044
icp	36	78.50321	68.81688	17.78442	459.2075
arp	36	46.74357	26. 13456	2.69477	95.36572

app	36	239.3027	246.308	113.2336	1622.868
ccc	36	-114.0559	191.3541	-1127.024	45.29255

Source: STATA 13.0 Output 2023

Table 1 provides descriptive information from the analysis of four beverage listed firms in Nigeria between 2013 - 2021, with 36 observations. According to the data, the variable mean of ROA is approximately.035, with a standard deviation of -.128919. The average CCC for the four beverage firms listed in Nigeria is around -114 days. Thus, it can be deduced that, on average, four Nigerian beverage listed firms experienced low profitability over the review period as indicated by their ROA. The four beverage companies that are publicly traded in Nigeria have good CCC on average, but the high standard deviation of 191.3541 suggests that the firms are widely spread on it.

Normality Test

This section presents the normality test of the variables used in this study which include return on assets, inventory conversion period, account receivable period, account payable period and cash conversion cycle.

Table 2: Normality test

Variable	W*	V*	z	Probz
ROA	.94851	2.082	1.359	0.08714
ICP	.40434	24.090	5.892	0.00001
ARP	.97350	1.072	0.128	0.44899
APP	.34350	26.551	6.072	0.00001
CCC	.51212	19.731	5.522	0.00001

Source: STATA 13.0 Output 2023

Under Shapiro (W) for normal data, null hypothesis principle is used to check a variable that came from a normally distributed population (the null hypothesis of the test is that, the data is normally distributed). Table 2 indicates that all the variables of the study did not follow the normal distribution because the p-value of the test statistic is statistically significant with the exception of return on assets (ROA) and account receivable period (ARP). Thus, the null hypothesis (that, the data is normally distributed) is rejected at 1% and 5% significant level. This implies that not all data that follow the normal data distribution assumption. Hence, normality of the data does not in any way affect the influential statistic.

Correlation Matrix

The following table presents the correlation matrix table where the relationship between the independent variable and the dependent variable is analyzed and also the independent variables themselves.

Table 3: Correlation Matrix

	ROA	ARP	APP	CCC	
ROA	1				
ICP	-0.0690	1			
	0.6891				
ARP	-0.4571*	-0.0030	1		
	0.0051	0.9862			
APP	0.0074	0.8896*	-0.0542	1	
	0.9658	0.0000	0.7537		
CCC	-0.0968	-0.7858*	-0.2052	-0.9747*	1
	0.5744	0.0000	0.2099	0.0000	

Source: STATA 13.0 Output 2023

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The correlation matrix of all variables included in the study is shown in Table 3. The result from the correlation analysis indicates that return on assets (ROA) has negative significant relationship with account receivable period (ARP), implying that ARP has potential to increase or reduce ROA of listed beverages firms in Nigeria. However, the result also shows that there is insignificant relationship between ROA and other explanatory variables (ICP, APP and CCC) indicating that increases or decrease in these explanatory variables have no potential to increase or reduce on the ROA of listed

beverages firms in Nigeria. However, Pearson's correlation coefficients clearly show that there is problem of multicollinearity. Robustness test was run to correct this problem.

Robustness Tests

The following table presents the VIF to checks for the possibility of multicollinearity and heteroscedasticity. Also, present here is the Hausman test and the Breusch-Pagan Lagrange Multiplier (LM) test.

Table 4: Diagnostic Tests

	Prob> chi2	VIF	1/VIF
APP		99.53	0.010047
CCC		54.30	0.018416
ICP		13.02	0.076817
Mean		55,62	
Hottest	0.3601		
Hausman Test	0.0287		
PCSEs	0.0019		

Source: STATA 13.0 Output 2023

Table 4 shows the robustness test to checks for the possibility of multicollinearity. The Variance Inflation Factor (VIF) reveals the absence of it as all factors are below 10 and tolerance values are below 1. This is based on Gujarati (2013) rule of thumb, who says that if the VIF of value exceeds 10, that value is said to be highly collinear, this Implies that there is a problem of multicollinearity. Table 4 also presents the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity which shows p-value of 0.3601, indicating that there is no presence of heteroscedasticity as the p-value is more than 0.05. This is based on Gujarati (2013) who says that if heteroscedasticity test is significant means there is a problem of heteroscedasticity. To correct the problem of multicollinearity, Panel Corrected Standard Errors (PCSEs) was conducted which shows an improvement and no autocorrelation, and heteroscedasticity was corrected.

Panel data was tested using a fixed effect, random effect, and pooled OLS regression models. In order to determine which of the models was appropriate for the study, Hausman test was used. The Hausman test determines the more suitable methodology between fixed and random effect.

The result in Table 4 also indicates that we accept the null hypothesis that the differences between the coefficients of the fixed and random effect models are not significant. This is because the prob Chi2 of 0. 0.0278 is lesser than 0.05. Therefore, the test concludes that fixed effect is the optimal model to be employed in this study, but because of the presence of multicollinearity, PCSEs is the most appropriate model for the study.

Analysis of Panel Regression Model Result

Table 4 presents the results obtained from equation

$$ROA_{it} = \beta_{0it} + \beta_1 ICP_{it} + \beta_2 ARP_{it} + \beta_3 APP_{it} + \beta_4 CCC_{it} + \varepsilon_{it}$$

In this equation, the dependent variable (ROA) is regressed against its determinants (ICP, ARP, APP and CCC). The regression results show a positive and significant relationship between ICP and ROA while APP and CCC variable shows negative significant relationship. The result implies that upward movement in ROA accompanied by an increased in ICP and board independence. Put differently, downward movement in ROA accompanied by an increase in APP and CCC of listed beverages firms in Nigeria.

Table 1: Summary of regression result

Variables	Coefficient	t value	p value
Constant	.0870842	4.72	0.000
ICP	.0007805	1.73	0.084
APP	-.0009561	-2.90	0.004
CCC	-.0010088	-3.32	0.001
R^2			0.2239
Wald chi^2			14.86
F-sig			0.0001

Source: STATA 13.0 Output 2023

Also, the result in table 5 shows that that ICP has insignificant influence in predicting ROA of listed Beverages Firms in Nigeria. Since the p-value in respect of ICP is insignificant at 5%, the result provides evidence of not rejecting the first hypothesis of the study. Therefore, the finding is in line with Afrifa and Padachi (2016), but contrary to the finding of Jaworski and Czerwonka (2022), Boisjolya et al, (2022), Basyith et al, (2021) and Sensini and Vazquez (2021).

Furthermore, the result in table 5 shows that that APP and CCC has negative significant influence in predicting ROA of listed Beverages Firms in Nigeria. Since the p-value in respect of APP and CCC is significant at 5%, the result provides evidence of rejecting the hypothesis two and four of the study. Therefore, the finding is in line with the findings of Basyith et al, (2021), Sensini and Vazquez (2021) and Novak et al, (2021), but contrary to the findings of Afrifa and Padachi (2016), Jaworski and Czerwonka (2022), Boisjolya et al, (2022), and Thiago et al, (2021).

CONLUSION AND RECOMMENDATIONS

The findings of present study indicated negative relationship between APP and CCC and ROA of listed beverage firms in Nigeria for the period of 2013-2021. Furthermore, present findings also showed a insignificant relationship between of working capital (measured by ARP and ICP) and ROA listed beverage firms in Nigeria for the period of 2013-2021.

This study has the following recommendations; This study recommended that managers could make worth for shareholders by decreasing APP and CCC and maintaining ICP and ARP. It is recommended that managers should give more consideration to the entire phases of WCM components, because proper management of inventory, payables and receivables can increase the firm profitability.

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Appendix

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Notes:
    1.  You are running Small Stata.

. edit

. *(7 variables, 36 observations pasted into data editor)

. label variable year "year"

. label variable id "ID"

. summarize roa icp arp app ccc
```

Variable	Obs	Mean	Std. Dev.	Min	Max
roa	36	.0346235	.0591088	-.128919	.17044
icp	36	78.50321	68.81688	17.78442	459.2075
arp	36	46.74357	26.13456	2.69477	95.36572
app	36	239.3027	246.308	113.2336	1622.868
ccc	36	-114.0559	191.3541	-1127.024	45.29255

```
. sfrancia roa icp arp app ccc
```

Shapiro-Francia W' test for normal data

Variable	Obs	W'	V'	z	Prob>z
roa	36	0.94851	2.082	1.359	0.08714
icp	36	0.40434	24.090	5.893	0.00001
arp	36	0.97350	1.072	0.128	0.44899
app	36	0.34350	26.551	6.073	0.00001
ccc	36	0.51212	19.731	5.523	0.00001

```
. sktest roa icp arp app ccc
```

Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	joint Prob>chi2
roa	36	0.2797	0.0987	4.09	0.1297
icp	36	0.0000	0.0000	49.41	0.0000
arp	36	0.8777	0.0896	3.14	0.2081
app	36	0.0000	0.0000	51.16	0.0000
ccc	36	0.0000	0.0000	44.82	0.0000

```
. pwcorr  roa icp arp app ccc, star (0.05) sig

                      roa       icp       arp       app       ccc
          ────────────────────────────────────────────────────────
          roa  │   1.0000


          icp  │  -0.0690    1.0000
               │   0.6891


          arp  │  -0.4571*  -0.0030    1.0000
               │   0.0051    0.9862


          app  │   0.0074    0.8896*  -0.0542    1.0000
               │   0.9658    0.0000    0.7537


          ccc  │  -0.0968   -0.7858*   0.2052   -0.9747*   1.0000
               │   0.5744    0.0000    0.2299    0.0000
               │
```

```
. reg  roa icp arp app ccc
note: arp omitted because of collinearity

      Source  │      SS        df       MS              Number of obs =      36
  ────────────┼──────────────────────────────          F(  3,    32) =    3.08
       Model  │  .02737666      3  .009125553           Prob > F      =  0.0414
    Residual  │  .094908207    32  .002965881           R-squared     =  0.2239
  ────────────┼──────────────────────────────          Adj R-squared =  0.1511
       Total  │  .122284867    35  .003493853           Root MSE      =  .05446


  ─────────────────────────────────────────────────────────────────────────────
         roa  │     Coef.    Std. Err.      t     P>|t|    [95% Conf. Interval]
  ────────────┼────────────────────────────────────────────────────────────────
         icp  │   .0007805    .0004826     1.62   0.116    -.0002026    .0017636
         arp  │          0    (omitted)
         app  │  -.0009561    .0003729    -2.56   0.015    -.0017156   -.0001966
         ccc  │  -.0010088    .0003545    -2.85   0.008    -.0017309   -.0002867
       _cons  │   .0870843    .0215816     4.04   0.000     .0431239    .1310446
  ─────────────────────────────────────────────────────────────────────────────
```

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
        Ho: Constant variance
        Variables: fitted values of roa

        chi2(1)      =      0.84
        Prob > chi2  =    0.3601

. xtset id year, yearly
        panel variable:  id (strongly balanced)
         time variable:  year, 2013 to 2021
                  delta:  1 year

. vif

    Variable  │      VIF       1/VIF
  ────────────┼─────────────────────
         app  │    99.53    0.010047
         ccc  │    54.30    0.018416
         icp  │    13.02    0.076817
  ────────────┼─────────────────────
    Mean VIF  │    55.62
```

```
. xtreg  roa icp arp app ccc, fe
note: arp omitted because of collinearity

Fixed-effects (within) regression              Number of obs     =         36
Group variable: id                             Number of groups  =          4

R-sq:  within  = 0.1614                         Obs per group: min =          9
       between = 0.3018                                        avg =        9.0
       overall = 0.1951                                        max =          9

                                                F(3,29)           =       1.86
corr(u_i, Xb)  = -0.0042                        Prob > F          =     0.1583
```

roa	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
icp	.0002775	.0005218	0.53	0.599	-.0007897	.0013448
arp	0	(omitted)				
app	-.0006519	.0004292	-1.52	0.140	-.0015297	.0002258
ccc	-.0007603	.0004336	-1.75	0.090	-.0016471	.0001265
_cons	.0821265	.0231675	3.54	0.001	.0347436	.1295095
sigma_u	.02752003					
sigma_e	.0518568					
rho	.21974654	(fraction of variance due to u_i)				

```
F test that all u_i=0:    F(3, 29) =     2.10                 Prob > F = 0.1222

. est store fe

. xtreg  roa icp arp app ccc, re
note: ccc omitted because of collinearity

Random-effects GLS regression                  Number of obs     =         36
Group variable: id                             Number of groups  =          4

R-sq:  within  = 0.1344                         Obs per group: min =          9
       between = 0.5319                                        avg =        9.0
       overall = 0.2239                                        max =          9

                                                Wald chi2(3)      =       9.23
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0264
```

roa	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
icp	-.0002283	.0002943	-0.78	0.438	-.0008051	.0003485
arp	-.0010088	.0003545	-2.85	0.004	-.0017036	-.000314
app	.0000527	.0000823	0.64	0.522	-.0001087	.0002141
ccc	0	(omitted)				
_cons	.0870843	.0215816	4.04	0.000	.044785	.1293835
sigma_u	0					
sigma_e	.0518568					
rho	0	(fraction of variance due to u_i)				

```
. est store re
```

```
. hausman fe re

                   ─── Coefficients ───
                  (b)           (B)           (b-B)       sqrt(diag(V_b-V_B))
                  fe            re          Difference           S.E.

       icp      .0002775     -.0002283       .0005058          .0004309
       app     -.0006519      .0000527      -.0007046          .0004212

                    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)
                       =          7.10
             Prob>chi2 =       0.0287

. xtpcse  roa icp arp app ccc
note: arp omitted because of collinearity

Linear regression, correlated panels corrected standard errors (PCSEs)

Group variable:    id                      Number of obs      =         36
Time variable:     year                    Number of groups   =          4
Panels:            correlated (balanced)   Obs per group: min =          9
Autocorrelation:   no autocorrelation                     avg =          9
                                                          max =          9
Estimated covariances      =       10       R-squared          =     0.2239
Estimated autocorrelations =        0       Wald chi2(3)       =      14.86
Estimated coefficients     =        4       Prob > chi2        =     0.0019
```

roa	Coef.	Panel-corrected Std. Err.	z	P>|z|	[95% Conf. Interval]	
icp	.0007805	.0004514	1.73	0.084	-.0001042	.0016653
arp	0	(omitted)				
app	-.0009561	.0003293	-2.90	0.004	-.0016016	-.0003106
ccc	-.0010088	.0003039	-3.32	0.001	-.0016044	-.0004132
_cons	.0870843	.0184314	4.72	0.000	.0509595	.1232091

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