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Cash Conversion Cycle and Profitability: Evidence from Greek Service Firms

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Abstract: The present study examines the relationship between the cash conversion cycle (CCC) and profitability in major service sectors in Greece, including hotels, education, healthcare, transfer—rentals, and information technology. Using financial data from 343 public limited companies for the year 2023, the research applies descriptive statistics, Pearson correlation analysis, and ANOVA to evaluate how CCC components affect profitability, measured through return on assets (ROA). The results indicate that firms across all sectors maintain a negative CCC, suggesting efficient liquidity management, with the education sector exhibiting the most negative CCC due to upfront tuition payments. Additionally, the study finds a significant positive correlation between CCC and ROA, implying that firms with longer negative CCC values tend to achieve higher profitability. However, firm size, measured by total assets and sales, does not appear to influence CCC efficiency or profitability. These findings underscore the importance of industry-specific financial strategies and highlight the role of CCC optimization in enhancing financial performance. The study contributes to the literature on working capital management and provides practical implications for improving liquidity and profitability in service-oriented firms.

Keywords: cash conversion cycle; profitability; return on assets; Greece; service sector

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1. Introduction

Capital structure is a critical financial aspect that organizations often prioritize to maximize profitability (Asman et al., 2022). This study focuses on the cash conversion cycle (CCC), which encompasses the sequence of transactional activities essential for generating profits and improving organizational performance. Effective working capital management (WCM) plays a pivotal role in a firm's financial success, and CCC has emerged as one of the most widely utilized tools for assessing WCM efficiency. The CCC measures the time interval between the acquisition of raw materials and the receipt of payments for finished goods sold to customers. CCC is indispensable for every organization and serves as a powerful tool for evaluating a business's working capital management (Hussain et al., 2021). Furthermore, CCC is extensively employed to assess and quantify the risks and returns associated with liquidity management (Chen et al., 2022).

Effective liquidity management plays a pivotal role in ensuring the sustainability of firms. The relationship between liquidity management and profitability is also grounded in established theories of corporate finance. The Trade-Off Theory suggests that firms seek an optimal balance between the costs and benefits of holding liquid assets: while liquidity reduces risk and potential financial distress, excessive liquidity may signal underutilized

resources and opportunity costs (Abel, 2018). The Pecking Order Theory, on the other hand, posits that firms prefer internal financing over external debt or equity, implying that efficient working capital management (and thus liquidity) can delay or reduce the need for outside capital (Serrasqueiro & Caetano, 2014). These theories help explain why firms may strategically manage their cash conversion cycle to maintain optimal liquidity levels while maximizing profitability. In this context, cash management, which involves achieving a balance between current assets and current liabilities, is fundamental for maintaining optimal liquidity (Kalantonis et al., 2019). Current liabilities encompass firms' short-term debts. To assess a firm's ability to meet these short-term obligations, analysts examine the sufficiency of current assets such as inventories, cash, marketable securities, and trade credit (accounts receivable). Essentially, the relationship between current assets and short-term liabilities is a critical determinant of a firm's capacity to settle its debts with creditors (Brealey et al., 2023).

Despite a growing body of the literature examining the relationship between CCC and profitability, the focus has largely been on manufacturing firms or economies with advanced financial systems (Saraswati & Bernawati, 2020; Ishikawa et al., 2025). Limited research has investigated this relationship within service-oriented industries in countries like Greece, where the service sector accounts for a substantial portion of GDP and employment (Danchev & Pavlou, 2022). Moreover, existing findings vary significantly across sectors and national contexts, revealing a clear need for more context-specific analyses. These gaps in the literature highlight the importance of exploring the CCC–profitability relationship in service sectors within financially constrained environments such as Greece.

Greece's service industry constitutes a fundamental pillar of its economy, contributing significantly to employment, GDP, and national development. Tourism is a pillar of the Greek economy, with hotels being a primary driver, accommodating millions of international visitors each year and contributing significantly to the hospitality and travel industries (Skordoulis et al., 2024a, 2024b). At the same time, transfer services and rentals play a crucial role in Greece's tourism, catering to millions of tourists annually and facilitating domestic mobility (Hellenic Logistics Association, 2022). It is noteworthy that the total contribution of tourism to the Greek economy, when multiplier effects are taken into account, is estimated between EUR 62.8 billion and EUR 75.6 billion, representing between 28.5% and 34.3% of GDP (INSETE, 2025; Katartis et al., 2024). The education sector, in particular in higher education, plays a pivotal role in the production of well-educated labor. The healthcare and medical services sector, with a focus on private hospitals, has seen substantial growth, offering high-quality medical care, specialized treatments, and shorter wait times compared to public facilities. According to (OECD, 2024), spending pressures for investment in education and healthcare will remain substantial in the years ahead. Lastly, IT Services have experienced rapid expansion, with key contributions from software development, cybersecurity, and digital transformation projects aimed at modernizing both the private and public sectors (Drosos et al., 2017a, 2017b; Loli & Panayiotou, 2021). Together, these sectors form a dynamic framework for Greece's overall economic growth and competitiveness in the global market.

The aim of this study is to investigate the relationship between the major sectors engaged in the provision of services in Greece and the length of CCC and profitability. Understanding CCC in depth and its impact on profitability can provide valuable insights for businesses, investors, and policymakers in optimizing financial performance, and efficiency. Moreover, analyzing the relationship between CCC and profitability can support businesses to enhance liquidity management, reduce financial risks, and improve strategic decision-making. Additionally, the study examines whether company size—measured by total assets and sales—affects the relationship between CCC and profitability, as firm size

may influence liquidity strategies and financial performance. This approach is consistent with previous research such as (Uyar, 2009), who used total assets and sales as proxies for firm size when investigating CCC dynamics and profitability in Turkish companies. The findings of this study are expected to contribute to the academic literature on financial management while offering practical recommendations for service sector firms to enhance their financial sustainability and long-term growth.

2. Literature Review

2.1. Liquidity and Profitability Metrics in the Context of the Cash Conversion Cycle

Several researchers have worked on the examination of the relationship between CCC and profitability. Numerous studies have employed various indicators to measure both liquidity and profitability, depending on the research context and industry focus. Liquidity indicators such as the current ratio, quick ratio, and cash ratio provide static views of a firm's short-term financial health, yet often fail to capture the dynamic aspects of operational liquidity. For instance, while the current ratio is widely used due to its simplicity, it can be misleading if a large portion of current assets is tied up in slow-moving inventory. Similarly, cash ratios reflect immediate liquidity but may not fully account for working capital efficiency (Madushanka & Jathurika, 2018).

On the profitability side, indicators like return on equity (ROE), net profit margin (NPM), and operating profit margin (OPM) have been utilized to assess performance. ROE, while useful, is influenced by financial leverage and may distort operational efficiency. NPM and OPM, although insightful in cost control and pricing strategies, are sensitive to external factors such as input costs and taxation policies (Choiriyah et al., 2021).

In contrast, ROA is favored for its ability to measure how effectively a firm utilizes its assets to generate earnings, independent of capital structure decisions. Coupled with the CCC, which dynamically reflects how quickly a firm converts its investments into cash flows, these two indicators provide a robust framework to evaluate the interplay between liquidity and profitability. The selection of ROA and CCC in this study is thus grounded in their broader acceptance in the financial literature as reliable and interpretable metrics for performance and working capital efficiency (Oseifuah, 2016).

2.2. Cash Conversion Cycle and Profitability

2.2.1. Global Evidence

(Nijam, 2016) investigated the relationship between CCC and profitability in Sri Lanka's hotel sector, emphasizing the use of Return on Assets (ROAs) as a key metric for evaluating how efficiently firms convert assets into profits. By analyzing data from 26 listed hotel companies between 2011 and 2013, the study found a positive and significant relationship between CCC and profitability, particularly when measured through net profit margin (NPM). These findings suggest that maintaining an optimal balance among receivables, payables, and inventory is essential for enhancing profitability. However, the study also notes that industry-specific characteristics may influence the strength of this relationship, underscoring the importance of considering sectoral differences in future research.

(Kithinji et al., 2023) examined the impact of cash management on the financial performance of public universities in Kenya, using Return on Assets (ROAs) as the key profitability measure. The study focused on variables such as the cash ratio, operating cash flow management, and cash budgeting. By analyzing data from 26 accredited public universities between 2016 and 2019, the authors found that effective cash management significantly enhances financial performance. Moreover, the study revealed that student enrollment moderates this relationship, underscoring the importance of prudent liquidity

management in the face of resource constraints and financial challenges in the higher education sector.

In their research, (Kipkemoi et al., 2018) investigated the influence of the cash conversion cycle (CCC) and inventory conversion period on the financial performance of commercial and service firms listed on the Nairobi Securities Exchange (NSE), identifying Return on Assets (ROAs) as the most appropriate evaluation metric. By analyzing data from 12 firms between 2007 and 2017, the study found that while the CCC did not have a statistically significant impact on ROA, the inventory conversion period exhibited a significant inverse relationship. These findings suggest that firms in the commercial and service sectors should prioritize effective inventory and credit management to avoid overinvestment in receivables and enhance working capital efficiency.

(Ceylan, 2021) explored the impact of the CCC on firm profitability, focusing on small and medium-sized enterprises (SMEs) operating in Turkey. The study identified ROA as the most suitable profitability metric, emphasizing its ability to reflect how efficiently companies utilize their assets to generate earnings. Unlike return on equity (ROE), which is influenced by capital structure, or net profit margin (NPM), which can fluctuate with cost variations, ROA provides a clear measure of operational efficiency independent of financing decisions. The research highlights the importance of balancing liquidity and profitability, as shortening the cash cycle indiscriminately may not always yield positive financial outcomes.

(Upadhyay & Smith, 2016) explored the relationship between the CCC and hospital liquidity, using a sample of 98 hospitals in Washington state from 2007 to 2013. The study found that a higher current ratio is associated with a longer CCC, indicating that hospitals with higher static liquidity tend to experience less efficient dynamic liquidity. However, the relationship between CCC and quick ratio was insignificant, while days-cash-on-hand showed an unexpected negative relationship with CCC, suggesting that better cash management reduces the length of the CCC. The study underscores the importance of considering both traditional static liquidity ratios and dynamic measures like CCC for comprehensive liquidity assessment. (Ishikawa et al., 2025) explored how the CCC affects profitability in Japanese software firms, focusing on its role in enhancing working capital efficiency. By analyzing a sample of 125 companies from 2021 to 2023, the study demonstrated that a reduced CCC leads to higher operating profit margins by accelerating the recovery of cash and facilitating faster reinvestment in core activities. The research highlights that in software firms, particularly those utilizing subscription-based models, efficient management of receivables and payables plays a crucial role in maintaining liquidity and driving profitability. The study outlines that optimizing CCC is essential for firms navigating cash flow uncertainties caused by delayed customer payments and high upfront expenses.

2.2.2. Evidence from Greece

Several studies have examined how liquidity management, as reflected in CCC, impacts the financial health of Greek firms. (Kalantonis et al., 2019) analyzed the effect of CCC on firms listed on the Athens Stock Exchange during the financial crisis period (2012–2014), finding that an extended CCC negatively impacted return on assets (ROA), suggesting that firms with longer cash cycles struggled with liquidity constraints. (Nema & Lyroydi, 2020) investigated the influence of the CCC on the financial health of Greek dairy companies. The findings revealed a strong association between CCC and Z-scores across all companies. However, the hypothesis of a linear relationship was rejected, indicating that the impact of CCC on solvency is more complex and may not follow a straightforward linear pattern. Additionally, (Kolias et al., 2020) examined the interdependence of CCC

components in Greek wholesale firms, focusing on how inventory, accounts receivable, and accounts payable interact. The findings confirmed that the CCC components are mutually dependent, with changes in one element influencing the others. Specifically, an increase in accounts payable was found to drive an increase in accounts receivable, indicating a mutual credit relationship within the sector. Additionally, the study identified an asymmetric effect between inventory and receivables, suggesting that firms adjust trade credit and stock management differently depending on market conditions. (Balios et al., 2024) further examined CCC's impact on Greek commercial firms listed on the Athens Stock Exchange, confirming that shorter CCCs enhance profitability, especially in times of economic downturns. Their research also found that extending the payment period for short-term liabilities positively contributed to profitability, while leverage had no significant effect.

The CCC represents the average duration that a firm's cash is engaged within its routine operational activities. It serves as a key metric in financial analysis to evaluate the efficiency of a firm's working capital management and to determine the liquidity required for external financing (Christopoulos et al., 2019). For Greek companies operating in service-oriented sectors—particularly hotels, higher education, healthcare, transfer—rentals, and IT services—maintaining an optimized CCC is essential for sustaining liquidity, managing operational risks, and ensuring long-term growth and stability. Efficient CCC management in these sectors is essential for mitigating Greece's overall economic challenges, such as limited access to financing and high borrowing costs. Companies with a shorter CCC are less dependent on external credit, reducing their vulnerability to financial shocks. Furthermore, maintaining sufficient liquidity ensures resilience against seasonality, demand fluctuations, and economic instability—common risks in Greece's economic environment. Effective CCC management, therefore, plays a key role in enhancing the long-term competitiveness and sustainability of service-oriented firms, enabling them to contribute more effectively to national economic growth.

2.2.3. Sectorial Comparisons

When comparing sectors, the CCC–profitability relationship becomes even more nuanced. In capital-intensive industries such as manufacturing and health care, efficient management of inventory and receivables plays a pivotal role in liquidity maintenance. For example, Upadhyay and Smith (2016) noted that delays in hospital reimbursements affect the CCC more than in retail sectors. In contrast, firms in the IT and education sectors, such as those studied by Ishikawa et al. (2025) and Kithinji et al. (2023), benefit from faster cash inflows due to upfront payments or subscription models.

These sector-specific findings underscore the strategic nature of liquidity management. Firms must tailor CCC optimization strategies according to the timing of receivables and payables, regulatory environments, and access to financing. Studies that fail to account for such differences risk generalizing findings that may not apply universally. The literature therefore supports the argument for disaggregated analysis, especially in economies with complex sectoral structures.

Based on the above analysis, it is obtained that the relationship between CCC and financial performance varies across different service sectors, reflecting sector-specific dynamics in cash management and profitability optimization. In the hospitality sector, achieving an optimal balance in managing receivables, payables, and inventory periods enhances profitability. For public universities, effective cash management practices are key to financial performance, especially under resource constraints and fluctuating student enrollments. Commercial and service firms benefit from efficient inventory and credit management, as overinvestment in receivables can harm working capital efficiency despite CCC showing a limited direct impact on profitability. Hospitals face challenges suggesting that higher

liquidity may sometimes reduce cash flow efficiency. Finally, in software firms, a shorter positive CCC enhances profitability by expediting cash recovery and reinvestment in core activities, underscoring the critical role of efficient receivables and payables management. Across these sectors, optimizing CCC and cash management emerges as a common but context-specific necessity to balance liquidity, working capital efficiency, and profitability.

3. Materials and Methods

3.1. Data Sources

The data used in this study were obtained from the financial statements of public limited companies (or Sociétés Anonymes) with at least 10 years of continuous operation in Greece. The financial statements were downloaded from the official website of the General Commercial Register for the year 2023 (General Commercial Register (G.E.MI.), 2025). The sample comprises service companies from the five highly important service sectors in Greece (hotels, education, health, transfers—rentals and IT). In total, approximately 7000 companies operate in the abovementioned sectors, meeting the criteria set (General Commercial Register (G.E.MI.), 2025).

These sectors, while operationally distinct, were selected not for their internal similarity but because they collectively represent the most economically significant and data-accessible branches of the Greek service industry (OECD, 2017). The objective is not to generalize across all services but to explore whether CCC–profitability dynamics exhibit common patterns or sector-specific behaviors across different service domains (Warrad, 2015). This comparative approach is especially relevant for informing policy and managerial decision-making in service-based economies (Kołodziejczak, 2025).

To enhance comparability across service industries, the sample was constructed with an equal distribution of firms across the five major sectors under study. Each sector accounts for approximately 20% of the total sample, ensuring balanced sectoral representation. In addition, the sample includes firms of varying sizes based on total assets, allowing for an evaluation of how CCC and profitability dynamics vary with firm scale. This distribution supports the study's objective to examine the CCC–profitability relationship across both sectoral and size dimensions.

Although there are approximately 7000 service sector firms operating in Greece, this study focuses on a sample of 343 companies for which complete and reliable financial data were available for the year 2023. The selection criteria included the availability of detailed financial statements and classification within one of the five major service sectors under study (hotels, education, healthcare, transfer—rentals, and IT). Companies with missing, incomplete, or inconsistent financial records were excluded to ensure data accuracy and methodological consistency.

According to Saunders et al. (2009), for a population of 10,000, a sample size of 370 is sufficient to achieve a 95% confidence level with a 5% margin of error. Given that the population in this study is smaller (approximately 7000), a sample of 343 firms falls within the acceptable range for representative and reliable statistical analysis.

The sampling strategy is consistent with prior empirical studies in the field. For instance, (Uyar, 2009) employed a comparable approach in a study of 166 Turkish firms, while (Skordoulis et al., 2020) adopted a similar methodology using a sample of 225 medium and large-sized enterprises in Greece to explore the relationship between green innovation and competitive advantage. Similarly, (Lazaridis & Tryfonidis, 2006) analyzed 131 firms listed on the Athens Stock Exchange during 2001–2004 to investigate the link between working capital management and profitability. In the same vein, (Kalantonis et al., 2019) examined 20 listed Greek firms over the period 2012–2014, focusing on the role of the cash conversion cycle in shaping firm performance during the financial crisis

3.2. Reasearch Variables

3.2.1. Cash Conversion Cycle

CCC quantifies the period during which a firm's cash is engaged in its operational activities—from selling inventory to collecting receivables and settling payables. It is a commonly utilized metric to assess the efficiency of a firm's working capital management and its reliance on external financing. It is also stated that "the longer the production process, the more cash the firm must keep tied up in inventories". This highlights the direct relationship between production cycle duration and the capital required to maintain inventory, emphasizing the importance of efficient production management in optimizing working capital (Brealey et al., 2023). The CCC encapsulates key aspects of a firm's operational process, including inventory purchasing, production, sales of products, debt collection, and payment (Wang, 2019). As it encompasses the fundamental business activities, it is a widely recognized measure for evaluating the efficiency of a firm's management and its inherent reliance on external financing (Wang, 2019).

CCC is measured using the following formula (Kalantonis et al., 2019):

$$\begin{aligned}\text{Cash Conversion Cycle} &\\ &= (\text{inventory period} + \text{recievable period}) \\ &- \text{accounts payable period}\end{aligned} \tag{1}$$

Asman et al. (2022) utilized the following equation, which includes the three determinant variables of the CCC:

$$\begin{aligned}\text{Cash Conversion Cycle} &\\ &= \text{Days of sales outstanding} + \text{Days of sales inventory} \\ &- \text{Days of payables outstanding}\end{aligned} \tag{2}$$

The determinant variables of the formula are explained as follows:

$$\text{Days of sales outstanding} = \frac{\text{Accounts receivable}}{\text{Sales}/365} \tag{3}$$

$$\text{Days of sales ininventory} = \frac{\text{Inventories}}{\text{Cost of goods sold}/365} \tag{4}$$

$$\text{Days of payables outstanding} = \frac{\text{Accounts payables}}{\text{Cost of goods sold}/365} \tag{5}$$

CCC is likely to be negative as well as positive. A negative CCC signifies that a company collects cash from its sales before it is required to pay its suppliers. This scenario can be advantageous as it minimizes the reliance on external financing and enhances liquidity (Dogan & Kevser, 2020). Firms with a negative CCC often exhibit higher profitability and greater firm value, attributed to efficient management of working capital. Additionally, a negative CCC reduces the capital tied up in short-term assets, which can contribute to increased shareholder value and positively influence stock prices. This highlights the strategic importance of optimizing the CCC to drive financial performance and bolster market valuation (Rahman Shaik, 2021).

A positive CCC indicates that a company takes more time to collect cash from sales than it requires to pay its suppliers, resulting in higher working capital needs and increased financing costs (Basyith et al., 2021). This extended cycle can negatively affect profitability due to elevated inventory holding costs and the greater need for short-term capital (Dogan & Kevser, 2020). However, if effectively managed, a longer CCC may yield benefits by enabling the provision of more trade credit to customers and maintaining higher inventory levels, which can drive increased sales and potentially enhance profitability. This dual

impact underscores the importance of strategic management in balancing the risks and opportunities associated with a positive CCC (Iqbal et al., 2014).

The optimal CCC emphasizes the balance between the advantages of holding sufficient inventory and extending trade credit to customers and the costs associated with higher working capital investment. An optimal CCC ensures that a firm effectively supports sales and customer satisfaction while minimizing the financial burden of tied-up capital (Pei, 2013). Companies should strive to shorten their CCC to a reasonable minimum, as this can reduce financing costs, improve liquidity, and ultimately enhance profitability and firm value (Dogan & Kevser, 2020). Achieving an optimal CCC is a critical component of strategic working capital management, directly impacting operational efficiency and long-term financial performance.

3.2.2. Return on Assets

ROA is a widely used financial metric that measures a firm's ability to generate profit from its total assets, making it a crucial indicator of operational efficiency. It is calculated using the following formula:

$$\text{ROA} = \frac{\text{Net income}}{\text{Total assets}} \times 100 \tag{6}$$

Several studies have utilized ROA as a key measure of profitability in analyzing the relationship between the CCC and financial performance. (Nijam, 2016) examined CCC and its components in Sri Lanka's hotel industry and justified the use of ROA due to its ability to capture how efficiently firms utilize their assets to generate profits. Similarly, (Kalantonis et al., 2019) explored the impact of liquidity management on Greek firms and employed ROA as a key metric to assess financial performance, arguing that it provides a clear measure of operational efficiency independent of capital structure. Additionally, (Ceylan, 2021) analyzed the effect of CCC on firm profitability in Turkish SMEs and found that ROA effectively reflects profitability changes resulting from working capital management strategies. Unlike return on equity (ROE), which can be influenced by debt financing decisions, or net profit margin (NPM), which fluctuates with operational costs, ROA offers a comprehensive measure of how effectively firms convert their resources into earnings. Given the significance of asset utilization in determining financial performance, this study adopts ROA as the primary profitability measure to evaluate the impact of CCC on firm performance in Greek companies.

While net profit provides a direct measure of earnings, ROA offers a normalized perspective by linking earnings to total assets. This makes it especially useful for comparing firms across different sizes and capital structures and is therefore widely adopted in academic finance research (Choiriyah et al., 2021).

To explore the potential influence of firm size on the relationship between CCC and profitability, the study includes total assets and sales as proxy indicators. These variables are widely used in corporate finance research to represent company scale and have been shown to influence working capital practices and profitability outcomes. This is supported by (Uyar, 2009), who incorporated both variables in a similar empirical study of Turkish firms. Including company size variables allows for an assessment of whether larger firms—due to scale efficiencies or resource availability—exhibit different CCC–profitability dynamics compared to smaller firms.

4. Results and Discussion

4.1. Descriptive Analysis

Table 1 provides the descriptive statistics for the variables used in this study. The table's discussion evaluates the differences in inventory levels, accounts receivables, accounts payables, CCC, total assets, and sales across these sectors, incorporating measures of variability such as standard deviations to assess financial fluctuation. Regarding inventories, the hotel sector maintains a significant inventory level, suggesting a necessity to hold stock for operations.

Table 1. Descriptive statistics.

Sector		Inventories	Accounts Receivables	Accounts Payables	Cost of Goods Sold	Days of Sales Outstanding	Days of Sales in Inventory	Days of Payables Outstanding
Hotels	Mean	49,281.29	3,113,861.45	3,230,871.63	4,265,501.60	211.94	11.05	394.57
	Std. Dev.	59,770.82	5,605,999.62	4,961,927.12	6,987,909.08	290.69	23.41	358.87
Education	Mean	0.00	2,279,845.73	5,246,244.99	5,993,600.02	297.27	0.00	1525.30
	Std. Dev.	0.00	2,069,682.84	5,046,728.92	6,865,367.74	457.92	0.00	2922.32
Health	Mean	245,753.95	2,254,400.62	4,695,146.36	5,959,576.29	169.47	51.94	308.40
	Std. Dev.	238,755.44	1,619,306.47	4,916,888.01	4,739,231.13	112.38	128.79	153.05
Transfers	Mean	18,873.11	4,315,451.83	10,313,181.35	4,643,143.90	337.28	10.07	707.29
	Std. Dev.	43,648.49	4,034,421.86	12,781,481.91	4,891,251.15	539.87	25.81	698.21
Information Technology	Mean	169,571.31	2,103,556.19	2,327,846.32	2,187,486.14	144.69	82.95	476.95
	Std. Dev.	252,947.20	4,579,560.65	4,233,148.28	3,957,197.75	115.77	163.66	419.77

The education sector reports no inventory, aligning with the nature of its service-oriented model. The health and IT sectors exhibit substantial inventory levels, which may indicate operational demands for stock availability. The high variation in the IT sector suggests inconsistent inventory management, potentially due to fluctuating supply chain conditions or demand variations. Accounts receivables analysis reveals that the transfers sector has the highest mean, highlighting a reliance on credit sales. The education sector also has substantial receivables, which could be due to deferred tuition payments. Hotels, with moderate receivables, indicate a balanced credit policy but also display high variability, suggesting inconsistencies. The highest accounts payables in the transfers sector highlight a dependency on credit purchases, whereas the IT sector, with the lowest accounts payables, suggests a tendency for prompt payments and minimal credit dependence. The negative CCC values across sectors signify efficient cash flow management. The education sector, with the lowest CCC, indicates that it collects receivables far more quickly than it makes payments. This suggests a strong liquidity position, reducing the need for external financing. The transfers sector also demonstrates strong liquidity but with a slightly shorter cycle than education. On the contrary, the health sector maintains the shortest CCC, indicating an optimal balance between receivables and payables. The hotel and IT sector also sustain negative CCC values, suggesting they effectively manage liquidity, but with higher variability in IT. According to sales performance, the transfer sector has the highest total assets. However, asset size does not always correlate with revenue performance. The education sector, with high sales, outperforms the hotel sector in revenue generation despite its moderate asset base. The hotel sector reports lower sales, possibly reflecting a longer asset turnover cycle. The IT sector, while holding the lowest assets, experiences high revenue volatility, highlighting its dynamic market conditions.

The findings underscore the need for sector-specific financial management approaches. Negative CCC values confirm efficient working capital management, but if sectors such as education and transfers improve their synchronization between receivables and payables, they may have more beneficial agreements with suppliers (Ceylan, 2021).

4.2. The Impact of the Sector on the Firm's Cash Conversion Cycle

To examine whether significant differences exist among industries regarding the CCC, a one-way ANOVA was performed. The ANOVA test was followed by a Duncan test as part of the post-hoc analysis. The results provided in Table 2 show that there is a statistically significant difference among industries in terms of the CCC.

Table 2. ANOVA Test.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8,642,833.16	4	2,160,708.29	1.696	0.016
Within Groups	58,619,583.98	46	1,274,338.78		
Total	67,262,417.14	50			

To further investigate the significant differences in CCC among industries, a Duncan post-hoc test was performed. The results, presented in Table 3, reveal two subsets of industries with similar CCC values. The Duncan test was chosen over Tukey's HSD and Bonferroni tests because it is less stringent, making it more suitable for exploratory analysis (Uyar, 2009). Similarly, while the Bonferroni test is highly effective at controlling for multiple comparisons, it tends to be overly conservative, increasing the risk of Type II errors (failing to detect real differences). Given that the primary goal of this analysis was to identify meaningful groupings of industries based on CCC, Duncan's test provided a more appropriate balance between statistical power and error control.

Table 3. Duncan's test.

Sector	N	Subset for Alpha = 0.05	
		1	2
Education	76	−1228.03	
Transfers	62	−359.93	−359.93
IT	77	−249.30	−249.30
Hotels	59	−171.58	−171.58
Health	69		−86.98
Sig.		0.058	0.085

The education sector forms a distinct group, suggesting it has a significantly different CCC compared to other industries. Meanwhile, the health sector is included only in the second subset, indicating that its CCC is not significantly different from that of the transfers, IT, and hotel sector. The latter three sectors appear in both subsets, suggesting their CCC values are not significantly different from each other. Although the Duncan test identifies potential groupings, the significance values for both subsets indicate that these differences are not strongly significant. Therefore, while there are observable trends in CCC variation across industries, the evidence for statistically significant distinctions remains weak.

The ANOVA means plot (Figure 1) visually depicts the differences in CCC across sectors, highlighting distinct industry-level variations. The education sector exhibits the most negative CCC, indicating that these firms collect payments much earlier than they pay suppliers. In contrast, the health sector shows the least negative CCC, suggesting a relatively longer cash cycle. The IT, transfers, and hotels sectors demonstrate intermediate CCC values, with moderate variation. The sharp drop in CCC for the education sector suggests that these firms operate with a significantly longer negative cash cycle compared to others, likely due to upfront tuition payments and structured financial policies. Conversely, the health sector's less negative CCC may reflect extended credit terms and higher inventory

requirements. The ANOVA results indicate a statistically significant difference in CCC across sectors. However, the relatively low F-value suggests that the magnitude of the difference among sectors is modest. The Duncan post-hoc test reveals that while the education sector has a notably lower CCC, pairwise comparisons among the other sectors do not show statistically significant differences, with subset significance values. To further validate the group differences, a Bonferroni post-hoc test was conducted, which confirmed that the education sector's CCC is significantly different from the other sectors. This finding strengthens the evidence that the education sector operates under distinct working capital management conditions compared to other industries. However, no significant differences were found between the remaining sectors, indicating that their CCC values are relatively similar. These findings suggest that while overall differences in CCC exist across sectors, the most notable variation comes from the Education sector, which operates with a substantially different CCC than the others. This highlights the importance of industry-specific factors in shaping working capital management strategies.

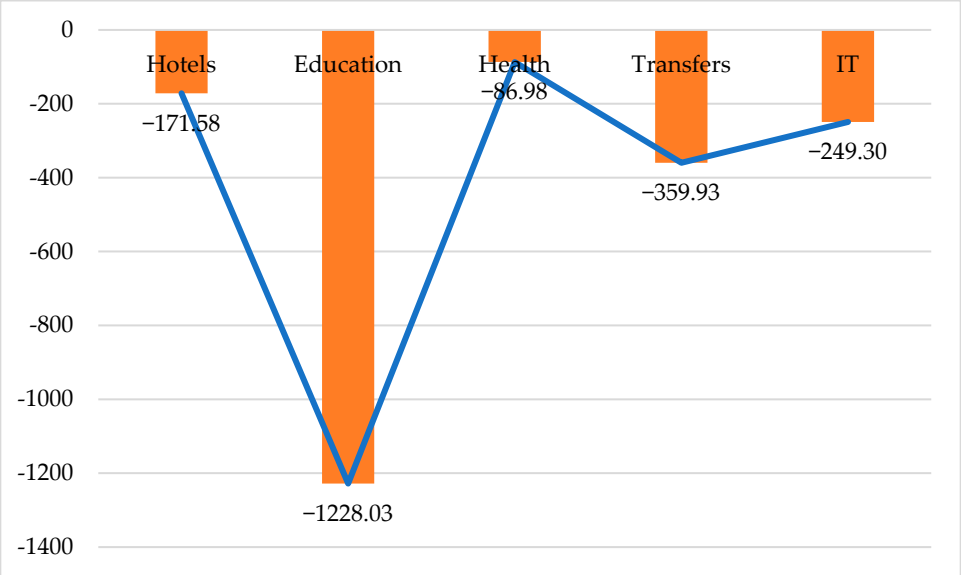

Figure 1. CCC means by sector and means plot.

4.3. Cash Conversion Cycle, Firm Size, and Profitability

Another key objective of the study is to illustrate the relationship between CCC, profitability, and firm size for which two measurements were used: sales and total assets. For this purpose, a Pearson correlation analysis was performed. The analysis reveals a strong positive correlation between CCC and ROA, suggesting that firms with longer CCCs tend to have higher profitability. Since the CCCs in this study are negative, firms with higher absolute CCC values (longer cash cycles) are more profitable, while firms with lower absolute CCC values (shorter cycles) experience lower profitability. Based on Table 4, the correlation between CCC and sales is statistically insignificant. This suggests that the size of a firm's revenue does not influence CCC, meaning both small and large firms can operate with negative CCCs depending on their industry and financial strategy. The correlation between CCC and total assets is also not significant, reinforcing the idea that firm size (measured by total assets) does not determine CCC efficiency. Larger firms may have more access to financial resources but their CCC is shaped by operational policies, industry structure, and business models rather than size alone.

Table 4. Pearson's correlation coefficient.

		CCC	Sales	Total Assets	ROA
CCC	**Pearson's R**	1			
	Sig.				
Sales	**Pearson's R**	0.096	1		
	Sig.	0.502			
Total Assets	**Pearson's R**	0.004	0.742	1	
	Sig.	0.976	0.000		
ROA	**Pearson's R**	0.566	0.200	0.049	1
	Sig.	0.000	0.159	0.734	

These findings indicate that firm size does not play a major role in CCC management, suggesting that CCC efficiency is primarily influenced by strategic financial decisions rather than the scale of a business. The relationship between sales and ROA is not statistically significant, implying that higher revenue does not necessarily lead to higher profitability. The correlation between total assets and ROA is also not statistically significant, suggesting that larger firms are not necessarily more profitable. These results support prior research indicating that profitability is driven more by operational efficiency and financial management rather than firm size alone (Wahyudi, 2023) (Saleh, 2023). While larger firms might benefit from economies of scale, their profitability depends on cost control, market positioning, and strategic investment rather than their assets.

This finding aligns with earlier studies such as (Kalantonis et al., 2019), who reported that efficient CCC management positively impacted profitability in Greek service firms, particularly during economic downturns. Similarly, (Ceylan, 2021) found a significant positive relationship between CCC and ROA in Turkish SMEs, suggesting that longer negative CCCs may allow firms to strategically reinvest early cash inflows. In contrast, (Kipkemoi et al., 2018) observed no significant relationship between CCC and profitability in listed Kenyan commercial firms, underscoring the importance of sectoral and regional factors. These comparative insights confirm that CCC's impact on profitability is not universal but shaped by contextual and operational dynamics.

Although profit for the period was not directly included, the use of ROA effectively captures firms' operational profitability relative to their assets. The observed positive relationship between CCC and ROA suggests that firms managing to sustain longer negative CCCs gain liquidity advantages that can enhance earnings (Abdulazeez et al., 2018). This has important managerial implications, as it supports the strategic value of CCC optimization in boosting financial performance.

5. Conclusions

5.1. Managerial Implications

This study makes an important contribution to the literature on working capital and liquidity management by focusing on an underexplored context—publicly listed service sector firms in Greece. While much of the existing research has emphasized manufacturing firms (Saraswati & Bernawati, 2020) or economies with more developed capital markets (Ishikawa et al., 2025), this paper offers empirical insights from a country with unique financial constraints and sectoral dynamics. By analyzing CCC behavior across five major service industries, the study enhances our understanding of how working capital efficiency relates to firm profitability in services—an area often overlooked in liquidity-performance studies.

Building on this contribution, the analysis compares CCC across five key service sectors in Greece—hotels, education, healthcare, transfer—rentals, and IT. The findings

reveal that all sectors maintain negative CCC values, indicating that firms collect receivables more quickly than they make payments. Among them, the education sector exhibits the most negative CCC, suggesting a particularly strong liquidity position that minimizes reliance on external financing. The transfer and IT sectors also demonstrate efficient cash flow management, while the healthcare sector has the least negative CCC, indicating a more synchronized balance between receivables and payables.

Furthermore, the study finds that firm size, measured by total assets and sales, does not significantly influence CCC or profitability. Instead, CCC exhibits a strong positive correlation with return on assets (ROA), meaning that firms with more negative CCC values (longer negative cycles) tend to be more profitable. This suggests that firms benefiting from an extended period between cash inflows and outflows can strategically manage liquidity to optimize financial performance.

These findings are consistent with previous research by (Kalantonis et al., 2019) and (Ceylan, 2021), who also observed a positive association between CCC efficiency and firm profitability in service and SME contexts. However, they contrast with (Kipkemoi et al., 2018) who found no significant relationship in a sample of Kenyan commercial firms. This suggests that sectoral and regional characteristics may play a significant role in shaping the CCC–profitability dynamic, particularly in liquidity—constrained environments like Greece (Louri & Migiakis, 2019).

The findings of this study offer valuable insights for financial managers and business decision-makers, emphasizing the importance of CCC management in enhancing profitability. Given that a more negative CCC is associated with higher profitability, managers should focus on optimizing receivables and payables to maintain a strong liquidity position. This includes negotiating favorable credit terms with suppliers, accelerating the collection of receivables, and implementing efficient inventory management practices. Industries such as education and transfers, which exhibit the most negative CCCs, can leverage their liquidity advantages to invest in growth initiatives or secure strategic supplier agreements that further enhance operational efficiency (Deloof, 2003). Additionally, firms with less negative CCC values, such as those in the healthcare sector, should consider financial strategies that improve liquidity without compromising operational stability. This may involve reassessing credit policies, reducing excess inventory, or optimizing accounts payable cycles to align with revenue streams. By effectively managing CCC, businesses can reduce reliance on external financing, lower financial risk, and improve overall working capital efficiency. Overall, effective liquidity management remains a cornerstone of financial sustainability, especially in service-oriented firms where timing mismatches in cash flows can significantly impact operations. Managers should also recognize that firm size alone does not determine CCC performance, reinforcing the need for tailored liquidity management strategies that align with sector-specific dynamics (Lazaridis & Tryfonidis, 2006).

5.2. Limitations and Future Research Directions

While this study provides important insights into the relationship between CCC and profitability in Greek service firms, several areas warrant further investigation. First, future research could explore the impact of macroeconomic factors, such as interest rates, inflation, and economic crises, on CCC efficiency and financial performance. Given Greece's history of financial instability, it is essential to examine how external economic conditions influence liquidity management strategies across different service sectors (Gill et al., 2010). Moreover, future studies could adopt a prolonged approach to assess CCC trends over time, capturing how firms adjust their working capital management practices in response to market fluctuations. Expanding the sample to include firms from other European countries would also provide a comparative perspective, offering deeper insights into the role of

industry-specific and regional financial dynamics in shaping CCC efficiency. Studies such as Kalantonis et al. (2019) and Uyar (2009) have emphasized the need for firms to tailor liquidity management strategies to their unique operational structures, which could be further explored through cross-industry comparisons.

Additionally, future research could perform comparative studies across different countries to examine how institutional, economic, and cultural contexts influence the relationship between CCC and profitability. Such international comparisons would offer broader insights and help validate the generalizability of the findings, particularly in service-oriented economies with varying financial infrastructures and credit environments.

Although this study employed descriptive statistics, Pearson correlation, and ANOVA—techniques widely accepted in exploratory corporate finance research—it is acknowledged that more advanced econometric models could provide greater robustness and control for endogeneity or omitted variable bias. Future research should consider applying multiple regression models, panel data analysis, or structural equation modeling to further validate and extend the current findings. These methodologies would allow researchers to assess dynamic relationships over time and better isolate the causal effects of CCC on profitability, especially in more complex or volatile economic environments.

Furthermore, it is important to investigate the potential non-linearity in the CCC–profitability relationship. Future studies could incorporate squared terms for CCC (CCC^2) in regression models to identify inverted U-shaped patterns, as suggested in the prior literature (e.g., Baños-Caballero et al., 2012). Such models could reveal whether there is an optimal range of CCC that maximizes profitability, beyond which either excessively short or long CCCs might harm performance. Exploring interaction effects between CCC and firm-specific variables (e.g., size, leverage, sector) could also enrich the understanding of how internal characteristics mediate liquidity-performance dynamics. Integrating time-series or panel data would further enhance the ability to capture firm behavior over time, allowing researchers to assess the stability and evolution of working capital strategies under changing economic conditions.

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