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# Working Capital Management and Profitability under an Economic Crisis: Evidence from Commercial Companies in Greece

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## Abstract

The main scope of this study is to investigate the relationship between working capital and profitability for companies that are active in the commercial sector, at least as one of their main activities, listed on the Athens Stock Exchange. This study attempts to contribute to the existing literature by focusing on the years 2014-2018, an economic crisis period that has a substantial impact on the financial data of the Greek commercial industry. The results show that the inventory conversion cycle, average collection period of short-term receivables, cash conversion cycle variables have a negative and statistically significant relationship with profitability. Instead, the average repayment period of short-term liabilities, circulation liquidity, direct liquidity, the size of the company and its growth is positively related to profitability. Finally, the effect of leverage on profitability is not significant.

## Keywords

Profitability, Working Capital, Financial Ratios, Commercial Companies, Greece

## 1. Introduction

It is evident that understanding the term working capital and the proper management of these funds plays a crucial role in whether this decision has a positive or negative impact on the future of the business. It provides a means to make

decisions on various projects and investments and to develop the financial budget of the business. Correct decision-making on the part of businesses leads to investments that bring capital greater than that of working capital. It is the basis of the survival of businesses; therefore, its bad management is the main cause of a business's bankruptcy. The lack of liquidity in a business can result from reduced working capital. With the contribution of working capital and its calculation, an investor or an analyst can examine the variability of a company's financial results and determine whether a stock is a good investment or carries financial risk, that is, it can lead to an increase in liabilities and the cost of doing business (O'Connell, 2018).

## 2. The Scope of the Present Study

This study aims to highlight the importance of working capital, the ways of its proper management and the value it has in businesses. This study concerns the management of companies' working capital and how it is related to their profitability. The case of commercial enterprises, one of the main forms of large enterprises in Greece, and the importance of working capital in them and their profitability are investigated. The commercial sector is very developed in Greece and also sensitive to economic shocks, such as the financial crisis, monetary policies, fiscal austerity, etc., which shows the critical role of working capital management. More specifically, commercial companies listed on the stock exchange of Athens, whose financial data show greater transparency, are used as research sample of the present study. This specific work is an empirical study based on the economic data of commercial enterprises in recent years in Greece. This study primarily attempts to contribute to the existent literature by focusing on the years 2014 – 2018, an economic crisis period which has a strong impact in the financial data of the Greek commercial industry. We clarify and summarize the data prevailing in our country in recent years and to provide immediate information on the current economic situation of commercial enterprises in Greece.

The implementation of this study, as empirical research, on an issue of intense interest for the financial analysis of companies, such as capital management in companies and the summary presentation of new data, will be a source of information for the directly interested public. More specifically, both financial managers and employees of the financial branch of businesses and research staff may study in a concise form the data of the current economic situation and the interaction of these two vital parameters, the working capital and profitability, in the commercial sector. In addition, businesses and their associated personnel will be able to understand some basic aspects and values of the proper management of their funds and their total assets and correct any mistakes and oversights. Furthermore, the statistical survey of the work and the study of the affected indicators and the cash conversion cycle can also be a point of reference for monitoring the competition in the commercial business sector in Greece and

in this way stimulate the competitiveness between businesses and expansion of the market as a whole. Finally, this paper aims to highlight the value of working capital in the decision-making process and the overall financial management of businesses in the commercial sector in Greece, but also at a general level and to highlight its significant contribution to efficiency, productivity, functionality and their effectiveness.

Regarding the structure of this study, the corresponding literature review is analyzed by paying attention on significant financial ratios which influence profitability. Relevant empirical studies that have been carried out in recent years and their results are then analyzed. Next, the research design is discussed providing details about the research model, the research sample and the adopted econometric methodology. Afterwards, the empirical findings are presented resulting to significant conclusions and policy implications.

## 3. Literature Review

The profitability of businesses expresses the dynamics of the business in the market and is measured with the help of profitability ratios. The two most important are return on assets (ROA) and return on equity (ROE). A direct relationship and interaction exists between working capital management and business profitability.

According to many researchers (Chatterjee, 2010; Dong & Su, 2010; Hager, 1976; Kamath, 1989; Lazaridis & Tryfonidis, 2006; Ramachandran & Janakiraman, 2009), working capital management is best expressed by the cash conversion cycle. The shorter this cycle is for a business, the less cash it has, and therefore, the better the business's functionality and efficiency, and the greater the present value of the cash flows. In addition, as has been shown by various research there is a negative relationship between the indicators of circulation / general and direct liquidity, but not with profitability. The cash conversion cycle and the net trade cycle (equal to the cash conversion cycle minus the average amount of accounts payable) have approximately the same information, and both have a negative relationship with profitability. Furthermore, this negative relationship is strengthened by the view that all three components of the cash conversion cycle are also negatively related to profitability, according to research conducted in Nigeria on listed companies (Falope & Ajilore, 2009). Furthermore, there is an interaction relationship between profitability and cash conversion cycle that are linked to each other with an inversely proportional relationship, while the more aggressive the company's management policy, the shorter the cash cycle duration and therefore, greater profits (Jose et al., 1996; Shin & Soenen, 1998). In addition to this relationship, it is considered that the reduction of inventories and the time of accounts receivable contributes enhancing profits for small and medium enterprises (Juan García-Teruel & Martinez-Solano, 2007). Contrary to the above conclusions, the more aggressive the management policy of the firm, the lower the profitability and returns (Afza & Nazir, 2007a,

2007b; Nazir & Afza, 2009). This policy, combined with the negative relationship of long-term financing and investment in business assets and short-term financing, is considered to reduce corporate profits further (Almwalla, 2012).

Research has shown that circulation and immediate liquidity indicators do not significantly affect profitability (Smith & Begemann, 1997). Other studies (Deloof, 2003; Lyroudi & Lazaridis, 2000; Wang, 2002), argue that there is a direct relationship between these two indicators with the cash conversion cycle, but also with the time the inventories remain in the warehouse and the collection days of receivables with a positive relationship. On the contrary, according to the exact research, there is a negative relationship between the payment days of short-term liabilities and the circulation and immediate liquidity indicators.

A negative relationship also appears between the conversion cycle and the ROE and ROA indicators, with these relationships being influenced by factors such as company structuring policies and the type of their operations by industry. Furthermore, a statistically significant but negative correlation has emerged between the conversion cycle elements and businesses' profitability. More generally, most research that examines the relationship between profitability and cash cycle time has shown that it is negative, meaning that as one increases, the other decreases.

An interaction also occurs between liquidity and profitability. Traffic velocity and cash conversion cycle indicators show a negative relationship with profitability. The size of the business affects profitability in the event that the data is examined on the basis of the sector and not individually on the whole of the respective business (Eljelly, 2004).

In all the indicators related to working capital management, studies have shown that the current assets to sales ratio (CTSR), the working capital turnover ratio (WTR) and the Debtors Turnover Ratio (DTR) are negatively related to profitability and the ROI index, while all the others show a positive interaction. Moreover, the decrease in the working capital rate is greater than the increase in the profitability of the business. Working capital management has a negative and statistically significant relationship with the business's profitability. The increase in profits is directly related to the proper management of the cash conversion cycle and the balance in their optimal values, the maintenance of inventories, receivables and accounts payable (Lazaridis & Tryfonidis, 2006; Narware, 2004).

In an extension of the previous literature, there appears to be a positive and statistically significant relationship between the cash conversion cycle and the operating profit of the firms, while the inventory remaining in the warehouse and the repayment time of the liabilities do not seem to affect the profitability (Gill et al., 2010). According to other research, low profitability is associated with large amounts in inventories and accounts receivable (Padachi, 2006). According to another research (Raheman & Nasr, 2007), profitability is negatively correlated with cash conversion cycle, inventory holding in warehouses, days to collect receivables and pay short-term bills and current liquidity ratio. Accord-

ing to the same research, the company's size shows a positive relationship with profitability, but a negative relationship with debt, since the greater the use of foreign capital, the lower the profitability. In another research, it is argued that there is a negative correlation between profitability and the remaining time of inventory in warehouses and the time of collection of receivables, but a positive correlation with the repayment time of short-term receivables (Vishnani & Shah, 2007). Leverage shows a negative relationship with profitability such as inventory holding, time of receivables and short-term accounts. However, it shows a positive and statistically significant relationship with sales change rate (Samiloglu & Demirgunes, 2008).

There is a negative relationship between profitability and ROA with the length of the cash conversion cycle. However, there is no significant relationship between profitability and ROE and the length of the cycle. Also, a negative relationship appears between profitability and the business size (Uyar, 2009). Other research (Charitou et al., 2010; Enqvist et al., 2014; Mathuva, 2015) argues that an increase in inventory holding time and the repayment of accounts payable combined with a decrease in the collection time of accounts receivable leads to an increase in profit of a business.

Studies conducted in various European countries argue that there is a negative relationship between the ROA index and therefore the three elements of the cash conversion cycle with the profitability of companies. Complementary to these researches is a Japanese study which claims that this negative relationship exists in all types of businesses, except for service and commercial businesses (Nobanee et al., 2011). More generally, depending on the time period and the place of the research, various studies support the negative relationship of the cash conversion cycle with the profitability of companies, which however differs in which of the components of the conversion cycle appears to have a negative relationship with profits (Alipour, 2011; Mojtahedzadeh et al., 2011; Sharma & Kumar, 2011). Other studies (Hayajneh & Yassine, 2011) in combination with the negative relationship between earnings and cash conversion cycle and its three components, argue that there is a negative relationship with leverage, while there is a positive relationship with the liquidity ratio, the size of business and increase sales.

The study of Hayajneh and Yassine (2011), as well as Almwalla (2012) reinforce the view that the increase in GDP (Gross Domestic Product) and the size of businesses are positively related to profitability. Contrary to these views, Abuzayed (2012) supports the positive interaction between profitability and cash conversion cycle, but measuring the gross operating profit and not the ratio of net operating income/total assets of the previous operations. Another view (Soekhoe, 2012) argues that profitability is negatively related to the two components of the cash conversion cycle, receivables collection time and short-term accounts payable time, as well as leverage, but positively related to inventory holding time in warehouses, the increase in GDP and the size of the business. As

for the cash conversion cycle itself, it is ultimately positively related to earnings, but not statistically significant.

A different approach to the relationship between profitability and working capital, which does not describe their relationship through the financial ratios, is that which relates profitability to the cash flows of businesses. More specifically, it is reported that the largest companies, with the change in their cash flows, usually invest in fixed capital, while the smaller ones in working capital. Furthermore, low cash flow levels are associated with fixed and working capital investments, while a high degree of leverage leads to only working capital investments. Firms with high working capital have more significant investment flexibility and adjust working capital more than their long-term capital, despite keeping the latter at high levels (Ding et al., 2013).

More recent studies argue that a firm's profitability positively correlates with the three components of the conversion cycle and can be increased through investments in working capital, inventory, receivables and accounts payable (Tran et al., 2017). However, another study conducted in Pakistan argues a negative relationship exists between profitability and accounts receivable collection time, return on equity and assets, operating and net profit, and cash conversion cycle (Akgün & Şamiloğlu, 2016). Another study negatively correlates the cash conversion cycle with profitability and argues that the degree of aggressiveness of working capital management affects profit rates, with the most aggressive policy showing the highest rates (Singh et al., 2017). According to another new research, there is an optimal amount of working capital that yields the most profitability for businesses, especially small and medium-sized businesses. Any deviation from this leads to a decrease in profit (Afrifa & Padachi, 2016). For the same category of businesses, it is argued that there is an inversely proportional relationship between the duration of the cash conversion cycle and profitability (Dalci et al., 2019). Another Indian research shows the negative relationship of the net trading cycle, the duration of the accounts receivable, the days of inventory concerning the financial condition of the company with the profit of the companies, as well as it points out the positive relationship of the duration of the accounts payable (Kaushik & Chauhan, 2019). Finally, an extensive study on Pakistan shows the positive correlation between cash conversion cycle and inventory holding with ROA and a negative relationship of the above with ROE and EPS. More generally, the applied administrative policy and working capital management play an important role in shaping the profitability of a business (Bhutto et al., 2019).

A significant part of the international literature was covered indicatively as it concerns the connection between profitability and working capital management for the company's position in the market and its operation and financial status in general. In the context of the present study, this literature review is taken into consideration investigating whether capital management affects profitability in a sample of commercial companies listed on the Stock Exchange of Athens.

## 4. Research Design

### 4.1. Research Model

The main objective of the empirical part of this study is to examine to what extent the profitability of a business is correlated with working capital. As described in previous literature review, the cash conversion cycle is an appropriate depiction of working capital management. The variables selected for the empirical analysis in this study are analyzed.

In the literature, the most common variable used to attribute the profitability of companies is the return on assets ratio or ROA. This specific indicator reflects the efficiency of using the assets of each company attempting to maximize its profitability. Indicatively, ROA index was used by Charitou et al. (2010), Karaduman et al. (2010), Deloof (2003).

Since the main objective of the present study is to investigate the relationship between working capital and profitability, the principal independent variable in our analysis is Cash Conversion Cycle (CCC) which is also used by similar studies as a proxy for working capital (Deloof, 2003; Mathuva, 2010). The cash conversion cycle is a measure obtained by subtracting the average short-term payback period (DAP) from the total operating cycle of each business. The business's operating cycle is the sum of two key quantities, the inventory conversion cycle (DINV) and the average accounts receivable conversion period (DAR). Therefore, if we add these two figures and subtract from them the average repayment period of short-term liabilities, we will get the cash conversion cycle, which is also our primary independent variable. All the above variables are used as independent variables individually in regression models, but also in combination for the needs of the empirical analysis, since they all show correlations with profitability, according to the literature review. During the cycle, businesses have their cash tied up. So, every firm wants to lengthen the average current liabilities repayment period and minimize the average inventory conversion period. In the same vein is the average duration of collection of claims that companies want to shrink as much as possible.

We expect the cash conversion cycle to have a negative relationship with profitability. The relationship of the average repayment period of short-term liabilities is also expected to be positive, since the longer this period increases, the more positively it affects profitability. We expect the inventory conversion cycle and the average receivables collection period to have negative relationship with profitability. However, we may observe differentiated results, such as those of Mathuva (2010) who highlighted a positive relationship between profitability and inventory conversion cycle. In the same study, profitability had a correspondingly negative relationship with the average repayment period of short-term liabilities. Therefore, there may be different from the expected results, which are not a part of a wrong analysis, but a highlighting of particularities of specific sectors, markets or even companies. Finally, a statistically significant relationship has indicated between profitability and some of the components of

the cash conversion cycle (Gill et al., 2010).

Control variables are independent variables not directly related to working capital, but they are suitable to demonstrate other factors that affect business profitability.

- Leverage is an essential element for any business, since it essentially informs us of the percentage of foreign capital it uses to finance its operation. At this point, it is understood that the higher the leverage ratio, the lower we expect the profitability of the company, since as the leverage increases, the company uses more and more funds obtained from borrowing, since it is unable to finance the operations of equity and may be over-indebted (Lazaridis & Tryfonidis, 2006). There is a limit up to which every company seeks to have high foreign financing, since the profitability of investments also increases. However, each company must be careful not to exceed in levels where profits before taxes and interest are higher than the burdens it accepts from short-term obligations. If it deviates from these limits, the business appears unprofitable.

- Liquidity is another control variable. For liquidity we use two indicators. The initial liquidity ratio is the circulation liquidity ratio. This specific indicator does not show a clear trend concerning profitability, since in many studies it appears to have a positive effect on profitability and some others negatively. Studies also point out that its effect is considered non-significant for profitability (Raheman et al, 2010; Afeef, 2011). The other applied liquidity index is the direct liquidity index (ACR—acid ratio) which shows similar behavior. This specific index does not clearly affect profitability like the circulation liquidity index.

- The size for a business is usually measured based on the sales recorded by the specific business (Deloof, 2003; Raheman et al., 2010; Lazaridis & Tryfonidis, 2006). The most common and accepted way to denote size is the natural logarithm of sales adopted by our empirical analysis. Previous studies (Deloof, 2003; Lazaridis & Tryfonidis, 2006; Mathuva, 2010) indicate the importance of the increase in the size of the company in its profitability. Specifically, as the sales and size of a company increase, it gains more market share, especially vis-à-vis its suppliers. By increasing its bargaining power vis-à-vis suppliers, it achieves a noticeable reduction in costs for itself. Suppliers are in a difficult position negotiating with a large company, since they do not want to risk stopping their cooperation and reducing their products' prices to these companies. The benefits also reach to final consumer, since large companies can offer their products at highly competitive prices, due to reduced costs. Based on the above analysis, we expect profitability to have a positive relationship with the size of the business. Studies point out that there is a positive relationship between these variables (Deloof, 2003; Mathuva, 2010). Instead, other studies indicate the existence of a negative relationship between profitability and company size (Charitou et al., 2010).

- Growth is another significant control variable. Growth shows whether a business's sales course is expected to be positive, so its size increases, or negative and the business shrinks. Studies argue that growth that positively affects the profitability of the company (Deloof, 2003).

It is worth to be clarified that due to the characteristics of the size index and the growth index, both of which are based on sales, it is essential to assess if the two indices are correlated to such an extent that they cannot be used simultaneously as control variables. We have to examine whether these specific variables may cause a multicollinearity problem in the multiple regression model to be used. These specific variables are simultaneously used in the studies of Deloof (2003) and Raheman et al. (2010). According these two studies, an empirical rule is adopted which considers that the multiple linear model is not affected if the linear correlation between two independent variables is lower, in absolute value, than 0.75 ($\rho \leq |0.75|$). The Pearson linear correlation coefficient for our study between the growth variables and firm size is estimated to be equal to $\rho = 0.53$ allowing us to include both variables together in the research models, since we do not consider that they create a multicollinearity problem.

In order to derive the main results of the present research analysis, specific regression models are estimated. As a dependent variable we define the profitability of the examined companies.

$$
\begin{aligned}
\text{ROA}_{i,} = {} & c + b_1 \text{DINV}_{i,t} + b_2 \text{Leverage}_{i,t} + b_3 \text{CR}_{i,t} + b_4 \text{ACR}_{i,t} \\
& + b_5 \text{Size}_{i,t} + b_6 \text{Growth}_{i,} + u_{i,t}
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
\text{ROA}_{i,} = {} & c + b_1 \text{DAR}_{i,t} + b_2 \text{Leverage}_{i,t} + b_3 \text{CR}_{i,t} + b_4 \text{ACR}_{i,t} \\
& + b_5 \text{Size}_{i,t} + b_6 \text{Growth}_{i,} + u_{i,t}
\end{aligned}
\tag{2}
$$

$$
\begin{aligned}
\text{ROA}_{i,} = {} & c + b_1 \text{DAP}_{i,t} + b_2 \text{Leverage}_{i,t} + b_3 \text{CR}_{i,t} + b_4 \text{ACR}_{i,t} \\
& + b_5 \text{Size}_{i,t} + b_6 \text{Growth}_{i,} + u_{i,t}
\end{aligned}
\tag{3}
$$

$$
\begin{aligned}
\text{ROA}_{i,} = {} & c + b_1 \text{CCC}_{i,t} + b_2 \text{Leverage}_{i,t} + b_3 \text{CR}_{i,t} + b_4 \text{ACR}_{i,t} \\
& + b_5 \text{Size}_{i,t} + b_6 \text{Growth}_{i,} + u_{i,t}
\end{aligned}
\tag{4}
$$

$$
\begin{aligned}
\text{ROA}_{i,t} = {} & c + b_1 \text{DINV}_{i,t} + b_2 \text{DAR}_{i,t} + b_3 \text{DAP}_{i,t} + b_4 \text{Leverage}_{i,t} \\
& + b_5 \text{CR}_{i,t} + b_6 \text{ACR}_{i,} + b_7 \text{Size}_{i,t} + b_8 \text{Growth}_{i,t} + u_{i,t}
\end{aligned}
\tag{5}
$$

In all of the above models, the data (variables) are cross-sectional for a total sample of twenty-two (22) examined companies ($i = 1, 2, ..., 22$) for a period of five (5) years ($t = 1, 2, ..., 5$).

The index $\text{ROA}_{i,t}$, captures the profitability of businesses and c is the constant term. The variable $\text{DINV}_{i,t}$, expresses the period of holding inventories (average value), the variable $\text{DAR}_{i,t}$, expresses the period of collection of receivables (average value) and the variable $\text{DAP}_{i,t}$, expresses the period of repayment of short-term liabilities (average value). Finally, the variable $\text{CCC}_{i,}$, expresses the cash conversion cycle.

In the above models we have defined some specific control variables which are

the variable $\text{Leverage}_{i,t}$, which expresses the leverage, the variable $\text{CR}_{i,t}$, which expresses the circulation liquidity, the variable $\text{ACR}_{i,t}$, which expresses the immediate-direct liquidity, the variable $\text{Size}_{i,t}$, which expresses the size of the company and finally the variable $\text{Growth}_{i,t}$, which expresses the increase in sales. $u_{i,}$ is essentially the disturbance term, which is the sum of the effect of each unobserved firm (defined as $\mu_i$) and the regression error which is actually the residual of the disturbance (defined as $v_{i,t}$).

It is worth mentioning that a sixth model that includes the variable of the cash conversion cycle ($\text{CCC}_{i,t}$) and its constituent elements—variables is not investigated in our research analysis since in this case we may face the problem of multicollinearity.

## 4.2. Research Sample

The main scope of this study is to investigate the relationship between working capital and profitability for companies that are active in the commercial sector, at least as one of their main activities. At this point it should be made clear that the specific companies may be active in more than one industry. Their commercial operation, however, is what constitutes their main activity. All the data used refer to the commercial activity of the selected companies; each company is studied in this respect. Furthermore, key criterion for selecting companies is to be listed on the stock exchange.

We randomly select 22 companies activated in the commercial sector and are characterized as commercials for the years 2014-2018. At this point it should be mentioned that the financial data of this period are affected by the economic crisis in Greece. All companies participate in product trading activities by statute and are listed on the stock exchange. Companies operating in the service sector were excluded from the research sample selection. Companies active in financial goods sectors are also excluded, due to the particularities they present in their operation and in their financial statements. The main reason for using companies listed on the Stock Exchange is the fact that listed companies display much more reliable and complete financial data. Conversely, non-listed firms tend to show reduced profits in their financial statements for tax reasons (Lazaridis & Tryfonidis, 2006). Table A.1 in Appendix A lists the companies selected for the research sample of the study by sector of activity.

## 4.3. Research Methodology

The empirical part of this study is based on a panel data from 22 companies listed on the Greek stock exchange, for 5 time periods, from 2014 to 2018. The specific companies either carry out exclusively commercial activity or it is a part of their activity.

Cross-sectional data provide information about the firms in the sample individually rather than as a result of time. They are related to the particularities displayed by each of the businesses separately at a specific time. As a result, the as-

sessed dataset contains a balanced number of observations per time period. More specifically, in each time period we have 22 observations, which is the number of companies we are studying. The most widespread analysis techniques for the analysis of cross-sectional data are the development of fixed effects and random effects models (Wooldridge, 2001). In cases where the time period (the number of annual data) is less than the number of independent variables, then we should adopt the fixed effect method (Cameron & Trivedi, 2005).

In addition, we examine for stable long-term effects based on Kao's criterion (Kao, 1999) and using a cointegration test. The characteristics of our research sample, i.e. panel data for a 5-year time horizon and 22 cross-sectional observations, indicate that this particular procedure is appropriate. Previous studies have also carried out Kao's criterion test (Deloof, 2003; Gill et al., 2010; Mathuva, 2010). An alternative methodological option for the same procedure would be to apply Pedroni (2004) criterion, which yields similar results. Both methods are based on Engle & Granger (1987) statistic. This particular statistic aims to prove whether the panel data used in the respective model have constant covariance over time.

## 5. Estimation Results

### 5.1. Descriptive Statistics

Table 1 presents the descriptive statistics of the variables investigated in the empirical part of the study.

Starting from the return on assets ratio (ROA) which is also the dependent variable, we observe that its mean value is positive (2.37). The companies show a standard deviation equal to 0.79 in terms of ROA and the maximum value is recorded by the company Karelia SA in 2015 with a value of 18.73. Accordingly, the minimum value of ROA index is found in the year 2017 by the company GE Dimitriou SA with a value of −19.35. Finally, the median of the profitability index is calculated to be 2.68. The mean value of the inventory conversion cycle (DINV) is 114.2 days with a standard deviation of 12.21 days among the firms in the sample. The median is 66 days. The maximum price is recorded by the Biocarpet SA company with a price of 566 days in the year 2018, while the minimum price is recorded by the REVOIL SA company with a price of 2.38 days, in the same year. For the average receivables collection period (DAR) the mean value is 74.25 days with a standard error of 4.82 days. The median is 59.93 days. The maximum value is recorded at 172.75 days at YALCO AE in 2015, while the minimum value is 5 days in 2015 by REVOILAE. The mean value of the average short term payment period (DAP) is 197.91 days and the median is 198 days. The standard deviation for this variable is 13.03 days. The minimum price is found in the year 2014 in the company ELINOIL SA with a price of 21 days, while the maximum price is recorded in the year 2015 by the company ALUMYL SA which is 561 days. The last variable is the cash conversion cycle (CCC). The mean value of this variable is calculated to be −9.46 and the median

−8.24. The standard deviation is 14.98. The maximum value in the cash conversion cycle is found in the company BIOCARPET SA in the year 2014, with a value of 425, while the minimum value was calculated to be −369.69 and is found in the year 2017, from the company AUTOHELLASAE.

Regarding the control variables, the mean value for the leverage variable is 0.89, a quite satisfactory value, given that it is an average of the companies. Accordingly, the current liquidity of all firms for all years is 1.71, indicating that liquidity is at a good level for our sample. We observe similar results for the mean value of the direct liquidity index, which is equal to 1.49. Business size shows a mean value of 18.2, demonstrating that we are dealing with businesses of great size and scope. Finally, the growth index has a mean value equal to 0.06, a positive value that is very close to zero, which means that there is a balance between positive and negative growth among firms. Our results are expected as they are also found in other studies (Mathuva, 2010; Raheman et al., 2010; Dong & Su, 2010).

Table 2 presents the mean value of the ROA index for each year of all companies and the mean value for the cash conversion cycle.

Table 1. Descriptive statistics.

|  | ROA | DINV | DAR | DAP | CCC | LEVERAGE | CR | ACR | SIZE | GROWTH |
|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 2.37 | 114.20 | 74.25 | 197.91 | −9.46 | 0.89 | 1.71 | 1.49 | 18.20 | 0.06 |
| Standard error | 0.79 | 12.21 | 4.82 | 13.03 | 14.98 | 0.07 | 0.16 | 0.24 | 0.22 | 0.02 |
| Median | 2.68 | 66.00 | 59.93 | 198.00 | −8.24 | 0.66 | 0.97 | 0.75 | 18.46 | 0.06 |
| Range | 38.08 | 563.67 | 167.75 | 540.00 | 794.69 | 3.69 | 7.10 | 21.78 | 9.22 | 1.37 |
| Minimum | 19.35 | 2.38 | 5.00 | 21.00 | −369.69 | 0.09 | 0.01 | 0.00 | 13.78 | −0.76 |
| Maximum | 18.73 | 566.05 | 172.75 | 561.00 | 425.00 | 3.78 | 7.11 | 21.78 | 23.00 | 0.61 |
| Count | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 |

Source: See Appendix A for data sources.

Table 2. Mean value of profitability and cash conversion cycle per year.

| Year | ROA% | CCC |
|---|---|---|
| 2014 | 2.25 | 2.64 |
| 2015 | 2.40 | −11.98 |
| 2016 | 2.35 | −11.64 |
| 2017 | 2.39 | −11.50 |
| 2018 | 2.43 | −14.85 |

Source: See Appendix A for data sources.

The highest mean value in the profitability index (ROA) is observed in year 2018 when the companies in our sample record an ROA index equal to 2.437. We notice that the lowest value of the money conversion cycle (CCC) is also in 2018, with a value equal to −14.85.

## 5.2. Diagnostic Tests

### 5.2.1. Correlation of Variables

Table 3 presents the correlations between the variables used resulting to first basic conclusions about the effects between the variables.

We observe a negative correlation between profitability and inventory conversion cycle (DINV), but also between average receivables collection period (DAR) and profitability. The above two results are considered as expected, since the same results are found in most of the literature. Respectively, the positive correlation that appears between ROA and the average duration of short-term liabilities (DAP) is expected. Finally, the relationship between working capital and profitability is negative, since the cash conversion cycle (CCC) has a negative effect on profitability, which is also confirmed by the relevant literature. Next, we examine the correlations between the control and dependent variables. More specifically, profitability and leverage have a negative correlation, since the existence of excessive external financing is expected to have a negative effect on the profitability of a company. Commenting on the indicators referring to the liquidity of the companies (CR and ACR) a positive correlation appears, a result that leads us to the conclusion that the amount of liquid assets held by the companies in the specific sample moves at satisfactory levels. Finally, the correlation of the profitability index with the company's size is positive, as well as the correlation between profitability and growth.

Table 3. Correlations between variables.

|  | ROA | DINV | DAR | DAP | CCC | LEVERAGE | CR | ACR | SIZE | GROWTH |
|---|---|---|---|---|---|---|---|---|---|---|
| ROA | 1 | | | | | | | | | |
| DINV | −0,079 | 1 | | | | | | | | |
| DAR | −0.253 | 0.409 | 1 | | | | | | | |
| DAP | 0.056 | 0.413 | 0.273 | 1 | | | | | | |
| CCC | −0.195 | 0.586 | 0.417 | −0.444 | 1 | | | | | |
| LEVERAGE | −0.852 | −0.138 | 0.162 | −0.186 | 0.101 | 1 | | | | |
| CR | 0.614 | 0.015 | 0.296 | −0.040 | 0.143 | −0.511 | 1 | | | |
| ACR | 0.464 | 0.032 | 0.117 | −0.025 | 0.086 | −0.353 | 0.646 | 1 | | |
| SIZE | 0.533 | −0.335 | −0.498 | −0.175 | −0.280 | −0.391 | 0.222 | 0.186 | 1 | |
| GROWTH | 0.511 | −0.178 | −0.362 | −0.046 | −0.221 | −0.508 | 0.048 | 0.023 | 0.530 | 1 |

Source: See Appendix A for data sources.

### 5.2.2. Cointegration Test

The results of the Kao-test for the first model (see Table B.1 in Appendix B) indicate that the p-value probability tends to zero. Therefore, the null hypothesis is rejected against the alternative and cointegration conditions are confirmed. So, we have sufficient evidence that there is a long-term equilibrium relationship between the variables of the model. The results of the Kao-test for the second model (see Table B.2 in Appendix B) indicate that there is a long-run equilibrium relationship between the variables since the null hypothesis is rejected. We notice that the probability value tends to zero, which leads us to conclude that we will accept the alternative hypothesis that refers to cointegration conditions between the variables. The results of the Kao-test for the third model (see Table B.3 in Appendix B) point out that for at least a 95% confidence level the null hypothesis is rejected. Therefore, since the hypothesis that there is no cointegration between the variables is rejected, we consider that the existence of a long-term equilibrium relationship between the variables is confirmed. The results of the Kao-test for the fourth model (see Table B.4 in Appendix B) lead to the conclusion that there are long-term equilibrium relationships between the variables. This is based on the rejection of the null hypothesis and the acceptance of the alternative, that is, the existence of cointegration conditions between the variables of the model. The results of the Kao-test for the fifth model (see Table B.5 in Appendix B) indicate that the value of the probability tends to zero, which leads us to the conclusion that the null hypothesis is rejected even for a 99% confidence level. Therefore, there is long-term equilibrium relation between the variables of the model.

### 5.2.3. Empirical Results of Research Models

In this section, we present the estimation results of the research models for the empirical analysis.

Table 4 presents the empirical results of the first model which focuses on the relationship between profitability and inventory conversion cycle.

Table 4 indicates that the inventory conversion cycle (DINV) has negative and statistically significant relationship with profitability (ROA). Furthermore, a positive relationship is observed between circulation liquidity (CR) and profitability, which is statistically significant even for a 1% level of significance. The size of the company and its growth has a corresponding positive and statistically significant relationship with profitability, at least for a 5% significance level. The above results are expected, since they are in line with the findings of the literature. Previous studies (Deloof, 2003; Lazaridis & Tryfonidis, 2006; Charitou et al., 2010; Raheman & Nasr, 2007; Enqvist et al., 2014) also conclude to negative relationship between inventory conversion cycle and profitability. However, studies (Gill et al., 2010; Sharma & Kumar, 2011) show a positive relationship. Leverage is not statistically significant, an evidence which agrees with Sharma and Kumar (2011). Direct liquidity (ACR) also appears a non-significant relationship with profitability being in agreement with results of Smith and Begemann (1997).

Table 4. Model 1 estimation results.

| Dependent variable: ROA | | | | |
|---|---|---|---|---|
| Method: Panel Least Squares | | | | |
| Variable | Coefficient | Std. Error | t-statistic | p-value |
| c | −6.642 | 4.505 | −1.474 | 0.144 |
| DINV | −0.027* | 0.006 | −3.938 | 0.000 |
| LEVERAGE | 0.357 | 0.300 | 1.188 | 0.238 |
| CR | 1.604* | 0.230 | 6.958 | 0.000 |
| ACR | −0.014 | 0.028 | −0.517 | 0.606 |
| SIZE | 0.492** | 0.234 | 2.100 | 0.039 |
| GROWTH | 1.883** | 0.781 | 2.408 | 0.018 |
| R-squared | 0.997 | Mean dependent var | | 2.368 |
| Adjusted R-squared | 0.9960 | S.D. dependent var | | 8.310 |
| S.E. of regression | 0.501 | Akaike info criterion | | 1.693 |
| F-statistic | 9.646 | Durbin-Watson stat | | 1.491 |
| Prob (F-statistic) | 0.000 | | | |

Note: *statistically significant at 1% significance level; **statistically significant at 5% significance level; Source: See Appendix A for data sources.

Table 5 presents the empirical results of the second model which focuses on the relationship between profitability and average collection period of short-term receivables (DAR).

The results in Table 5 confirm the expected negative and statistically significant relationship between the dependent variable (ROA) and the independent variable average collection period of short-term receivables (DAR). Previous studies (Deloof, 2003; Lazaridis & Tryfonidis, 2006; Charitou et al., 2010; Raheman & Nasr, 2007; Enqvist et al., 2014; Gill et al., 2010; Mathuva, 2010) have also pointed out that there is a negative relationship between the two specific variables. Instead, Sharma and Kumar (2011) claim that profitability is positively related to collection period of short-term receivables. The circulation liquidity appears to have a positive and quite strong relationship with profitability a 1% significance level. Profitability index is also positively related to the direct liquidity index. The relationship between profitability and firm size is also positive and statistically significant at a 10% level of significance. Finally, the effect of leverage on profitability is not significant, a result that agrees with the findings of Sharma & Kumar (2011).

Table 6 presents the empirical results of the third model which focuses on the relationship between profitability and the average repayment period of short-term liabilities (DAP).

Table 5. Model 2 estimation results.

| Dependent variable: ROA | | | | |
|---|---|---|---|---|
| Method: Panel Least Squares | | | | |
| Variable | Coefficient | Std. Error | t-statistic | p-value |
| c | −5.411 | 4.210 | −1.285 | 0.202 |
| DINV | −0.032* | 0.006 | −5.108 | 0.000 |
| LEVERAGE | 0.188 | 0.281 | 0.667 | 0.506 |
| CR | 1.602* | 0.218 | 7.345 | 0.000 |
| ACR | −0.072** | 0.028 | −2.497 | 0.014 |
| SIZE | 0.396*** | 0.224 | 1.770 | 0.080 |
| GROWTH | 3.113* | 0.810 | 3.840 | 0.000 |
| R-squared | 0.997 | Mean dependent var | | 2.368 |
| Adjusted R-squared | 0.996 | S.D. dependent var | | 8.310 |
| S.E. of regression | 0.474 | Akaike info criterion | | 1.586 |
| F-statistic | 1.074 | Durbin-Watson stat | | 1.092 |
| Prob (F-statistic) | 0.000 | | | |

Note: *statistically significant at 1% significance level; **statistically significant at 5% significance level; ***statistically significant at 10% significance level; Source: See Appendix A for data sources.

Table 6. Model 3 estimation results.

| Dependent variable: ROA | | | | |
|---|---|---|---|---|
| Method: Panel Least Squares | | | | |
| Variable | Coefficient | Std. Error | t-statistic | p-value |
| c | −1.616 | 4.088 | −3.955 | 0.000 |
| DINV | 0.012* | 0.003 | 3.382 | 0.001 |
| LEVERAGE | −0.170 | 0.320 | −0.532 | 0.595 |
| CR | 1.090* | 0.268 | 4.065 | 0.000 |
| ACR | −0.014 | 0.029 | −0.508 | 0.612 |
| SIZE | 0.791* | 0.226 | 3.494 | 0.000 |
| GROWTH | 0.134 | 0.853 | 0.157 | 0.874 |
| R-squared | 0.997 | Mean dependent var | | 2.368 |
| Adjusted R-squared | 0.996 | S.D. dependent var | | 8.310 |

Continued

| S.E. of regression | 0.512 | Akaike info criterion | 1.738 |
| F-statistic | 9.225 | Durbin-Watson stat | 1.344 |
| Prob (F-statistic) | 0.000 | | |

Note: *statistically significant at 1% significance level; Source: See Appendix A for data sources.

Table 6 points out that the relationship between profitability and the average repayment period of short-term liabilities is positive and statistically significant even at a 1% level of significance, a result that is expected based on previous literature. Previous studies (Mathuva, 2010; Dong & Su, 2010) agree with our findings. Instead, other studies (Deloof, 2003; Lazaridis & Tryfonidis, 2006; Charitou et al., 2010; Enqvist et al., 2014) conclude to a negative relationship. A significant effect on profitability is shown by circulation liquidity. The relationship between size and profitability is also statistically significant, with size having a positive effect on profitability. Finally, leverage does not appear to significantly affect the profitability index, which agree with Charitou et al. (2010). Growth is not also statistically significant, Sharma and Kumar (2011) also concludes to similar results.

Table 7 presents the empirical results of the fourth model which focuses on the relationship between profitability and cash conversion cycle (CCC).

Table 7 indicates that the variable of the cash conversion cycle, and therefore the working capital, is statistically significant and negatively related to the profitability of the companies. Other studies (Raheman & Nasr, 2007; Deloof, 2003; Lazaridis & Tryfonidis, 2006; Charitou et al., 2010; Enqvist et al., 2014) also find a negative relationship between the two specific variables. Instead, a positive relationship was observed in Gill et al. (2010) and Sharma and Kumar (2011). Circulation liquidity (CR) is statistically significant and it is positively related to business profitability. The size variable is also statistically significant at the 10% significance level showing a positive correlation with profitability.

Table 8 presents the fifth model's empirical results, which focuses on the relationship between profitability and the components of the Cash Conversion Cycle together.

Table 8 shows that the statistically significant variables are the average conversion period of inventories (DINV), the average conversion period of accounts receivable (DAR), the average conversion period of accounts payable (DAP), general liquidity (CR) and growth (GROWTH). More specifically, the variables DINV and DAR are negatively related to profitability. Instead, the variables DAP, CR and GROWTH have a positive relation with profitability. Leverage variable is not statistically significant. The relationships of the variables with the dependent are expected and confirmed by the literature review.

Table 7. Model 4 estimation results.

| Dependent variable: ROA | | | | |
|---|---|---|---|---|
| Method: Panel Least Squares | | | | |
| Variable | Coefficient | Std. Error | t-statistic | p-value |
| c | −5.578 | 3.422 | −1.629 | 0.107 |
| CCC | −0.018* | 0.002 | −8.064 | 0.000 |
| LEVERAGE | 0.221 | 0.245 | −0.902 | 0.369 |
| CR | 0.955* | 0.198 | 4.803 | 0.000 |
| ACR | −0.035 | 0.023 | −1.542 | 0.126 |
| SIZE | 0.347*** | 0.187 | 1.853 | 0.067 |
| GROWTH | 1.011 | 0.620 | 1.629 | 0.107 |
| R-squared | 0.998 | Mean dependent var | | 2.368 |
| Adjusted R-squared | 0.997 | S.D. dependent var | | 8.310 |
| S.E. of regression | 0.405 | Akaike info criterion | | 1.268 |
| F-statistic | 1.476 | Durbin-Watson stat | | 1.685 |
| Prob (F-statistic) | 0.000 | | | |

Note: *statistically significant at 1% significance level; ***statistically significant at 10% significance level; Source: See Appendix A for data sources.

Table 8. Model 5 estimation results.

| Dependent variable: ROA | | | | |
|---|---|---|---|---|
| Method: Panel Least Squares | | | | |
| Variable | Coefficient | Std. Error | t-statistic | p-value |
| c | −1.580 | 3.714 | −0.425 | 0.671 |
| DINV | −0.025* | 0.005 | −4.341 | 0.000 |
| DAR | −0.024* | 0.005 | −4.273 | 0.000 |
| DAP | 0.014* | 0.002 | 5.124 | 0.000 |
| LEVERAGE | −0.061 | 0.248 | −0.247 | 0.805 |
| CR | 1.128* | 0.207 | 5.433 | 0.000 |
| ACR | −0.044*** | 0.024 | −1.808 | 0.074 |
| SIZE | 0.209 | 0,191 | 1.093 | 0.277 |
| GROWTH | 1.828** | 0.726 | 2.515 | 0.014 |

Continued

| | | | |
|---|---|---|---|
| R-squared | 0.998 | Mean dependent var | 2.368 |
| Adjusted R-squared | 0.997 | S.D. dependent var | 8.310 |
| S.E. of regression | 0.395 | Akaike info criterion | 1.229 |
| F-statistic | 1.459 | Durbin-Watson stat | 1.728 |
| Prob (F-statistic) | 0.000 | | |

Note: *statistically significant at 1% significance level; **statistically significant at 5% significance level; ***statistically significant at 10% significance level; Source: See Appendix A for data sources.

### 5.4. Control Variables Analysis

We briefly discuss the relationship of the control variables with the dependent variable. Initially, leverage, in all estimated models, is presented as statistically non-significant. Sharma and Kumar (2011) claim that leverage is statistically non-significant, confirming the findings of our own analysis. However, other studies (Gill et al., 2010; Lazaridis & Tryfonidis, 2006; Charitou et al., 2010; Mathuva, 2010) ascertain that leverage appears a negative and significant effect on profitability.

Liquidity in our models is divided into the circulation liquidity ratio (CR) and the immediate-direct liquidity ratio (ACR). In all models, the circulation liquidity ratio liquidity appears to have a positive and statistically significant effect on profitability. This relationship is confirmed in the studies of Haq et al. (2011) and Alipour (2011). On the contrary, we observe a negative relationship in the study by Raheman and Nasr (2007). The relationship between direct liquidity and profitability is estimated to be positive. This evidence is also found in the studies of Smith and Begemann (1997) and Haq et al. (2011).

The next control variable used is the company's size, which is given by the natural logarithm of sales. We observe that the size of the business is positively related to profitability, since as the size increases, so does profitability. However, in the last fifth estimated model, this variable appeared not to affect profitability significantly. A positive and significant relationship between the size of the company and profitability is also pointed to previous studies (Deloof 2003; Mathuva, 2010; Lazaridis & Tryfonidis, 2006; Raheman & Nasr, 2007). However, other studies (Charitou et al., 2010; Gill et al., 2010) claim that there is non-significant relationship between size and profitability.

The last control variable used is the growth variable. Growth in the estimated models appears to have a statistically significant and positive effect on profitability—as expected—but in one case it is marginally statistically non-significant. This positive relationship is also found in the studies of Deloof (2003) and Raheman and Nasr (2007).

## 6. Conclusion

In the context of this study, an attempt is made to analyze the effect of working capital on the profitability of businesses investigating companies that are active in the commercial sector and are all public companies, listed on the Athens Stock Exchange. The analyzed period covers the years 2014-2018, indicating the economic crisis period in the Greek economy and the adverse economic conditions of the memoranda policies and fiscal austerity, which significantly affected the business sector. The results of our analysis do not differ from those of the relevant literature, demonstrating that commercial enterprises did not face particular changes in the relationship between profitability and the management of working capital, which indicates the implementation of correct and effective management even in adverse economic environment. A result that was not expected, although similar conclusions are found in the literature, is the non-significant relationship between the leverage ratio and profitability that needs further research. This evidence may due to particularities of the data selected in this study such as the precarious financial environment of Greek economy.

Even though the empirical analysis of this research study has focused on the sample selection of 22 companies that are activated in the commercial sector and are characterized as commercials for the years 2014-2018, the size of the research sample may be considered relatively small, since the research samples, as well as the investigated time period, are short. Furthermore, the sample selection excludes companies not listed on the stock exchange since the financial data they publish may be manipulated to some extent mainly for tax reasons. Thereafter, we may be cautious to some extent about the conclusions of this study. We consider that the present study may be repeated in the future, considering a greater sample of commercial sector firm by extending the investigated period in order to compare the results in periods before and after the economic crisis in the Greek economy.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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# Appendix A

## Data sources

Data were retrieved from the official website of the Athens Stock Exchange (https://www.athexgroup.gr/) ("Athens Exchange Group-athexgroup.gr").

A series of data used in this analysis also came from the sectoral study of the company ICAP which analyzes extensively the sector of trading oil and its derivatives sector in Greece for the years 2014-2018.

**Table A.1.** The sample companies and their industrial sector.

| Industrial sectors | Companies |
| --- | --- |
| Trade | DOUROS S.A., G.E. DIMITRIOU, SATE A.E., AUTOHELLAS S.A., ASCOMPANY S.A., JUMBO S.A., B & F S.A., YALCO S.A., ELTRAK S.A. |
| Industrial products | PLASTIKA OF CRETE S.A. |
| Technology | MLS COMPUTING S.A., BYTE COMPUTER S.A., PLAISIO COMPUTERS S.A. |
| Personal and home goods | HOUSEMARKET S.A., BIOCARPET S.A. |
| Constructions | ALOUMIL S.A. |
| Oil and Gas energy | ELPE S.A., CORAL S.A., REVOIL S.A.,ELINOIL S.A., MOTOR OIL S.A. |
| Food | KARELIA S.A. |

Note: All the companies in the table have as their main activity, commercial activity, despite their participation in more sectors of the economy.

# Appendix B

Kao Residual Cointegration Test

Series: ROA DINV LEVERAGE CR ACR SIZE GROWTH

Sample: 2014 2018

Included observations: 110

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

User-specified lag length: 1

Newey-West automatic b and width selection and Bartlett kernel

Table B.1. Kao-test results for the first model.

|  | t-Statistic | Prob. |
| --- | --- | --- |
| ADF | −2.998 | 0.001 |
| Residual variance | 0.259 |  |
| HAC variance | 0.249 |  |

Kao Residual Cointegration Test

Series: ROA DAR LEVERAGE CR ACR SIZE GROWTH

Sample: 2014 2018

Included observations: 110

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

User-specified lag length: 1

Newey-West automatic b and width selection and Bartlett kernel

Table B.2. Kao-test results for the second model.

|  | t-Statistic | Prob. |
| --- | --- | --- |
| ADF | −3.276 | 0 |
| Residual variance | 0.196 |  |
| HAC variance | 0.245 |  |

Kao Residual Cointegration Test

Series: ROA DAP LEVERAGE CRA CR SIZE GROWTH

Sample: 2014 2018

Included observations: 110

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

User-specified lag length: 1

Newey-West automatic b and width selection and Bartlett kernel

**Table B.3.** Kao-test results for the third model.

|  | t-Statistic | Prob. |
| --- | --- | --- |
| ADF | −2.259 | 0.011 |
| Residual variance | 0.262 |  |
| HAC variance | 0.242 |  |

Kao Residual Cointegration Test

Series: ROA CCC LEVERAGE CR ACR SIZE GROWTH

Sample: 2014 2018

Included observations: 110

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

User-specified lag length: 1

Newey-West automatic b and width selection and Bartlett kernel

**Table B.4.** Kao-test results for the fourth model.

|  | t-Statistic | Prob. |
| --- | --- | --- |
| ADF | −2.838 | 0.002 |
| Residual variance | 0.212 |  |
| HAC variance | 0.188 |  |

Kao Residual Cointegration Test

Series: ROA DINV DAR DAP LEVERAGE CR ACR SIZE GROWTH

Sample: 2014 2018

Included observations: 110

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

User-specified laglength: 1

Newey-West automatic b and width selection and Bartlett kernel

**Table B.5.** Kao-test results for the fifth model.

|  | t-Statistic | Prob. |
| --- | --- | --- |
| ADF | −3.936 | 0 |
| Residual variance | 0.186 |  |
| HAC variance | 0.183 |  |