THE IMPACT OF WORKING CAPITAL ON THE PROFITABILITY AND LIQUIDITY RISK OF GREEK COMPANIES

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Abstract

The main purpose of this paper is to investigate whether working capital management (WCM) has a significant impact on the profitability of small and medium-sized enterprises (SMEs). This study intends to contribute to the existing literature by examining further whether there is a linear and a no-linear relationship (concave) between WCM and the profitability of Greek SMEs and by focusing on the economic crisis period that has a significant effect on the financial data of the Greek SMEs. The sample consists of 101 Greek SMEs from various industries (e.g., consumer goods, industrials, and healthcare) for the period between 2014 and 2020. The results led to the conclusion that the fixed effects model was appropriate for our data. Regarding the utilized indicators, the cash conversion cycle (CCC) is used as a proper indicator for the WCM while return on asset (ROA), return on equity (ROE), and return on capital employed (ROCE) are considered for profitability. Furthermore, this paper innovates, since each working capital factor was examined separately to identify to what extent they can affect profitability indicators on a stand-alone basis. According to the empirical results considering ROA there exists a concave relationship between profitability and WCM.

Keywords: Working Capital Management, Cash Conversion Cycle, Return on Assets, Concave Relationship, Profitability, Panel Data, Hausman Test

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1. INTRODUCTION

The recent experience (i.e., the financial crisis of 2008, the COVID-19 pandemic, and geopolitical turmoil by the invasion of Russia into Ukraine) showed that the economic environment cannot be always stable and robust. In that time of stress, it is a sheer necessity for companies to stay resilient by having the necessary funds available to survive. In small countries such as Greece, where access to capital markets is quite limited, this need is even more critical. Furthermore, it is a fact that the operating conditions of modern business are shaped under the influence of a strongly changing

economic environment. Under these conditions, the enterprises are obliged to demonstrate not only an immediate adaption to the environment but also a high degree of efficiency.

The frequent global economic slowdowns of the last decades highlight the paramount importance of effective working capital management (WCM) by companies around the world. This is because, during a crisis, low sales and high pressures on pricing are almost inevitable. By having effective working capital management, a company can handle the negative consequences of such difficulties and manage to survive even in a stressed environment where other peers are going to fail. The significance of the working capital for a company has been noted by various authors in the respective literature. For Sharma (2009), working capital is considered as one of the most crucial measures of a company's financial strength. According to Smith (1980), effective working capital management is important for the profitability and ultimately for the value of the company.

According to the "Pressure on the Production Line" report, published by the PwC in 2018, industrial companies worldwide lose valuable sources of cash mainly due to inefficient working capital management; cash that could be used to boost their growth and innovation activities. The same study indicates that the most suitable management focuses on debt collection and inventory management discipline. This could provide the necessary cash for investment in the manufacturing industry. In conclusion, industrial enterprises in 2017 could have released up to $177 billion in cash by improving their working capital management while it is pointed to a continuous slowdown in the recovery of trade receivables, with the average collection period being at the highest levels of five years.

Having a high level of working capital means the significant resources of the company remain idle rather than be used in other ways of investment which may provide higher profits. We should also take into account an additional risk that emerged by having a high level of working capital; we cannot preclude the possibility of inventory being damaged or even completely ruined. It is also highly possible that trade receivables will not be paid by the company's counterparts. On the other hand, having a minimum investment in working capital exposes a company to a material liquidity risk. In particular, a lack of liquidity may lead the company to default on its payments to its creditors for current liabilities that have become due. To achieve optimal working capital management is of crucial importance and a company must consider a lot of parameters. Nazir and Afza (2009) highlighted the necessity for companies to deeply understand the role and importance of working capital.

This paper aims to contribute to this direction and investigates effective working capital management for a number of small and medium-sized enterprises (SMEs) located in Greece. For this purpose, we apply recently introduced statistical methods that examine whether a concave (non-linear) relationship between profitability and working capital management exists. It is true that so far, a large portion of the researchers in the relevant literature has revealed a linear correlation between working capital and profitability. The purpose of this study is to examine, beyond the linear relationship, if indeed there is an optimal level of working capital that firms should stack to to maximize their profitability. If this is true, we expect that any working capital levels below or above this ideal point will cause decreased profitability. So, this study aspires to contribute to the existing literature about the impact working capital management may have on the profitability of a company. The main research questions of this paper, by examining the effect of working capital management on profitability and relevant risks, are:

RQ1: Is there a negative and linear relationship between the cash conversion cycle (CCC) and the company's profitability?

RQ2: Is there an optimal level of cash conversion cycle (CCC) that maximizes a company's profitability due to a non-linear (concave) relationship between them?

The rest of the paper is structured as follows. Section 2 presents several past studies to elaborate the literature review section and reveal the international experience on the issue of working capital, profitability, and risks that can arise from working capital management. Section 3 describes the selected methodology and the employed quantitative variables. The empirical results are tabulated and discussed analytically in Section 4. Section 5 concludes this paper.

2. LITERATURE REVIEW

The working capital of a company refers to the amount that is readily available to finance its daily operations. It could be diversified into net working capital and gross working capital. The first is defined in the relevant literature as the arithmetic difference between the current assets and the current liabilities on the balance sheet of an entity (Sagner, 2010). On the other hand, the gross working capital definition refers solely to the current assets (Sharma, 2009). Net working capital measures the operating efficiency, the short-term financial health of a company, and the liquidity. In a healthy one, this metric is expected to be positive, indicating that the firm has enough cash for its rapid growth when opportunities occur or for fully covering its obligations in the case of unforeseen expenses.

Working capital management is a process that an entity follows to determine a certain amount of working capital needed to withhold, to have sufficient cash flows for eliminating the risk of financial obligations nonfulfillment, and for avoiding excessive investment in current assets. The main goal of working capital management is to maintain an excellent mix among the elements that make up working capital (Filbeck & Krunger, 2005), while effective management is a fundamental part of the financial strategy of companies to maximize the wealth of their shareholders (Nazir & Afza, 2009). For that reason, companies strive to maintain an excellent level of working capital to maximize their value (Deloof, 2003) to be as profitable as possible, and to have a good long-term perspective (Richards & Laughlin, 1980).

There are two alternative strategies that a firm can adopt to perform working capital management. the first is the conservative management and the second is the aggressive management. The difference between these two strategies is how they use the sources of financing. According to the conservative strategy, the management of the company should maintain a significant amount of capital placed on liquid assets (Awopetu, 2012). With aggressive management on the other hand, the company maintains just some small amounts of current assets available to be able to pay its current liabilities when they have become due (Al Shubiri, 2011).

The analysis of both conservative and aggressive policies, concludes that there is a trade-off relationship between risk and return, which results from investing in current assets. It is up to each manager to decide which approach suits better to his/her company at a certain point in time, and these decisions are an important element of working capital management. Therefore, the overall management of the working capital elements should aim to reach an optimum level where the marginal cost will be equal to the marginal income, balancing liquidity with efficiency. In other words, the ultimate goal of working capital management is to achieve a balance between profit (profitability) and risk (liquidity) that contributes positively to the value of the business. The ratios used more frequently to understand working capital management are cash conversion cycle, average payment period, inventory turnover ratio, current ratio, and net working capital turnover (Kusuma & Dhiyaullatief Bachtiar, 2018, Balios et al., 2024). The traditional liquidity measures used to assess the solvency of enterprises are the current ratio and the quick ratio (acid ratio).

By reviewing the relevant literature, someone can notice that multidisciplinary researchers have associated with the topic in the past. A quite common conclusion reached in almost all of this research is the fact that working capital management has an impact on the profitability of a company. Dozens of researches, performed in recent years, have concluded the same outcome; business profitability is negatively correlated with the duration of the cash conversion cycle. The use of the aggressive working capital management strategy is justified by these conclusions because when this approach is followed business performance is positively affected. On the other hand, there are also various studies that support the use of the conservative strategy instead (Akgun & Memis Karatas, 2020). Consequently, there is a massive debate in the literature on whether it is preferable to have a high or a low amount of cash committed in working capital (Afrifa & Padachi, 2016). Many of these studies have been focused on testing the relationship, particularly for large companies and non-financial firms.

According to Richards and Laughlin (1980), working capital management occupies the major portion of a manager's attention and time. To achieve optimal working capital management a company must consider a lot of parameters. Considerations such as how to manage cash, reduce the amount of accounts receivables, and improve the amount of accounts payables (Sagner, 2014, Balios et al., 2024). Nazir and Afza (2009) found that the optimal level of working capital is the point at which a balance is achieved between risk and effectiveness. The working capital needs of a company are primarily affected by the type of its activity (i.e. industry) and the way it operates.

Garcia-Teruel and Martinez-Solano (2007) revealed with their research that the shortening of the cash conversion cycle improves the profitability of the firm. Specifically, the analysis concluded that there is a significant negative relation between the number of days of accounts receivables and days of inventory and the enterprise profitability. To prove this, they used return on asset (ROA) as the dependent variable and cash conversion cycle as the independent variable. The authors conducted their research leverage on data collected from 8,872 SMEs in Spain for the period from 1996 to 2002. The panel data method was used and robust tests were applied to address the possible presence of endogeneity problems.

Deloof (2003) has conducted similar research using data gathered from a sample of 1,009 Belgian large and non-financial firms for the period between 1992 to 1996. The author used the cash conversion cycle to estimate working capital management and gross operating income to measure profitability. The results suggest that firms can increase corporate profitability by decreasing the number of accounts receivable days. The relationship was found to be negative between the components of working capital (i.e., accounts receivable days, inventories, and accounts payables) and gross operating income.

In the recent literature, the cash conversion cycle has been extensively used as a proper predictor of firm profitability and value (Ebben & Johnson, 2011, Balios et al., 2024) and its popularity has increased. Gallinger (1997) urges companies to abandon traditional liquidity ratios, which are static, and to use instead the cash conversion cycle, which is a dynamic measure of liquidity, as it looks at corporate cash flows over time.

Lazaridis and Tryfonidis (2006) conducted research based on a sample of 131 companies listed in the Athens Stock Exchange (ASE) for the period from 2001 to 2004. The investigation showed that there is a statistically significant relationship between profitability and working capital management. The gross operating profit was selected to measure the profitability and the cash conversion cycle was used as a measure of working capital management. The authors used regression analysis to find the effect of working capital management on the company's profitability. The regression analysis disclosed a negative relationship between the cash conversion cycle and profitability and between gross operating profit and accounts payable.

Baños-Caballero et al. (2012) studied the relationship of profitability and working capital management in SMEs. The novelty that they added was the additional utilization of a non-linear relationship between the aforementioned variables. The results of their investigation demonstrated that there was a non-monotonic relationship between profitability and working capital level. Similarly, to vast majority of relevant research used the cash conversion cycle to gauge working capital management and Gross operating Income to gauge

profitability. Their research included panel data of 1,008 SMEs positioned in Spain. The estimation method was preferred to avoid problems of possible endogeneity and heterogeneity.

Nobanee et al. (2011) also inferred a negative relationship between the cash conversion cycle and a firm's profitability. Their research was based on a sample of Japanese firms' data ranging from 1990 to 2004. They focused on Japanese firms which are differentiated from the USA firms due to their different organizational structure. Thus, they have introduced to the modern literature the analysis of the relation of working capital to profitability based on the Japanese experience. Once again, the cash conversion cycle was implemented to measure the efficiency of the working capital management.

Afrifa and Padachi (2016) conducted similar research using regression analysis on data gathered from 160 SMEs listed on the alternative investment market. They proved that there is a concave relationship between working capital level and profitability and that there exists an optimal level of working capital that maximizes the firm's profitability. Any deviations in the amount of working capital below or above this optimal level will result in a reduction in profitability. The authors used the return on asset ratio to measure profitability and the cash conversion cycle to indicate working capital.

Pais and Gama (2015) employed a sample of 6,063 small to medium-sized Portuguese companies to examine the effect that working capital management has on firm profitability. The data gathered was for the period from 2002 to 2009 and the used method was panel regressions and instrumental variables. The results of the research implied that a decrease in the inventory, in the number of days that it is needed to pay off liabilities and to collect receivables will lead to an increase in profitability. The authors used return on asset as the dependent variable and the number of days accounts receivable, the number of days accounts payable, the number of days of inventory, and the cash conversion cycle were employed as exogenous variables.

Samiloglu and Akgun's (2016) analysis revealed that there is a negative relationship between the cash conversion cycle and net profit margin. Multiple linear regression models were chosen to find out the effect of working capital management on the firm performance. The determinants used to gauge the profitability of a firm were the return on asset, return on equity, operating profit margin, and net profit margin. Indicators of working capital used were the accountant receivable period, inventory conversion period, accountant payable period, and cash conversion cycle.

Cumbie (2016) selected 140 firms and examined if there is a curvilinear relationship between accounts receivable, accounts payable, and inventory days and the firm value. The results of the study indicated that there was a statistically significant relationship to the firm value. The study added to the existing literature by examining the components of working capital and how they are related to the firm value. The author used a polynomial regression to prove their theory. The author also performed regression analysis to find the relationship between the cash conversion cycle and the firm value. The analysis showed that there is a maximizing point and increasing or decreasing the cash conversion cycle above or below this point, does not increase the value of the firm.

Kusuma and Dhiyaullatief Bachtiar (2018) deal with the same issue gathering data from firms listed in the Indonesian stock exchange. Their research was focused on the manufacturing sector of Indonesia. The originality that they introduced was the usage and comparison of five measures of working capital: current ratio, net working capital turnover, inventory turnover ratio, average payment period, and cash conversion cycle. Furthermore, they tried to find the best proxy for working capital. Their results disclosed a significant relationship between working capital and performance, and that a low cash conversion cycle improves performance. Moreover, concluded that inventory turnover as a measurement of working capital is the best proxy to explain the firm's performance.

Balios et al. (2024) investigated the relationship between working capital and profitability for companies listed on the ASE in the commercial sector, for the years 2014–2018 economic crisis period. They found that the inventory conversion cycle, the average collection period of short-term receivables, and the cash conversion cycle variables had a negative and statistically significant relationship with profitability. Whereas profitability was positively related with the average repayment period of short-term liabilities, circulation liquidity, direct liquidity, and the size of the company and its growth.

In conclusion, most of the above studies have proven that there is a negative relationship between various measures of working capital and profitability which indicates that companies can increase their profitability when reducing the working capital levels. However, the traditional liquidity measures used by many studies are static and do not consider the deferral of the company's receipts and payments, the quality of the assets' turnover, as well as the degree of liquidity of these assets. Also, they are not able to assess the return on investment in turnover.

Recently, some studies have investigated the probability of a non-linear (concave) relationship between the aforementioned variables. Those studies have introduced the risk of loss in the sales figure and interruptions of the production process due to low levels of investment in working capital. This more recent method supports the hypothesis that there is a certain optimal level of working capital that maximizes profitability and any levels below or above this threshold will reduce it. They have also presented evidence to support that there is a relationship (concave) between profitability and working capital management.

3. DATA AND METHODOLOGY

3.1. Data collection

This study is focused on SMEs located in Greece. This is decided taking into account the magnitude of SMEs in the Greek and the European economy. In particular, according to the SME performance review of the European Commission (EC) for the year 2021, SMEs in Greece were 718,558 accounting for 99.99% of the total market. At the same time, large enterprises represent only 0.01% of the total market.

In the European Union (EU) as a whole, this ratio does not change a lot. The percentage of SMEs in the total population in the EU is 99%. It is obvious from that data that in the EU and especially in Greece SMEs play the most important role in shaping economic development.

SMEs are defined following the Commission Recommendation of 6 May 2003 on the official website of the EU. SMEs are defined as firms that 1) occupy less than 250 persons, 2) have an annual turnover of not more than 50 million euros, or have total assets that do not exceed the threshold of 43 million euros. Specifically, small enterprises are firms with less than 50 employees and their annual turnover and/or annual total assets do not exceed the threshold of 10 million euros (European Commission, 2003).

The firms that have been included in the sample of this investigation, were mainly found in the 14th edition issued by ICAP SA "Business Leaders in Greece". From the total 500 companies covered in the issue, only firms that met the criteria of SMEs were selected. Since the information for the number of employees, the annual turnover, and the annual total assets is not available in the said database, a case-by-case review of the published financial statements of these companies has been performed to identify the SME ones.

Furthermore, for this analysis, certain categories of firms were omitted from the sample due to the nature of their activity. Specifically, firms that are classified as financial and banking institutions, as well as real estate and insurance firms have been excluded from the sample since different accounting requirements apply to these industries compared to the typical industrial or commercial firms. If these types of companies were included in the sample, the financial figures would not be comparable and thus the quality of the data would be questionable. These exclusions were in line with previous studies performed by Afrifa and Padachi (2016), Deloof (2003), and Baños-Caballero et al. (2010, 2012).

Finally, our data from SMEs in the Greek economy covers seven years from 2014 to 2019, and a total of 705 observations have been obtained.

3.2. Variables

The dependent variable that is used to evaluate profitability is return on asset (*ROA*). In the relevant literature, ROA is the most frequently used variable to estimate the profitability of a firm (Tauringana & Afrifa, 2013). In addition, two other dependent variables will be used to measure profitability, this is return on equity (*ROE*) and return on capital employed (*ROCE*).

ROA: The return on assets is defined as the amount of net income divided by total assets:

$$ROA = \frac{Net\ income}{Total\ assets} \quad (1)$$

ROA measures the ability of the management of a company to utilize its resources to generate profits. ROA should be as high as possible because this means that the company makes more money with less investment.

ROE: The return on equity is defined as the amount of Net Income divided by shareholders' equity:

$$ROE = \frac{Net\ income}{Shareholders\ equity} \quad (2)$$

It is an alternative indicator to estimate the effectiveness of a company. ROE should be again as high as possible since this measure indicates how much profit can be produced using the available resources invested by its shareholders (share capital) and its reserves.

ROCE: The return on capital employed is a financial ratio and is calculated by dividing EBIT by capital employed. Capital employed is total assets minus current liabilities:

$$ROCE = \frac{EBIT}{Capital\ employed} \quad (3)$$

In this study, we use the cash conversion cycle and its components, which are *accounts receivable days*, *days sales of inventory*, and *accounts payable days*, as representative measures for working capital management.

The cash conversion cycle considers the time it takes the company to sell its inventory plus the time it takes to collect receivables minus the time it takes to pay its payables. The speed at which the management team of a company processes inventory to products and sales, and sales to cash is very important for the business's success.

Accounts payable days refer to the average number of days that a company takes to pay its suppliers:

$$Accounts\ payable\ days = \frac{Accounts\ payable}{COGS} * 365 \quad (4)$$

Accounts payable days show us how many days the company pays its short-term creditors. If the payback period of the short-term liabilities is longer than the collection time of the receivables, then the company has created an effective source of financing:

$$Accounts\ receivable\ days = \frac{Accounts\ receivables}{COGS} * 365 \quad (5)$$

Accounts receivable days show us how many days from the moment of sale the company is expected to collect its receivables. The shorter the time, the higher the collection speed, so the shorter the time to commit funds, the better the position of the firm, and the less likely to suffer losses from bad debts:

$$Days\ sales\ of\ inventory = \frac{Average\ inventory}{COGS} * 365 \quad (6)$$

Day sales of inventory measure how many days the inventory lies in wait in the company from the time of purchase to the time of sale. In industrial enterprises, the cycle lasts more days from the purchase to the sale of the stocks. The shorter the inventory time in the warehouse and provided that no forced liquidation takes place, the higher the degree of liquidity of the company.

COGS is the cost of goods sold.

The age of the company, the firm's size, financial leverage ratio, short-term financing, and industry classification are the control variables that will be included in all regressions. These variables have been proven by the recent literature to define the firm's profitability. The company age is the number of years between the end of each accounting year and the incorporation of the company while size is the sales natural logarithm used to express the size of each business. The leverage represents the financial ratio of debt which is the quotient of total debt to capital at the end of the fiscal year and the short-term financing is estimated by the ratio of current liabilities divided by total assets at the end of the fiscal year. For industry classification, we implement a dummy for the industries included in our research. The industry classification in this paper is according to the Industry Classification Benchmark (ICB) Code which is worldwide recognized. The ICB was developed by Dow Jones and the FTSE. The main categories which are included in this paper are basic materials, industrials, consumer goods, healthcare, consumer services, telecommunications, utilities, and technology.

Figure 1. Companies' sector composition

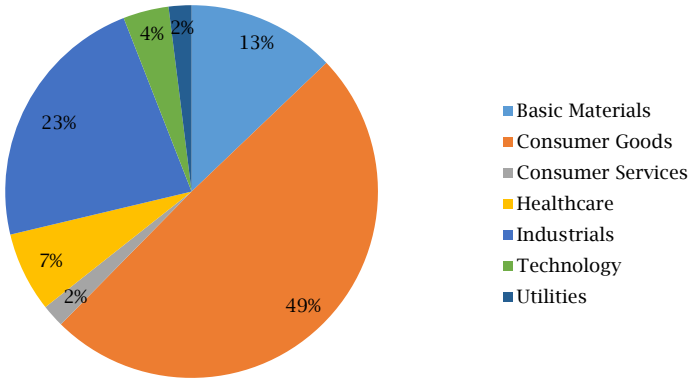

Table 1. Descriptive statistics

Variable	*Mean*	*Median*	*Std. Deviation*	*Minimum*	*Maximum*	*10th perc.*	*90th perc.*
CCC	128.7199	120.8904	110.2705	-329.6612	756.1013	8.6296	255.1249
ROA	0.0466	0.0516	0.1700	-3.7509	0.5069	-0.0218	0.1470
ROE	0.1350	0.1123	1.0349	-8.4567	23.4279	-0.0166	0.3097
ROCE	0.1692	0.1421	0.5323	-4.5031	11.9428	0.0196	0.3300
LEV	0.9732	0.4169	6.9448	-115.3832	96.1211	0.0000	2.0525
DSI	108.6176	84.3512	102.0215	0.9462	867.0030	23.4260	214.4483
DSO	113.9852	106.4219	65.8548	2.0995	466.3627	43.3060	185.6246
DPO	93.8829	71.0568	74.0647	0.1016	468.1880	24.5392	189.4357
SFIN	0.4133	0.3486	0.4854	0.0277	7.7448	0.1163	0.6515
CSIZE	16.5383	16.9453	1.7548	7.4207	18.2628	15.5393	17.5953
CAGE	36.41	33.00	19.10	5.00	93.00	15.00	62.20

Table 1 shows the descriptive statistics for the period from 2014 to 2020. The descriptive statistics measures presented are mean, median, standard deviation, minimum and maximum value, 10th percentile, and 90th percentile. *CSIZE* is the size of the company and is the logarithm of sales. *SFIN* is short-term financing calculated as current liabilities divided by total assets. *LEV* is financial leverage calculated by dividing total debt by capital at the end of the year. *CAGE* is the age of the company since incorporation. *CCC* is the cash conversion cycle and is measured in days. *ROA*, *ROE*, and *ROCE* are dependent variables. *DSI* is days of inventory and is calculated by (inventory / cost of sales) * 365. *DSO* is days sales outstanding and is calculated by (accounts receivable / sales) * 365 whereas *DPO* is days payables outstanding and is calculated by (accounts payable / cost of sales) * 365.

As can be seen in Table 1, *CCC*'s mean value is almost 128 days. Furthermore, *CCC* takes a minimum rate of minus 329 days and a maximum of 756 days. The average rate discloses a long *CCC*, which means that it takes Greek SMEs a long time to generate cash, 128 days. The management of the companies is not enough efficient in converting inventory into sales. This inefficiency can lead, especially for small companies, like those in our sample, to insolvency. The average *CCC* days calculated in this study are longer compared to *CCC* days in other studies such as Afrifa and Padachi (2016) where the mean figure of *CCC* was 62.40 days. A shorter *CCC* means that the company is a healthier one. *DPO* is almost 94 days which means that it takes companies on

average 94 days to pay back their bills and invoices to their suppliers. *DSO* is 114 days signifying that it takes a company 114 days to collect payment after a sale. Generally, *DSO* beyond 45 days is considered to be low, thus it takes Greek companies a long time to collect money after the sale. *DSI* is 109 and is considered quite long, while smaller values of the ratio are preferred. Small values indicated that it takes the company less time to sell its inventory.

ROA is on average 4.66 percent with a median of 5.16 percent and *ROE* is on average 13.5 percent and has a median of 11.23 percent. While *ROCE* has a mean of 16.92 percent and a median of 14.21 percent. This outcome shows us that *ROA* is at low levels. Due to differences in the outcomes of the different measures of profitability, it is important to include all of them (*ROA*, *ROE*, and *ROCE*) in our research (Afrifa & Padachi, 2016). The average firm age is 36.41. *LEV* is 0.97 and *SFIN* is 0.41. The level of financial leverage is quite high which means that companies are funded more by debt than equity. A higher leverage ratio means that the company is at a bigger risk.

Table 2. Variables' mean by industry

Industry	*ROA*	*ROE*	*ROCE*	*LEV*	*DSI*	*DSO*	*DPO*	*CCC*	*SFIN*	*CSIZE*	*CAGE*
Basic materials	0.09	0.19	0.27	0.66	85.17	104.27	55.34	134.10	0.40	15.45	35.77
Consumer goods	0.02	0.09	0.20	0.95	106.36	101.86	83.23	124.99	0.53	16.58	30.54
Consumer services	0.02	-0.18	0.01	1.79	59.14	106.41	250.75	-85.20	0.51	16.35	45.00
Health care	0.02	0.26	-0.47	0.38	142.57	211.47	173.43	180.61	0.49	16.80	40.29
Industrials	0.06	0.12	0.18	0.47	117.41	106.63	69.21	154.84	0.33	16.30	33.52
Technology	0.00	0.02	0.10	1.13	36.01	199.47	96.95	138.53	0.56	16.52	25.25
Utilities	0.07	0.13	0.17	0.30	30.85	106.46	96.42	40.88	0.29	16.79	28.00
Total	0.05	0.13	0.17	0.97	108.62	113.99	93.88	128.72	0.41	16.54	36.41

Table 2 gives the averages of the variables included in our equation for each sector. *CCC* is negative in the consumer services sector. A negative *CCC* indicates that the working capital has become a source of cash for the firms in this sector. Utilities is the next sector with the lower *CCC* measured in days. However, all the other sectors present an average *CCC* above 100 days. Basic materials, utilities, and the industrial sector seem to have the highest average *ROA*. The average *ROE* in the consumer sector is negative which indicates that on average the companies in this sector report losses.

LEV in the consumer services industry is above 1, which means that for every euro in equity, the companies on average have 1.79 percent of leverage. The smaller price in the leverage ratio seems to belong to the utility sector. However, the sample includes only two companies, therefore safe conclusions can not be drawn. The average age of the companies in the sample is between 25 years to 45 years. The consumer services companies are the oldest and the technology companies are the youngest. As expected for the technology sector, as the technology companies have made a recent appearance in Greece.

3.3. Research hypotheses and methodology

This research paper examines the effect of working capital management on profitability. Considering, the results from previous studies and empirical evidence that reveal a linear relationship between working capital management and profitability, this study will investigate eight hypotheses. At first, the hypotheses are tested for the existence of a linear relationship:

H1: There is a negative and linear relationship between the cash conversion cycle and the company's profitability.

H2: There is a negative relationship between days of inventory and the company's profitability.

H3: There is a negative relationship between days sales outstanding and the company's profitability.

H4: There is a positive relationship between days payables outstanding and the company's profitability.

However, lately, literature has been concerned about whether there exists a non-linear (concave) relationship between profitability and CCC and its components. Therefore, additional we investigate the following hypotheses:

H5: There is an optimal level of cash conversion cycle that maximizes the company's profitability.

H6: There is an optimal level of days of inventory that maximizes the company's profitability.

H7: There is an optimal level of days sales outstanding that maximizes the company's profitability.

H8: There is an optimal level of days payables outstanding that maximizes the company's profitability.

To test *H5*, *H6*, *H7*, and *H8* referring to the non-linearity, the firm's profitability will be regressed against *CCC*, *DSI*, *DSO*, *DPO,* and their squares. To test all the above hypotheses, an unbalanced panel data regression analysis will be conducted. The basic model is formulated as follows:

$$y_{it} = \beta_0 + \delta_0 d_t + \beta_1 x_{it} + a_i + u_i \qquad (7)$$

where y_{it} is the dependent variable for the i unit and t the time period, β_0 is the intercept, and x_{it} is the independent variable. The methods that can be applied to analyze panel data are the pooled ordinary least squares (OLS) model, the fixed effects model, and the random effects model.

The decision on which model is most suitable for our panel data depends on the statistical tests performed such as the Breusch-Pagan Lagrange Multiplier test (for the comparison between the least squares method and the random method effects) and the Hausman test (for comparison between the fixed effects method and the random effects method) (Park, 2011). With the help of the Breusch-Pagan control, we can conclude whether the estimated residual variance of a regression depends on the values of the independent variables. In this case, the panel model is characterized by heteroskedasticity. The rejection of the null hypothesis (homogeneity of the residuals), infers

that there exists a significant effect of random effects on the panel model and thus the random effects model can better cope with the problem of residual heterogeneity than the least squares model. If the estimated residual variance of a regression does not depend on the values of the independent variables, then the panel model is characterized by homoscedasticity (Park, 2011).

Hausman (1978) proposed the application of a test in which the existence or not of correlation of the individual characteristics of the entities of a regression model with the coefficients of the independent variables is of particular importance. If there is no correlation, then the best application model proposed for our regression model is that of the random effects model. On the contrary, if there is a correlation then the model that is proposed to be applied is that of the fixed effects (fixed effects model). If the null hypothesis is rejected for non-correlation, then we can conclude that individual estimates of the error term are significantly related to at least one independent variable of our regression model, so the fixed effects model can better explain our model. Otherwise, the random effects model will be preferred.

4. EMPIRICAL RESULTS

A multivariate analysis with multiple regressions will be conducted to test the hypotheses stated above. As the sample that was collected is quite large (101 companies) and from different business sectors, it is natural for each entity/business to have its characteristics which may or may not affect the forecast variables. EViews student version and IBM SPSS were used to perform the statistical analysis.

The Breusch-Pagan control was used to determine whether heteroskedasticity is present in the regression models that are investigated. The alternative hypothesis was accepted and the conclusion was that heteroskedasticity is present in the regression model that tests for the linear relationship between ROA and CCC. Thus, the random effects model is preferable to pooled OLS. Also, from the values of the Durbin-Watson test which is above 2, it seems that autocorrelation is present in our data.

The Hausman test was implemented in our data to indicate whether the fixed or the random effects model is more suitable for this study. The Hausman test is run to show possible unobserved effects due to specific characteristics between companies. The null hypothesis tells that there is no correlation between the unobservable heterogeneity term and the explanatory variables. If the null hypothesis is not rejected, then there are random effects and the random effects model is more suitable. However, if the null hypothesis is rejected, the fixed effects model is more appropriate because the effects are considered to be fixed.

Table 3a. Hausman test: Fixed effects model

Correlated random effects — Hausman test ***Test cross-section random effects***			
Test summary	***Ch-Sq. Statistic***	***Chi-Sq. d.f.***	***Prob.***
Cross-section random	39.688322	5	0.0000

Table 3b. Hausman test: Random effects model

Correlated random effects — Hausman test ***Test cross-section random effects***			
Test summary	***Ch-Sq. Statistic***	***Chi-Sq. d.f.***	***Prob.***
Cross-section random	41.611872	5	0.0000

Since the p-value < 0.05 we reject the null hypothesis. Consequently, the fixed effects model is chosen to investigate if there is a linear relation between profitability and *CCC* and its components. Furthermore, the fixed effects model is preferred also for the investigation of a non-linear relationship between the variables.

4.1. Linear relationship: Regression analysis

To investigate whether exists a linear relationship between working capital management and profitability we estimate the three models below:

$$ROA_{it} = \beta_0 + \beta_1 CCC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \mu_i + \varepsilon_{it} \quad (8)$$

$$ROE_{it} = \beta_0 + \beta_1 CCC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \mu_i + \varepsilon_{it} \quad (9)$$

$$ROCE_{it} = \beta_0 + \beta_1 CCC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \mu_i + \varepsilon_{it} \quad (10)$$

Equations (8), (9), and (10) will be estimated to test for *H1*.

Also, for the components of the CCC, days sales of inventory, days sales outstanding, and days sales payables, the models to be estimated are:

$$ROA_{it} = \beta_0 + \beta_1 DSI_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \mu_i + \varepsilon_{it} \quad (11)$$

$$ROA_{it} = \beta_0 + \beta_1 DSO_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \mu_i + \varepsilon_{it} \quad (12)$$

$$ROA_{it} = \beta_0 + \beta_1 DPO_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \mu_i + \varepsilon_{it} \quad (13)$$

Equations (11), (12), and (13) will be estimated to test for *H2*, *H3* and *H4*.

where *t* refers to the time period and is expressed in years, *i* refers to the companies and β_0 is the intercept.

In Table 4, we see the regression estimates of Eq. (8), where the results of the pooled OLS regression for the first model are presented. In Eq. (8) we used *ROA* as a dependent variable to express profitability and the *CCC* as the independent one. The other variables are used as controls in our model. As shown in Table 4, there is a negative relationship between the two variables examined. This result supports the view of the negative effect of working capital on profitability. If *CCC* increases for one day (one unit) the profitability will decrease by 0.000112 units. According to the other estimated variables, the company size has a negative effect on the profitability of the firm. The bigger the size of the firm, the worse the profitability will be.

Table 4. The outcome of the regression analysis for Eq. (8) with pooled OLS

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	0.156311	0.010999	14.21157	0.0000
CCC	-0.000112	1.97E-05	-5.707578	0.0013
LEV	-0.000669	0.000285	-2.346704	0.0573
SFIN	-0.159402	0.005156	-30.91302	0.0000
CAGE	0.000252	9.67E-05	2.607881	0.0402
CSIZE	-0.002236	0.000530	-4.219123	0.0056

Note: Dependent variable: ROA.

By using panel least squares (PLS) to estimate the model, the results show that the *CCC* is negatively related to profitability (as evaluated here by the ROA ratio). The *CCC*, the *SFIN*, the fixed term (β_0), the *CSIZE,* and the *CAGE* are statistically significant at the 5 percent level. *SFIN* is negatively related to *ROA*. *LEV* has a negative impact on profitability which is as normally is expected. However, leverage is significant at the 10 percent level but not significant at the 5 percent level.

Table 5 shows the regression estimators of Eq. (8) using the fixed effects model. This equation has an 82 percent interpretive capacity of the total profitability variability. Almost all coefficients are statistically significant at the 5 percent level. Only *LEV* is not significant and it would be better to be excluded from the equation. *CCC* has a negative impact on *ROA*. It indicates that if there is a day increase in the length of *CCC*, *ROA* will be decreased by 0.0146 percent. Therefore, *H1* is not rejected, when *ROA* is considered as the profitability ratio.

CSIZE has a positive relationship with *ROA*. A positive relationship is expected and it indicates that bigger companies are more efficient in generating sales and money. These results are consistent with Lazaridis and Tryfonidis (2006). *CAGE* is significant and positively related to *ROA*. That means that older companies are more efficient in being profitable due to experience. *SFIN* is significant and negatively related to *ROA* which is consistent with the results of Caesar and Holmes (2003).

Table 5. The outcome of the regression analysis for Eq. (8) with fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	-0.134539	0.099608	-1.350683	0.2255
CCC	-0.000146	2.48E-05	-5.865573	0.0011
LEV	7.83E-06	0.000170	0.046066	0.9648
SFIN	-0.073197	0.008620	-8.491674	0.0001
CAGE	0.001390	0.000390	3.568827	0.0118
CSIZE	0.010860	0.006610	1.642978	0.1515

Note: Dependent variable: ROA.

In Table 6 we see the regression estimates of Eq. (9) using the fixed effects model. In Model 2, we use the *ROE* as the dependent variable to express profitability, the *CCC* as the independent variable, and all the other as controls. The coefficient of *CCC* reveals a positive impact on profitability (expressed here by ROE) which is not expected. It implies that if there is an increase in the length of *CCC* the *ROE* would be increased by 0.0163 percent. The results are opposite from that of the regression analysis of Eq. (8) with *ROA* as the dependent variable. Thus, if *ROE* is used as the dependent variable, the *H1* is rejected.

Furthermore, the coefficient of *CCC* and all the controls except for *SFIN* are statistically significant at the 5 percent level. Although *SFIN* is statistically significant at a 10 percent level. *LEV*, *CAGE*, and *SFIN* coefficients estimators are negative. *CSIZE* coefficient estimator has a positive impact on *ROE* as it is seen on *ROA*. The outcome from the regression analysis with *ROE* as the dependent variable is very controversial and not in line with the results of other papers that have examined the linear relationship.

Table 6. The outcome of the regression analysis for Eq. (9) with fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	-2.248206	0.131469	-17.10069	0.0000
CCC	0.000163	4.84E-05	3.357743	0.0008
LEV	-0.097234	0.005820	-16.70739	0.0000
SFIN	-0.043878	0.023890	-1.836666	0.0668
CAGE	-0.007975	0.001144	-6.968866	0.0000
CSIZE	0.167218	0.008936	18.71369	0.0000

Note: Dependent variable: ROE.

In Table 7 we have the regression estimates of Eq. (10) using the fixed effects model. In Eq. (10), we use the *ROCE* as a dependent variable to express profitability and as the independent variable the *CCC*, with the rest variables as controls. The intercept is significant and negative. *CCC* coefficient is significant at any conventional level and positive. This positive relation indicates that an increase in the length of *CCC* will have a positive impact on *ROCE*. The results are in contradiction with the results of the *ROA* estimated Eq. (8) of Model 1 above. Thus, if *ROCE* is used as the dependent variable, *H1* is rejected. *CSIZE* coefficient is positive and statistically significant. *SFIN* is insignificant at a 5 percent level. Also, *CAGE* is insignificant and negative which was not expected. Finally, the *LEV* coefficient is negative and significant.

Table 7. The outcome of the regression analysis for Eq. (10) with fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	-0.907678	0.154743	-5.865710	0.0000
CCC	0.000229	4.69E-05	4.884879	0.0000
LEV	-0.006809	0.001482	-4.593676	0.0000
SFIN	0.024090	0.013296	1.811757	0.0705
CAGE	-0.002525	0.001462	-1.727034	0.0847
CSIZE	0.068705	0.011794	5.825480	0.0000

Note: Dependent variable: ROCE.

Table 8 presents the regression estimates of Eq. (11) using the fixed effects model. In Eq. (11), we use *ROA* and *DSO* as the dependent and independent variables respectively while all the other variables act as controls. *DSO* coefficient is negative and statistically significant. The negative relation indicates that an increase in the length of the days that a company needs to collect its sales, will decrease the *ROA*. Therefore, *H2* is not rejected. *LEV* coefficient is statistically insignificant and positive which is an unexpected outcome. *CSIZE* and *SFIN* coefficients are insignificant at any level. The *CAGE* coefficient has a positive and statistically significant relationship with *ROA*. On the other hand, *SFIN* has a negative impact on *ROA*.

Table 8. The outcome of the regression analysis for Eq. (11) with fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	-0.089378	0.124747	-0.716476	0.4740
DSO	-0.000168	2.99E-05	-5.624994	0.0000
LEV	0.000227	0.000196	1.158731	0.2470
SFIN	-0.067124	0.013186	-5.090396	0.0000
CAGE	0.001713	0.000585	2.927785	0.0035
CSIZE	0.007278	0.008485	0.857799	0.3913

Note: Dependent variable: ROA.

Table 9 shows the regression estimates of Eq. (12) using the fixed effects model. In Eq. (5), we use the *ROA* as the dependent variable to express profitability and as the independent variable the *DSI*. *CSIZE*, *LEV*, *CAGE*, and *SFIN* are used as controls. *LEV* coefficient remains insignificant in this model estimation. *DSI* coefficient is negative and significant at any level. The estimator indicates that an increase in the length of time that a company requires to convert its inventory into sales by one day, will cause a decrease in *ROA* by 0.0312 percent. Consequently, *H3* is accepted. The *CAGE* coefficient is positive and significant, while the *CSIZE* coefficient is insignificant and positive. Furthermore, *SFIN* is negative and significant. *CSIZE* and *ROA* have a significant and positive relationship.

Table 9. The outcome of the regression analysis for Eq. (12) with fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	-0.154290	0.131664	-1.171845	0.2417
DSI	-0.000312	5.82E-05	-5.367293	0.0000
LEV	7.65E-05	0.000205	0.374226	0.7084
SFIN	-0.062647	0.014220	-4.405644	0.0000
CAGE	0.001923	0.000804	2.391039	0.0171
CSIZE	0.011530	0.009086	1.268984	0.2049

Note: Dependent variable: ROA.

Table 10 presents the results for the regression estimates of Eq. (13) using the fixed effects model. In this case, *ROA* is the dependent variable to express profitability, and *DPO* is the independent variable. *CSIZE*, *LEV*, *CAGE*, and *SFIN* are used as controls. The *DPO* coefficient is significant and negative, meaning an increase in the number of days that the company needs to pay back its suppliers, decreases the *ROA* ratio. This outcome is consistent with other papers. Regarding the controls, *LEV* and *CSIZE* are not significant at the 5 percent level, while *SFIN* is significant. The *CAGE* coefficient is positive, whereas *SFIN* has a negative impact on *ROA* which is in line with the research of Tauringana and Afrifa (2013). Although not presented all the above equations have been estimated including the sector dummies as well. The results have revealed that the coefficients for the sectors are not statistically significant and have been omitted from the equations to not complicate the analysis. All models have been corrected for heteroscedasticity and autocorrelation.

Table 10. The outcome of the regression analysis for Eq. (13) with fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	-0.006052	0.127865	-0.047330	0.9623
DPO	-0.000184	4.29E-05	-4.296820	0.0000
LEV	0.000401	0.000212	1.892316	0.0589
SFIN	-0.060879	0.013352	-4.559514	0.0000
CAGE	0.002674	0.000708	3.776060	0.0002
CSIZE	-0.000156	0.008989	-0.017311	0.9862

Note: Dependent variable: ROA.

4.2. Non-linear relationship: Regression analysis

We next examine a concave (non-linear) relationship between *ROA*, *CCC*, and its components. The difference from the former equations is that the square of *CCC*, *DSI*, *DSO*, and *DPO* are included.

$$ROA_{it} = \beta_0 + \beta_1 CCC_{it} + \beta_2 CCC_{it^2} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \beta_7 SIZE_{it} + \mu_i + \varepsilon_{it} \quad (14)$$

$$ROE_{it} = \beta_0 + \beta_1 CCC_{it} + \beta_2 CCC_{it^2} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \beta_7 SIZE_{it} + \mu_i + \varepsilon_{it} \quad (15)$$

$$ROCE_{it} = \beta_0 + \beta_1 CCC_{it} + \beta_2 CCC_{it^2} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \beta_7 SIZE_{it} + \mu_i + \varepsilon_{it} \quad (16)$$

Equations (14), (15), and (16) are estimated to test the *H5*.

Also, for the components of the *CCC*, *DSI*, *DSO*, and *DPO*, the models to be estimated are as follows. Equation (17) is estimated to test *H6*. Equation (18) will be estimated to check for *H7*. Equation (19) will be estimated to make a conclusion for *H8*.

$$ROA_{it} = \beta_0 + \beta_1 DSI_{it} + \beta_2 DSI_{it^2} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \beta_7 SIZE_{it} + \mu_i + \varepsilon_{it} \quad (17)$$

$$ROA_{it} = \beta_0 + \beta_1 DSO_{it} + \beta_2 DSO_{it^2} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \beta_7 SIZE_{it} + \mu_i + \varepsilon_{it} \quad (18)$$

$$ROA_{it} = \beta_0 + \beta_1 DPO_{it} + \beta_2 DPO_{it^2} + \beta_3 LEV_{it} + \beta_4 SFIN_{it} + \beta_5 LIQ + \beta_6 AGE + \beta_7 SIZE_{it} + \mu_i + \varepsilon_{it} \quad (19)$$

Tables 11, 12, and 13 below, exhibit the results of the fixed-effects regression analysis having used as independent variables the *CCC* and its square. Table 11 shows the regression estimates of Eq. (14). In this fixed effects model (correcting for heteroscedasticity and autocorrelation), *CCC* square has a negative impact and is statistically significant at a 1 percent level. The results shown in Table 11 indicate that *CCC* has a negative but insignificant impact on *ROA*. Thus, an insignificant relationship between *CCC* and profitability is revealed, with a low level of investments in working capital.

To accept the hypothesis about the non-linearity between the dependent and the independent variable and that there is an optimal level of CCC where profitability is maximized, the *CCC* coefficient must be positive and the *CCC* square coefficient must be negative. The results confirm the above hypothesis. From the above-estimated model, there is proof that working capital increases the profitability of a company until an optimal level, and increases in CCC after this level will decrease profitability. According to the results obtained from this equation, *H5* is accepted.

This model's interpretive capacity is about 85 percent of total profitability variability. *CAGE* is positively related to profitability, as is expected to be positive. Old firms have the experience and also have created the clientele to enhance sales compared to new companies. *LEV* is insignificant and has a positive relationship with *ROA*. *SFIN* coefficient estimator is negative and statistically significant. *CSIZE* has an insignificant and positive impact on *ROA*.

Table 11. The outcome of the regression analysis for Eq. (14) with fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	-0.097773	0.119377	-0.819028	0.4131
CCC	1.61E-06	2.89E-05	0.055635	0.9557
CCC_2	-4.62E-07	1.11E-07	-4.158859	0.0000
LEV	0.000128	0.000140	0.919094	0.3584
SFIN	-0.071455	0.011692	-6.111281	0.0000
CAGE	0.001720	0.000615	2.796030	0.0053
CSIZE	0.007518	0.008255	0.910731	0.3628

Note: Dependent variable: ROA.

In Table 12, we observe the regression estimates of Eq. (15) using the fixed effects model. This interpretive capacity of the model is about 78 percent of total profitability variability. Profitability is measured by *ROE*. All independent variables and controls are statistically significant at any level except for *SFIN* which is significant at a 10 percent level. *CCC* is negative and *CCC* square is positive. To confirm, the hypothesis that there is an optimal level of working capital where profitability takes the highest price, the coefficient of *CCC* square must be negative. Prices below and after this level decrease profitability. Our coefficient estimator is positive, therefore our hypothesis is rejected. The results do not show an optimal level of *CCC* and consequently a concave relationship.

On the contrary, the results indicate that for a determined number of *CCCs*, profitability will take a minimum price. *LEV* has a negative and significant relationship with *ROE*. The results from the regression analysis reveal a negative impact of *CAGE* on profitability.

Table 12. The outcome of the regression analysis for Eq. (15) with the fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	-2.795664	0.241131	-11.59398	0.0000
CCC	-0.000537	0.000117	-4.588089	0.0000
CCC_2	2.01E-06	3.30E-07	6.087333	0.0000
LEV	-0.093681	0.007698	-12.16920	0.0000
SFIN	-0.048253	0.028438	-1.696808	0.0903
CAGE	-0.011131	0.001649	-6.750067	0.0000
CSIZE	0.209121	0.016517	12.66130	0.0000

Note: Dependent variable: ROE.

In Table 13, we present the regression estimators of Eq. (16) using the fixed effects model. This model has an interpretive capacity at about 82 percent of total profitability variability. Profitability is measured by *ROCE*. Almost all coefficients are significant except *CAGE*. *CCC* square has a negative impact on *ROCE* while *CCC* has a positive impact on *ROCE*. *CSIZE* has a positive relationship with the profitability ratio. *CAGE* and *SFIN* coefficients are positive. And lastly, the *LEV* coefficient is negative as well as the *CAGE* coefficient. The results from the estimation of Eq. (16), reveal that there is an optimal level of working capital management. Consequently, *H5* is accepted.

Table 13. The outcome of the regression analysis for Eq. (16) with fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	-0.891266	0.146715	-6.074799	0.0000
CCC	0.000601	9.66E-05	6.220034	0.0000
CCC_2	-1.06E-06	2.18E-07	-4.847887	0.0000
LEV	-0.005588	0.001385	-4.034162	0.0001
SFIN	0.036150	0.015653	2.309528	0.0213
CAGE	-0.002402	0.001258	-1.909137	0.0567
CSIZE	0.066011	0.010649	6.198862	0.0000

Note: Dependent variable: ROCE.

In Table 14, the regression estimators of Eq. (17) are shown using the fixed effects model. The dependent variable is *ROA* and the independent variables are the *DSO* ratio and its square. *DSO* has a positive impact on *ROA* and is statistically significant. *DSO* square has a significant and negative impact on *ROA*. These results are in line with what we have been expected. Consequently, *H6* is not rejected. The outcomes are consistent with the results of Baños-Caballero et al. (2012) who have proven a negative relationship between profitability and *DSO* square. *SFIN* coefficients are insignificant and positive. The *CAGE* coefficient is negative but insignificant. The *LEV* coefficient is significant and negative.

Table 14. The outcome of the regression analysis for Eq. (17) with the fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	-1.134400	0.143783	-7.889670	0.0000
DSO	0.000524	0.000137	3.817033	0.0001
DSO_2	-9.39E-07	3.12E-07	-3.007506	0.0027
LEV	-0.006782	0.001484	-4.568881	0.0000
SFIN	0.026102	0.013756	1.897488	0.0582
CAGE	-0.001738	0.001284	-1.354075	0.1762
CSIZE	0.079784	0.010322	7.729823	0.0000

Table 15 presents the regression estimates of Eq. (18) using the fixed effects model. The independent variables are *DSI* and *DSI* square. *DSI* coefficient is negative and significant. *DSI* square coefficient is positive and not significant. That means that *H7* about an optimal level of DSI that maximizes the company's profitability is rejected. The results have shown that there is a minimum level, which was not expected. *SFIN* and *CSIZE* are negative and significant while *CAGE* is significant and positive.

Table 15. The outcome of the regression analysis for Eq. (18) with the fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	1.071474	0.417445	2.566746	0.0105
DSI	-0.001360	0.000346	-3.930987	0.0001
DSI_2	8.79E-07	5.71E-07	1.539449	0.1242
LEV	0.000451	0.000855	0.528006	0.5977
SFIN	-0.043622	0.021119	-2.065491	0.0393
CSIZE	-0.075658	0.027852	-2.716467	0.0068
CAGE	0.010222	0.003115	3.281880	0.0011

Finally, in Table 16 the regression estimates of Eq. (19) using the fixed effects model are demonstrated. The independent variables are *DPO* and its square. *DPO* is statistically coefficient significant at 5 percent and negative. *DPO* square is not significant and is positive. For this reason, *H8* has to be rejected. There is not an optimal level of *DPO* that maximizes the company's profitability. *LEV* is insignificant and positive. *SFIN* and *CSIZE* are negative and statistically significant. Also, *CAGE* is significant at 1 percent and positive.

Table 16. The outcome of the regression analysis for Eq. (19) with the fixed effects model

Variable	*Coefficient*	*Std. Error*	*t-statistic*	*Prob.*
β_0	1.048690	0.440245	2.382059	0.0175
DPO	-0.000791	0.000382	-2.072339	0.0387
DPO_2	1.07E-06	8.46E-07	1.270073	0.2046
LEV	0.000515	0.000880	0.584539	0.5591
SFIN	-0.045156	0.022304	-2.024566	0.0434
CSIZE	-0.076289	0.029416	-2.593410	0.0097
CAGE	0.009248	0.003193	2.896390	0.0039

The current study applies the pooled OLS for the regression analysis. Another possible avenue could be the utilization of the maximum likelihood estimation for the regression analysis. The majority of conventional research has demonstrated that there is a negative correlation between a number of working capital metrics and profitability, meaning that businesses can boost their profitability by lowering their working capital levels. Unfortunately, many studies employ static traditional liquidity measurements that ignore the company's deferral of revenues and payments, the quality of asset turnover, and the level of liquidity of these assets. Furthermore, they are unable to evaluate the turnover's return on investment.

The likelihood of a non-linear (concave) relationship between the aforementioned factors has been the subject of several recent research. These studies have highlighted the possibility of decreased sales and production process disruptions as a result of inadequate working capital investment. The idea that there is an ideal working capital threshold that maximizes profitability and that any levels below or above it will decrease is supported by this more modern approach. Additionally, they have provided proof that working capital management and profitability have a concave relationship.

The present study elaborated an analysis of Greek SMEs for an extended time period, from 2014 to 2020, by incorporating several crisis periods for Greece (sovereign debt crisis, COVID-19 crisis, and by analyzing various business sectors). This was done following the above and to expand the research scope from previous studies. Basic materials, industrials, consumer goods, healthcare, consumer services, telecommunications, utilities, and technology are the primary categories covered in this article. In addition, all regressions have incorporated the following control variables: industry classification, financial leverage ratio, age of the company, firm size, and financial leverage ratio. Recent research has demonstrated that these factors determine a company's profitability.

5. CONCLUSION

This research focuses on investigating the relationship between working capital management and the profitability of SMEs. For this reason, we use as many as possible variables for the two basic concepts we want to explain.

Working capital management is a key factor for the smooth running of the business. In addition, profitability is a concept that has many aspects and many ways to be expressed. The term profitability in this paper is expressed through the variables return on assets (ROA), return on equity (ROE), and return on capital (ROCE) employed. The cash conversion cycle (CCC), the accounts receivable days (DSO), the days sales of inventory (DSI), and the number of days in accounts payable (DPO) are chosen as the key elements of working capital management (WCM).

First, this study examines the linear relationship between working capital management and profitability. Secondly, it examines if there is an optimal level of working capital at which profitability is maximized.

The obtained results do not prove a robust negative relationship between profitability and the basic element of working capital management, the cash conversion cycle. Although the ROA ratio seems to be connected negatively to the cash conversion cycle, the examination of ROE and ROCE revealed a positive relationship with CCC.

H1 is accepted, so there exists a negative and linear relationship between the cash conversion cycle and the company's profitability when profitability is estimated through ROA and ROCE. However, it is not accepted if it is examined through ROE. The results from the regression analysis revealed a linear but positive relationship between the profitability ratios of ROE and ROCE, with CCC. In addition, the findings show that companies can create value for their shareholders by reducing the number of days they need to collect their receivables. Similarly, a reduction in the days of holding inventory will lead to increased profitability.

Secondly, the examination of a non-linear relationship revealed that there is an optimal level of WCM where profitability reaches the maximum value when ROA and ROCE are used in measuring profitability.

The findings of this work do not entirely coincide with the previous research. One of the reasons behind the results obtained which are in direct contradiction to the existing literature could be the fact the data from SMEs in Greece were used to test the hypotheses. Lazaridis and Tryfonidis (2006), in their research, used data from companies listed on the ASE market avoiding SMEs since these companies have the incentive not to disclose true operational results. According to them, the financial statements of SMEs in Greece do not reflect the real financial and operational activities.

Limitations of this study are considered mainly the number and business sectors of the examined companies that have their activities only in Greece. Furthermore, the sample companies were evaluated on their performance in a specific period. Thus, the study results came from several Greek companies and there is not an international comparison of the received results with some others from other countries. Furthermore, another limitation of this study could be the misuse of data from only 101 Greek companies. Other papers, such as Banos-Caballero et al. (2012), have included more companies in their research. Last but not least, the economic conditions of the Greek economy in the last years were not favourable for Greek companies.

Having a high level of working capital means that significant resources of the company remain idle rather than be used in other ways of investment which may provide higher profits. We should also take into account an additional risk that emerged by having a high level of working capital; we cannot preclude the possibility of inventory being damaged or even completely ruined. It is also highly possible that trade receivables will not be paid by the company's counterparts. On the other hand, it is obvious that having a minimum investment in working capital exposes a company to a material liquidity risk. In particular, a lack of liquidity may lead the company to default on its payments to its creditors for current liabilities that have become due. Therefore efficient Working capital management is of crucial importance.

Working capital management enhances the financial health of the company while maintaining growth, profitability, and liquidity along with the success of the company. Therefore, managers should understand and properly manage all the financial elements of their business to achieve the established profitability goals.

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