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Effects of Working Capital Management on the Profitability of Pharmaceutical Wholesale Companies in Croatia*

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Abstract

The main objective of this paper is to examine the relationship between working capital management and the profitability of companies engaged in the wholesale distribution of pharmaceutical products to pharmacies, hospitals, and other healthcare institutions in Croatia. This objective arises from the research question of whether working capital management has the same impact on the profitability of micro and small companies as it does on medium and large companies. Based on a sample of 157 companies observed over the period from 2015 to 2024, a panel data analysis was conducted to examine the impact, intensity, and direction of key working capital management factors—days of receivables collection (DCR), days of inventory stocked (DIS), and days of payment to suppliers (DPS)—on return on assets (ROA). The results indicate that DCR, DIS, and DPS have statistically significant negative effects on ROA, and that the COVID-19 pandemic and inflation further reduced ROA. Importantly, company size significantly moderates the effect of DPS: the effect remains negative for micro and small companies but becomes positive for medium and large companies. The findings suggest that managers should pay particular attention to working capital management, especially supplier payment policies, and adapt these practices to firm size in order to improve profitability and maintain financial stability during periods of economic uncertainty.

Keywords*: wholesale trade, pharmaceutical products, working capital management, profitability, COVID-19*

JEL classification: *G30, G32, G39*

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1. Introduction

This paper focuses on the management of short-term decisions, that is, decisions that require continuous monitoring of business processes by management to enable rapid adjustments to emerging market changes, as well as to changes within the company itself. These decisions are related to the management of working capital, specifically current assets and current liabilities. The importance of working capital management is reflected, on the one hand, in maintaining a company's liquidity and solvency and, on the other hand, in achieving a level of profitability that increases the company's value and consequently creates wealth for its owners. Although working capital management has been widely recognized in the literature, and it gained even greater importance during periods of financial crisis and the COVID-19 pandemic. Modern companies face numerous challenges for which management must be adequately prepared. Given the current geopolitical tensions, the risk of disruptions in international supply chains is unavoidable, which may consequently lead to increased transaction costs, longer delivery times, and deterioration in relationships with suppliers. At the same time, delivery delays may disrupt both production processes through inventory shortages and distribution processes involving finished goods. Furthermore, delays in delivery and failure to fulfil contractual obligations toward customers may result in contract cancellations, negatively affecting working capital through reduced cash inflows and an extended cash conversion cycle. Management in modern companies must therefore be prepared for such situations and continuously maintain an adequate level of liquidity while ensuring that the company's profitability is not compromised.

Effective management requires maintaining an optimal balance between profitability and liquidity, as well as between profitability and business risk. Excessive investment in working capital reduces risk but simultaneously lowers profitability. Conversely, lower investment increases the risk of maintaining the company's liquidity, while at the same time increasing the probability of achieving higher profitability. Based on previous research, several key determinants of working capital management that influence corporate profitability have been identified at the company level. These include the number of days required to collect receivables from customers, days of inventory stocked, days of payment to suppliers, company size, inflation, and GDP growth rate. However, the direction and intensity of the impact of each factor may vary across companies operating in different industries and of different sizes.

Previous findings indicate the existence of positive, negative, as well as statistically insignificant relationships between profitability and working capital management. The results vary depending on the country, company size, and the industry in which the company operates. The study Annual Global Working Capital Survey (PwC,

2015) identifies four main factors influencing working capital requirements: the sector in which the company operates, the level of economic development of the region, company size, and the importance attributed to cash and working capital management. Although it is often assumed that companies operating within the same sector have similar working capital requirements, significant differences exist in practice due to varying levels of managerial efficiency in managing working capital components. More efficient working capital management is more frequently observed in developed economies with institutionally stable market environments and among large companies. Conversely, small companies, despite their greater need to optimize working capital, often possess more limited managerial and financial capacities for their effective management. Cash and working capital management are crucial for maintaining a company's liquidity and financial stability. Nevertheless, management often focuses on external financing through banks or investors rather than generating additional free cash flows through the optimization of working capital.

This paper focuses on companies engaged in the wholesale distribution of pharmaceutical products (NACE Rev. 2 – 46.46) in Croatia, including the distribution of medicines and other pharmaceutical products to pharmacies, hospitals, and other healthcare institutions. The wholesale trade sector comprises companies engaged in the resale of goods without their transformation and represents an intermediate stage in the distribution chain. Within the pharmaceutical supply chain, the first stage is the pharmaceutical industry, namely the manufacturing of pharmaceutical and medical products, where the two most important business activities are research and development and the production of medicinal products. This is followed by the wholesale distribution trade of pharmaceutical products, which involves the distribution and sale of medicinal products to pharmacies, retail outlets, and hospitals, thereby ensuring the availability of medicinal products to end users, namely consumers and patients. According to the Ordinance on Good Distribution Practice for Medicinal Products (2013), the wholesale distribution of medicinal products includes procurement, receipt, storage, transportation, sale, and delivery, excluding dispensing to the final consumer, as well as the import, export, and transfer of medicinal products. According to the Medicines Act (2025), wholesalers may procure medicinal products directly from manufacturers, importers, and other wholesalers licensed by the competent authority, while supplying pharmacies, healthcare institutions, and other authorized entities.

Most of the European countries regulate wholesale markup and margin schemes, at least for reimbursable medicinal products. Most Member States apply regressive margins (Matteucci & De Santis, 2025). In Croatia, wholesale margins are regulated by the Ordinance on Amendments to the Ordinance on the Criteria for Determining the Maximum Permitted Price of Medicinal Products (2023). According to Article 4 of the Ordinance, the wholesale price of a medicinal product includes the wholesale

margin and other related costs. The wholesale price is determined by increasing the manufacturer's price by the value of the differentiated wholesale margin in accordance with Table III, which forms an integral part of the Ordinance. Croatia applies a differentiated wholesale margin system, whereby the applicable margin varies across price ranges from 4.5% to 8.5%, subject to a maximum cap of EUR 4,000. The differentiated margin system is intended to reduce medicine prices and control healthcare system costs. However, pharmaceutical wholesalers advocate higher margins for lower-priced medicines and argue that the maximum margin of 8.5% is insufficient to cover distribution costs, the high standards required for the storage of medicinal products, and the risks associated with potential product withdrawals due to expiration dates. Additional pressures arise from inflation and financing risks related to delayed payments, which most commonly occur with hospitals and account for approximately 45–50% of the total sales of pharmaceutical wholesalers.

Payment periods for pharmaceutical wholesalers are generally longer than those in other wholesale sectors. Due to delays in the settlement of obligations by healthcare institutions, pharmaceutical manufacturers often allow wholesalers extended collection periods for accounts receivable. The pharmaceutical manufacturer grants a permissible delay period to the wholesaler, while the wholesaler, in turn, applies a trade credit strategy toward hospitals (Karuppasamy & Uthayakumar, 2019). For pharmaceutical manufacturers, minimizing the collection period is not necessarily the primary objective, and they may accept a more aggressive credit policy to avoid direct transactions with healthcare administration. Inventory policy is strongly influenced by demand conditions. Most inventory models assume that the demand rate is constant. However, in the healthcare sector, demand for the pharmaceutical products is dynamic and varies over time (Karuppasamy & Uthayakumar, 2019). At the same time, pharmaceutical wholesalers cannot afford stockouts because these products are essential for protecting human health and life. Consequently, the optimal inventory level in pharmaceutical companies is generally higher than in other wholesale sectors.

In Croatia, there are currently no studies examining the relationship between working capital management and the profitability of pharmaceutical wholesale companies; therefore, this study represents the first research of this kind. Considering the specific characteristics of working capital management in pharmaceutical wholesalers—namely the need to ensure the continuous availability of medicines while simultaneously facing long collection periods, particularly from healthcare institutions—this research aims to provide new insights for the management of pharmaceutical wholesalers regarding the impact of working capital on profitability, with the goal of helping companies maintain liquidity and stable sources of financing. Accordingly, the following hypothesis is formulated: Working capital management does not have the same effect on the profitability of medium and large companies as it does on micro and small companies in the pharmaceutical wholesale sector.

The paper is structured as follows. The introductory chapter defines the research problem and subject and presents the research hypothesis. The second chapter provides a literature review, including the theoretical framework and an overview of empirical studies on working capital management. The third chapter presents the data and the methodological approach used in the analysis in a transparent manner. The fourth chapter presents the results of the empirical analysis and provides an explanation of the findings. The fifth chapter discusses the economic significance of the results, while the sixth chapter concludes with the author's final remarks.

2. Literature review

Traditionally, in a broader sense, gross working capital is understood as working capital and is defined as a company's investment in current assets. However, considering the interdependence between investments in current assets and the financing of those assets, gross working capital includes not only the total current assets of a company but also the methods used to finance those assets (Orsag, 2015). According to the duration of use, gross working capital can be divided into permanent and temporary gross working capital. Permanent current assets represent the minimum level of investment in current assets required for a company to maintain its sales, while any level above that represents temporary current assets (Pepur et al., 2015). Permanent current assets include all categories of inventories, namely raw materials, work in progress, finished goods, and merchandise, whereas temporary current assets consist of cash, marketable securities, and accounts receivable (Orsag, 2003). Net working capital is commonly defined as the difference between a company's current assets and current liabilities (Sen & Oruc, 2009; Brigham & Ehrhardt, 2011; Gitman & Zutter, 2011; Orsag, 2015), that is, the portion of current assets financed by long-term sources. A company may have either positive or negative net working capital. Positive net working capital indicates that a company is in good financial condition and can meet its short-term obligations through the sale of current assets or the collection of receivables from customers. In contrast, negative net working capital indicates that a company is unable to meet its debt obligations even if it liquidates its current assets (Seyoum et al., 2016), suggesting that it is not generating sufficient sales to maintain liquidity. Net operating working capital, also referred to as non-cash working capital, is defined as the sum of inventories and accounts receivable minus accounts payable. Smith (1980) was among the first authors to highlight the importance of working capital management due to its impact on a company's profitability and risk, and indirectly on its market value. Following this early contribution, numerous authors have confirmed the importance of an efficient working capital management policy.

Numerous empirical studies have examined the relationship between working capital management and corporate profitability and have identified the key

determinants of working capital management that influence the level of profitability. The results obtained vary depending on company size, the country in which the company operates, and the industry in which it operates. Most of the research on working capital has been conducted in countries with well-developed capital markets and a large share of manufacturing companies, such as India, Pakistan, China, the United States, the United Kingdom, Germany, and Belgium. In contrast, there is a lack of research in transition and Central and Eastern European (CEE) countries, particularly sector-specific studies. Although most studies provide empirical evidence of a negative relationship between the level of working capital and profitability, the literature reveals considerable heterogeneity in the results. Some studies report a positive effect, while others do not confirm the existence of a statistically significant relationship between working capital and profitability. Working capital policies differ across sectors and also change over time within each sector (Filbeck & Krueger, 2005).

Most empirical studies confirm a negative relationship between accounts receivable and corporate profitability (Gill et al., 2010; Mathuva, 2010; Akoto et al., 2013; Gul et al., 2013; Tauringana & Afrifa, 2013; Wesley et al., 2013; Almazari, 2014; Nigatu, 2015; Pais & Gama, 2015, among others), whereas Sharma and Kumar (2011) report a positive relationship in their study. In contrast, Sen and Oruc (2009), Raheman et al. (2010), Makori and Jagongo (2013), Enqvist et al. (2014), and Seyoum et al. (2016) do not find a statistically significant relationship between accounts receivable and corporate profitability. Similarly, existing empirical research also confirm a negative relationship between inventory levels and profitability (Sen & Oruc, 2009; Raheman et al., 2010; Sharma & Kumar, 2011; Gul et al., 2013; Almazari, 2014; Enqvist et al., 2014; Nigatu, 2015; Pais & Gama, 2015; Seyoum et al., 2016, among others). Mathuva (2010) and Makori and Jagongo (2013) report a positive relationship between inventory levels and profitability, while Gill et al. (2010), Tauringana and Afrifa (2013), and Wesley et al. (2013) do not find a significant relationship. Although most researchers initially expect a positive relationship between accounts payable and profitability, most empirical studies report a negative relationship (Sen & Oruc, 2009; Sharma & Kumar, 2011; Tauringana & Afrifa, 2013; Almazari, 2014; Enqvist et al., 2014; Pais & Gama, 2015; Seyoum et al., 2016, among others). Studies such as Mathuva (2010), Gul et al. (2013), Makori and Jagongo (2013), and Farhan et al. (2021) find a positive relationship, while several other studies do not report a statistically significant association (Gill et al., 2010; Raheman et al., 2010; Akoto et al., 2013; Wesley et al., 2013; Nigatu, 2015, among others). These findings indicate that the relationships between company-level working capital management components and corporate profitability vary across countries, company sizes, and industries.

Since this study analyses the period from 2015 to 2024, it also includes the period affected by the COVID-19 pandemic. Several studies have examined the impact

of working capital management on corporate profitability before and during the COVID-19 pandemic. Shen et al. (2021) analysed the impact of COVID-19 on the corporate performance of Chinese listed companies and found a negative effect on company performance. Similarly, Hamshari et al. (2022) examine the impact of the pandemic on working capital management practices of companies in the financial sector listed on the Amman Stock Exchange. Their results reveal that the COVID-19 pandemic had a significant and negative impact on working capital management and that companies tended to adopt a relatively conservative approach to working capital management during this period. The findings also indicate that the pandemic crisis triggered changes in working capital management practices. Yousaf (2022), in a study of Czech manufacturing companies, concludes that the efficiency of working capital management was significantly affected by the COVID-19 pandemic. Other studies focused on whether the pandemic altered the relationship between working capital management and company performance. Liu et al. (2024) examine the impact of working capital management on the financial performance of companies in the Chinese agri-food sector from 2006 to 2021 and assessed whether this relationship differed during the 2008 financial crisis and the COVID-19 crisis. Their results show that the relationship between working capital management and financial performance was more strongly affected during the COVID-19 crisis. However, the evidence is not entirely consistent. Zimon and Tarighi (2021) investigate the effects of the COVID-19 pandemic on working capital management policies among Polish small and medium-sized companies and conclude that the pandemic crisis did not significantly alter their working capital management strategies.

3. Methodological approach

After reviewing the relevant literature and numerous empirical studies, the variables used in this research were selected in accordance with the hypothesis that "*working capital management does not have the same effect on the profitability of medium and large companies as it does on micro and small companies in the pharmaceutical wholesale trade sector*". These variables are presented in Table 1, together with their description, definition and role. In addition to the variables used to measure profitability and working capital management during the observation period, the model also includes control and moderating variables.

Table 1: Variables with full term, abbreviation and explanation

Variable	Description	Definition	Role
Return on assets	Earnings before interest and taxes to the total assets (%)	$ROA = \frac{EBIT}{TA}100\%$	Dependent
Days of receivables collection	Ratio between the number of days in a year and receivables turnover	$DCR = \frac{AR * 360}{Sales}$	Independent
Days of inventory stocked	Ratio between the number of days in a year and inventory turnover	$DIS = \frac{INV * 360}{COGS}$	Independent
Days of payment to suppliers	Ratio between the number of days and payables turnover	$DPS = \frac{AP * 360}{COGS}$	Independent
Size	Dummy variable (1 for medium and large companies and 0 otherwise)	$SIZ = \begin{cases} 0 \\ 1 \end{cases}$	Moderator
COVID	Dummy variable (1 for years during pandemic (2020, 2021 and 2022) and 0 otherwise)	$COVID = \begin{cases} 0 \\ 1 \end{cases}$	Control
Inflation rate	Annual inflation (%)	$INF = \ln\left(\frac{CPI_t}{CPI_{t-1}}\right)100\%$	Control
GDP growth	Real GDP annual growth rate (%)	$growth = \ln\left(\frac{GDP_t}{GDP_{t-1}}\right)100\%$	Control
Current liquidity	Ratio of current liquidity and current liabilities	$liquidity = \ln\left(\frac{asset_{it}}{liabilities_{it}}\right)$	Control

Source: Author's representation

Company-level variables were obtained from the Croatian Financial Agency (FINA, 2025), while macroeconomic variables such as inflation and GDP growth (company-invariant but time-varying variables) were obtained from the EUROSTAT database. Among the control variables, the current liquidity ratio represents the firm-level control variable. Its inclusion is appropriate because it reflects firms' short-term liquidity positions and serves as a robustness check to determine whether the main findings remain stable after controlling for firms' ability to meet current obligations with current assets.

Since the data were observed across multiple companies over a ten-year period (2015-2024), a panel data analysis was employed as the appropriate methodological approach due to repeated observations of the same units over time. In the corresponding panel model, the dependent variable is profitability, measured by return on assets (ROA). The independent variables include accounts receivables,

inventories and accounts payables, the moderator variable is company size, while the control variables are COVID, inflation, and GDP.

$$ROA_{i,t} = \beta_1 DCR_{it} + \beta_2 DIS_{it} + \beta_3 DPS_{it} + \beta_4 SIZ_i \times DCR_{it} + \beta_5 SIZ_i \times DIS_{it} + \\ + \beta_6 SIZ_i \times DPS_{it} + \beta_7 COVID_t + \beta_8 INF_t + \beta_9 GDP_t + \mu_i + \varepsilon_{it} \quad (1)$$

The above equation represents a full panel model, which requires estimating 9 parameters in total, while μ_i is unobserved company-specific fixed effects and ε_{it} is idiosyncratic error term, assuming that individual effects are independent with error terms. This model is the one-way fixed effects (FE) panel, which does not consider a time-specific effect, because it is already partially captured by the COVID variable. In the one-way fixed effects (FE) panel model, the estimation is based on the within transformation, which eliminates unobserved time-invariant individual effects from the model. Specifically, the within estimator transforms the data by subtracting the time average of each variable for a given unit from the corresponding observed values. In the fixed-effects model, the constant term is omitted because the estimation is based on the within transformation (demeaning procedure), which removes time-invariant company-specific effects from the model. Consequently, the intercept is not estimated separately, as it is absorbed by the individual fixed effects. Ultimately, confirming the proposed hypothesis relies on testing the statistical significance of the interaction effects (coefficients β_4, β_5, β_6), which are represented in the model by multiplicative terms. These interactions capture the moderating role of company size in the relationship between working capital management indicators and profitability. If the estimated interaction effects are statistically significant, this indicates that the impact of individual working capital indicators differs between the two groups of companies. Furthermore, the sign and magnitude of the estimated coefficients provide information on the direction and strength of these differences, thereby revealing how the effects of specific working capital management indicators on profitability vary across the two groups of companies.

Company size is included as a moderator variable because the relationship between working capital management and profitability may vary depending on company size. Larger companies often have better access to financing and more efficient inventory management, which can alter the effect of working capital components on profitability. Several macroeconomic control variables are incorporated to isolate the effect of the main explanatory variables. The COVID variable captures the impact of the pandemic-related economic disruption, while inflation and GDP control for broader macroeconomic conditions that can influence companies' financial performance and operating environment. Including these control variables helps reduce omitted variable bias and improves the reliability of the estimated relationships in the panel model.

Several panel model specifications were estimated to obtain a clearer understanding of the impact of working capital management indicators on profitability. Specifically, the models were estimated both with all working capital management indicators included simultaneously and with the indicators introduced separately. Although these indicators are expected to be positively correlated, as they capture related dimensions of working capital management, the correlations are not sufficiently high to raise serious multicollinearity concerns. Estimating alternative model specifications is a common practice in empirical research, as it enables researchers to assess the robustness of the findings, identify the specification that best fits the data, and provide stronger support for testing the proposed hypothesis.

The analysis initially employed fixed-effects (FE) panel models as baseline specifications, as this approach allows for controlling unobserved company-specific heterogeneity that may be correlated with the explanatory variables. Following the estimation of the baseline models, a series of diagnostic tests was conducted to assess whether the assumptions underlying the selected specification were satisfied and to identify the most appropriate estimator for the analysis. These tests examined common panel data issues, including serial correlation, cross-sectional dependence and slope heterogeneity, as well as the overall suitability of fixed-effects relative to alternative panel estimators. If the assumptions required for the standard fixed-effects estimator were not satisfied, alternative estimators capable of producing valid and robust results were considered. Special attention was given to the structure of the variables included in the model. The COVID variable, inflation, and real GDP growth are time-varying variables that change over time but are identical across all companies within a given period. In contrast, company size is time-invariant but differs across companies. This distinction was considered when selecting and interpreting the appropriate panel model specification.

4. Empirical data and analysis

The units of analysis are companies engaged in the wholesale of pharmaceutical products (NACE Rev. 2 - 46.46), including the distribution of medicines, drugs, and other pharmaceutical preparations to pharmacies, hospitals, and other healthcare institutions. Although the number of such companies in Croatia is finite (574 companies observed over 10-year period), the panel dataset, when considering both its cross-sectional and time-series dimensions, does not represent a finite population in the statistical sense, as each company contributes multiple observations over time.

The sample selection criteria were based on data completeness and panel balance, ensuring that all companies included in the sample had available data for all variables and were continuously observed throughout the entire period from 2015 to 2024. This balanced panel structure is preferable because it enables more consistent estimation

and facilitates model comparison. Applying these criteria resulted in a final sample of 157 companies, of which 123 were classified as micro or small companies and 34 as medium or large companies. It is also noteworthy that none of the selected companies changed their size classification during the observation period.

Table 2 presents descriptive statistics for the key variables used in the analysis, grouped by company size, while Table 3 reports the correlation coefficients between ROA, used as the measure of profitability, and the three working capital management indicators: days of receivables collection (DCR), days of inventory stocked (DIS), and days of payment to suppliers (DPS).

Table 2: Descriptive statistics

	Size	Min	Max	Mean	Sd
ROA	micro and small	-197.60	119.29	13.43	19.32
	medium and large	-27.73	104.03	13.31	15.80
DCR	micro and small	0.00	574.63	90.61	79.07
	medium and large	0.00	329.86	123.08	73.18
DIS	micro and small	0.00	1955.50	202.90	266.22
	medium and large	0.00	923.95	79.10	81.75
DPS	micro and small	0.00	1528.80	94.62	139.25
	medium and large	0.00	262.59	70.00	63.98

Source: Author's calculations in RStudio using data obtained from the Croatian Financial Agency (FINA, 2025)

According to Table 2 the average ROA is very similar across groups (13.43% for micro and small companies and 13.31% for medium and large companies), suggesting comparable levels of profitability. However, micro and small companies exhibit substantially greater variability (standard deviation of 19.32 vs 15.80) and more extreme minimum values, indicating higher financial instability. Regarding working capital management indicators, medium and large companies have a longer average collection period (DCR:123.08 versus 90.61 days), suggesting lower receivables collection efficiency. In contrast, micro and small companies hold inventories (DIS 202.90 versus 79.10 days) and delay payments to suppliers (DPS 94.62 versus 70.00 days) for considerably longer periods, reflecting less efficient and more volatile working capital management practices. Overall, larger companies appear to maintain more stable and controlled working capital policies, which may reflect stronger financial discipline and better access to external financing sources.

The correlation matrix between profitability and working capital management indicators, presented in Table 3, reveals several statistically significant relationships.

However, these results should be interpreted with caution, as they are based on pooled panel data and do not account for company-specific effects. ROA is negatively and significantly correlated with all working capital management indicators, suggesting that longer collection, inventory holding, and payment periods are associated with lower profitability. The strongest negative correlation is observed between ROA and DIS.

Table 3: Correlation matrix between key variables

	ROA	DCR	DIS	DPS
ROA	1			
DCR	-0.1666***	1		
DIS	-0.2332***	0.1004***	1	
DPS	-0.1777***	0.2214***	0.1262***	1

Note: ***, ** and * denote significance at 1%, 5% and 10% level

Source: Author's calculations in RStudio using data obtained from the Croatian Financial Agency (FINA, 2025)

The analysis begins with the estimation of fixed-effects (FE) panel models, as this approach controls for unobserved time-invariant heterogeneity across companies, thereby reducing omitted variable bias and providing more consistent estimates when company-specific effects are correlated with the explanatory variables. Several model specifications are estimated by sequentially introducing additional variables, including control variables and, subsequently, company size as a moderating dummy variable (equal to 1 for medium and large companies and 0 otherwise), resulting in a total of seven models presented in Table 4. The sequence of variable introduction was guided by their economic role in the model. The first three models include the main working capital management variables to assess their direct effects on profitability. Next, interaction terms with company size are introduced to examine potential moderating effects, while macroeconomic variables are added in the final models as controls to evaluate the stability and robustness of the estimated relationships. This hierarchical specification reflects the theoretical structure of the model rather than a data-driven variable selection procedure. Subsequently, a series of diagnostic tests is conducted to assess the validity of the fixed-effects assumptions and to determine the most appropriate estimator for the subsequent analysis. These tests evaluate whether alternative estimators that account for serial correlation, cross-sectional dependence, or slope heterogeneity are required, as such issues are common in panel data analysis. It should be noted that neither revenue nor revenue growth is included as a control variable because both are directly related to the calculation of return on assets, the dependent variable. Their inclusion could therefore lead to tautological relationships and biased inference.

Table 4: Fixed effect panel models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DCR	-0.043***	-0.040***	-0.031***	-0.031***	-0.036***	-0.037***	-0.037***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
DIS		-0.011***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
DPS			-0.019***	-0.019***	-0.018***	-0.018***	-0.018***
			(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
COVID				-0.446**	-0.512**	-0.821***	-0.831***
				(0.221)	(0.225)	(0.302)	(0.3012)
DCR × SIZ					0.035	0.031	0.031
					(0.023)	(0.023)	(0.023)
DIS × SIZ					-0.000	-0.001	-0.001
					(0.012)	(0.012)	(0.012)
DPS × SIZ					0.054**	0.056**	0.056**
					(0.025)	(0.026)	(0.026)
INF						-0.147*	-0.163*
						(0.085)	(0.096)
GDP							0.034
							(0.076)
Num.Obs.	1,570	1,570	1,570	1,570	1,570	1,570	1,570
R2	0.20	0.38	0.54	0.55	0.57	0.58	0.59

Note: ***, ** and * denote significance at 1%, 5% and 10% level (standard errors in parenthesis)

Source: Author's calculations in RStudio using data obtained from the Croatian Financial Agency (FINA, 2025)

The models are estimated sequentially, with the gradual introduction of additional explanatory variables, interaction effects, and macroeconomic control variables, allowing for an assessment of the robustness and stability of the estimated parameters. Model 1 includes only DCR and shows a negative and statistically significant effect, indicating that a one-day increase in DCR reduces profitability by 0.043 percentage points (pp). This effect remains stable and highly significant across all subsequent models, although its magnitude slightly decreases when additional controls are introduced, ranging from -0.031 to -0.040 pp. This stability confirms that DCR is a robust negative predictor of ROA. Model 2 introduces DIS, which also exhibits a negative and statistically significant coefficient, suggesting that an increases in DIS by 1 day reduces ROA by 0.011 pp. The magnitude and significance remain unchanged across all specifications, indicating a consistent negative predictor of ROA. Model 3 adds DPS, which likewise exhibits a negative and statistically significant relationship with ROA (-0.019 pp). Model 4 introduces the COVID dummy variable, which has

a negative and statistically significant effect. This implies that the pandemic period was associated with a substantial decline in ROA of 0.446 percentage points. The magnitude of this effect increases further in Models 6 and 7 (reaching -0.831 pp), indicating that, once company-size interactions and macroeconomic controls are considered, the adverse impact of the pandemic appears even stronger.

Models 5, 6, and 7 incorporate interaction terms between the key explanatory variables and company size (SIZE), allowing the effects of working capital management indicators on profitability to differ between micro and small companies and medium and large companies. The interaction between DCR and company size is positive but statistically insignificant, suggesting that the negative impact of DCR on ROA does not differ significantly across company size categories. Similarly, the interaction between DIS and company size is not statistically significant. However, the interaction between DPS and company size is positive and statistically significant at the 5% level (Model 6). This finding indicates that company size moderates the relationship between DPS and ROA. Specifically, the baseline effect of DPS (-0.018 pp) applies to micro and small companies, implying a negative relationship between DPS and ROA for these companies. For medium and large companies, the effect becomes positive, as indicated by the combined coefficient of -0.018 + 0.056 = 0.038 pp. This suggests that an increase in DPS is associated with higher ROA among medium and large companies, in contrast to its negative effect among micro and small companies. Model 6 introduces inflation, which has a negative and statistically significant coefficient, indicating that a one-percentage-point increase in inflation is associated with a 0.147 pp decrease in ROA. This finding suggests that macroeconomic instability may adversely affect company profitability. Model 7 additionally includes GDP growth, which exhibits a positive but statistically insignificant coefficient, indicating no clear relationship with ROA.

The explanatory power of the models increases with their complexity, with R^2 rising from 0.20 in Model 1 to 0.59 in Model 7, indicating an improved model fit as additional variables are introduced. However, Model 6 represents the most appropriate specification. It includes all key company-level variables, the COVID-19 effect, company size interaction terms, and inflation as a relevant macroeconomic control variable, while maintaining statistical stability and a satisfactory goodness-of-fit. Although Model 7 yields a slightly higher R^2, the GDP growth variable is not statistically significant and does not materially affect the estimated relationships. The results indicate that DCR, DIS, and DPS have statistically significant effects on ROA, while COVID-19 and inflation are associated with lower profitability. Importantly, company size significantly moderates the effect of DPS: the relationship remains negative for micro and small companies but becomes positive for medium and large companies.

To assess the appropriateness of the fixed-effects specification, several diagnostic tests were conducted. The results are presented in Table 5.

Table 5: Fixed effect panel models diagnostics

Model	Poolability test	Serial correlation test	Cross-sectional dependence test
(1)	1.2749**	3.5422***	4.8436***
(2)	1.6969***	3.7997***	4.2051***
(3)	1.6576***	3.7766***	4.3561***
(4)	1.6094***	3.7763***	4.7836***
(5)	1.3658**	3.7432***	2.4285**
(6)	1.2427**	3.7450***	2.7768**
(7)	1.2359**	3.7446***	2.6104**

Note: ***, ** and * denote significance at 1%, 5% and 10% level

Source: Author's calculations in RStudio using data obtained from the Croatian Financial Agency (FINA, 2025)

The diagnostic results presented in Table 5 reveal several important characteristics of the panel models estimated in the first stage of the analysis. The poolability test rejects the null hypothesis of slope homogeneity in all model specifications, indicating that pooled OLS is inappropriate and that unobserved heterogeneity across companies must be controlled for, thereby supporting the use of fixed-effects models. The Wooldridge test for serial correlation is highly significant in all models, indicating the presence of autocorrelation in the idiosyncratic error term. This violates the classical fixed-effects assumption of no serial correlation and may result in biased standard errors if left uncorrected. Furthermore, the Pesaran test for cross-sectional dependence is significant in all models, suggesting the presence of contemporaneous correlation across companies. Taken together, these findings support the use of fixed-effects models with robust standard errors that account for both serial correlation and cross-sectional dependence, such as Driscoll-Kraay standard errors, or alternatively, common correlated effects estimators, to ensure valid statistical inference.

Given the rejection of slope homogeneity and the presence of cross-sectional dependence, the Common Correlated Effects Mean Group (CCEMG) estimator is employed, as it allows for heterogeneous slope coefficients and accounts for unobserved common factors, thereby providing consistent estimates in heterogeneous panels. The CCEMG estimator is estimated for six model specifications, as GDP growth was not statistically significant in Model 7 and was therefore excluded from further analysis.

Table 6 presents the results obtained using the CCEMG estimator, which accounts for cross-sectional dependence, unobserved common factors, and heterogeneous slope coefficients across companies. Compared with the fixed-effects (FE) models,

the CCEMG approach provides more robust estimates, particularly when companies are exposed to common macroeconomic shocks and other unobserved factors that affect all cross-sectional units simultaneously.

Table 6: Common Correlated Effects Mean Group models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DCR	-0.101**	-0.063	0.057	0.136	-0.024	-3.410	-3.021
	(0.047)	(0.048)	(0.051)	(0.111)	(0.035)	(2.146)	(1.998)
DIS		-0.125*	0.073	-0.075	-0.031	0.055	0.054
		(0.067)	(0.107)	(0.205)	(0.024)	(1.329)	(1.325)
DPS			-0.137**	-0.121**	-0.020*	-0.265**	-0.273**
			(0.063)	(0.055)	(0.012)	(0.120)	(0.134)
COVID				-0.012*	-0.012*	-0.177**	-0.175**
				(0.007)	(0.007)	(0.081)	(0.080)
DCR×SIZ					0.003	-0.899	-0.641
					(0.002)	(0.894)	(0.775)
DIS×SIZ					-0.004*	0.202	0.182
					(0.002)	(0.987)	(0.747)
DPS×SIZ					0.005*	0.480**	0.477**
					(0.002)	(0.227)	(0.225)
INF						-0.633*	-0.640*
						(0.335)	(0.362)
LIQUDITY							0.002
							(0.003)
Num.Obs	1,570	1,570	1,570	1,570	1,570	1,570	1,570
R2	0.31	0.42	0.32	0.47	0.55	0.60	0.61

Note: ***, ** and * denote significance at 1%, 5% and 10% level (standard errors in parenthesis)
Source: Author's calculations in RStudio using data obtained from the Croatian Financial Agency (FINA, 2025)

In Model 1, DCR exhibits a negative and statistically significant coefficient, which is consistent with the fixed-effects results. However, the coefficient becomes statistically insignificant and unstable in magnitude once additional controls and correlated effects are introduced (Models 2-6). This suggests that part of the negative relationship observed in the FE models may reflect common macroeconomic or cross-sectional influences rather than purely company-level effects. Model 2 introduces DIS, which has a negative and weakly significant coefficient (-0.125 pp), again consistent in direction with the FE models, where DIS also exhibited a negative and statistically significant effect. However, the coefficient becomes statistically insignificant in

Models 3–6, indicating that the evidence for a persistent effect of DIS is weaker under the CCEMG specification.

Model 3 introduces DPS, which exhibits a negative and statistically significant coefficient, indicating a consistent negative relationship with ROA. The persistence of this effect across both FE and CCEMG estimators suggests that DPS is one of the most robust determinants of profitability. The COVID variable becomes negative and statistically significant once introduced, with coefficients ranging from -0.012 to -0.177 pp. This finding is consistent with the FE results, which also indicate a significant adverse effect of the pandemic on ROA. Although the magnitude of the estimated effect differs across estimators, both approaches clearly suggest that the pandemic period had a negative impact on company profitability. The interaction effects reveal important heterogeneity across companies of different sizes. The interaction between DPS and company size is positive and statistically significant, consistent with the fixed-effects results, where the same interaction term was also positive and statistically significant. In both estimators, the results indicate that DPS has a negative effect on profitability for micro and small companies, whereas this effect becomes positive for medium and large companies. This consistency across estimators strengthens the conclusion that larger companies are better able to absorb or benefit from changes in DPS than micro and small companies. The interaction between DIS and company size is weakly negative and only marginally significant, whereas the interaction between DCR and company size is statistically insignificant. Inflation enters the model with a negative and statistically significant coefficient, suggesting that inflation represents an important common factor affecting company profitability. The explanatory power of the CCEMG models increases steadily, with R^2 rising from 0.31 to 0.60. Model 6 provides the most comprehensive specification, incorporating company-level determinants, pandemic effects, interaction terms, and macroeconomic controls while accounting for cross-sectional dependence and slope heterogeneity. Robustness is confirmed in the extended model (Table 6, Model 7), as including the current liquidity ratio (current assets/current liabilities) in the CCEMG specification does not substantially change the direction or statistical significance of the estimated relationships. Moreover, the current liquidity ratio has a positive coefficient, suggesting that liquidity may support profitability, although the estimated effect is not statistically significant.

5. Results and discussion

The focus of this study is on pharmaceutical wholesale companies, which play a crucial role in ensuring the continuous availability of medicines and pharmaceutical products to healthcare institutions, pharmacies, and ultimately patients. The sample comprises 123 micro and small companies and 34 medium and large companies operating in the Croatian pharmaceutical wholesale sector.

The descriptive statistics reveal several notable differences between the two company-size groups. Medium and large companies exhibit longer average accounts receivable collection period (123.08 days) compared with micro and small companies (90.61 days). One possible explanation is that larger wholesalers operate more extensive distribution networks and maintain business relationships with a broader range of healthcare institutions and pharmacies, which may result in longer collection periods. In contrast, micro and small companies display considerably longer inventory holding periods (202.90 days compared with 79.10 days) and longer payment periods to suppliers (94.62 days compared with 70.00 days). These findings suggest less efficient working capital management and a stronger reliance on trade credit among smaller companies. The average return on assets is very similar across the two groups (13.43% for micro and small companies and 13.31% for medium and large companies); however, micro and small companies exhibit substantially greater variability, indicating higher financial instability and more challenging business conditions.

The correlation analysis indicates that profitability is negatively associated with all three working capital management indicators. The strongest negative correlation is observed between ROA and inventory holding periods (DIS), suggesting that longer inventory cycles may be particularly detrimental to profitability. Since these correlations are based on pooled panel data, they should be interpreted with caution and viewed as preliminary evidence rather than causal relationships. The fixed-effects panel models indicate that all three working capital management components, days of receivables collection (DCR), days of inventory stocked (DIS), and days of payment to suppliers (DPS), have a negative and statistically significant effect on profitability. These findings are generally consistent with the prevailing empirical literature, which reports that longer working capital cycles tend to reduce profitability by tying up financial resources and increasing operating costs.

The negative effect of DCR is consistent with numerous previous studies, including Gill et al. (2010), Akoto et al. (2013), and Pais and Gama (2015), which report that longer receivables collection periods reduce profitability because financial resources remain tied up in outstanding receivables and cannot be used for productive investments. Similarly, the negative effect of DIS supports findings reported by Sen and Oruc (2009), Enqvist et al. (2014), and Seyoum et al. (2016), suggesting that prolonged inventory holding periods increase storage, handling, and obsolescence costs, thereby reducing profitability.

The results also indicate a negative relationship between DPS and profitability. This finding is consistent with studies such as Pais and Gama (2015), Enqvist et al. (2014), and Seyoum et al. (2016), which argue that prolonged payment periods may reflect liquidity constraints or financial difficulties. However, the analysis further reveals that company size significantly moderates this relationship. While DPS has a negative effect on profitability among micro and small companies, the

effect becomes positive for medium and large companies. This suggests that larger companies may be better positioned to use supplier credit strategically and exploit their stronger bargaining power, which is more consistent with the findings of Mathuva (2010) and Gul et al. (2013).

The COVID-19 variable exhibits a negative and statistically significant coefficient across both FE and CCEMG specifications, indicating that the pandemic adversely affected profitability in the pharmaceutical wholesale sector. This finding is consistent with Shen et al. (2021), who documented a negative impact of the pandemic on company performance, as well as with Hamshari et al. (2022) and Yousaf (2022), who reported significant disruptions in working capital management during the COVID-19 period. The results also support the conclusions of Liu et al. (2024), who found that the relationship between working capital management and financial performance became more pronounced during the COVID-19 crisis. Inflation likewise exerts a negative effect on profitability, highlighting the importance of macroeconomic conditions for company performance.

The diagnostic tests reveal the presence of serial correlation, cross-sectional dependence, and slope heterogeneity, indicating that the assumptions underlying the standard fixed-effects estimator are not fully satisfied. Consequently, the Common Correlated Effects Mean Group (CCEMG) estimator was employed to obtain more robust estimates. Although the CCEMG results are weaker in terms of the number of statistically significant coefficients, several important findings remain consistent across both estimation approaches. First, DPS remains a statistically significant determinant of profitability. Second, the negative impact of the COVID-19 pandemic is confirmed in both methodologies. Third, the interaction between DPS and company size remains positive and statistically significant, indicating that the moderating role of company size is robust across alternative specifications. Finally, inflation continues to exert a negative effect on profitability. At the same time, the CCEMG results suggest that the effects of DCR and DIS become less robust once cross-sectional dependence and heterogeneous slopes are explicitly considered. This finding highlights the importance of accounting for common macroeconomic shocks and unobserved factors that simultaneously affect companies operating within the same sector.

Overall, the results provide only partial support for the proposed hypothesis. The moderating role of company size is consistently confirmed for DPS across both FE and CCEMG estimators, whereas the interaction effects involving DCR and DIS are generally not statistically significant. Therefore, differences between company-size groups appear to be concentrated primarily in supplier payment management rather than across all components of working capital management.

From a managerial perspective, the findings underline the importance of efficient working capital management, particularly during periods of economic uncertainty. The significant negative effects of both COVID-19 and inflation demonstrate that

crisis conditions may substantially affect profitability. In such circumstances, maintaining liquidity becomes a strategic priority. Companies should continuously monitor receivables, inventories, and payables and adjust their working capital policies to changing market conditions to preserve financial stability and operational continuity. In crisis conditions, the principle that *cash is king* becomes particularly relevant, meaning that cash flow becomes the most important resource. In such circumstances, companies are often required to establish a so-called *cash room* (or cash management task force), where the primary objective is the stabilization of cash flow—accelerating cash inflows, reducing cash outflows, and increasing liquidity. Once liquidity is stabilized, the second phase follows, involving changes in policies aimed at long-term adjustment to crisis conditions.

6. Conclusion

This study examined the relationship between working capital management and profitability in Croatian pharmaceutical wholesale companies during the period 2015–2024. The study also developed and applied a panel-data framework for analysing the impact of working capital management on profitability while accounting for company size and selected macroeconomic factors.

The results provide partial support for the proposed hypothesis. The findings indicate that the effect of working capital management on profitability differs across company-size groups primarily through the days of payment to suppliers (DPS) component. While DPS negatively affects profitability among micro and small companies, the effect becomes positive for medium and large companies. In contrast, the moderating effects of company size on DCR and DIS are generally not statistically significant across model specifications. The results further demonstrate that longer receivables collection periods, inventory holding periods, and supplier payment periods are generally associated with lower profitability. In addition, both the COVID-19 pandemic and inflation exerted statistically significant negative effects on profitability.

The baseline analysis was conducted using fixed-effects panel models, while additional robustness was provided through the application of the Common Correlated Effects Mean Group (CCEMG) estimator. Although some coefficients became less significant under CCEMG estimation, the negative impact of COVID-19, the negative effect of inflation, and the positive moderating role of company size in the DPS-profitability relationship remained consistent. These findings suggest that the main conclusions are robust to cross-sectional dependence and slope heterogeneity.

The findings provide useful guidance for managers operating in pharmaceutical wholesale companies. Efficient working capital management remains essential for maintaining profitability, particularly during periods of economic instability.

Managers should pay special attention to receivables collection, inventory control, and supplier payment policies, while also considering the specific characteristics associated with company size. The results suggest that larger companies may be able to utilise supplier credit more effectively, whereas smaller companies should exercise greater caution when extending payment periods.

Several limitations of this study should be acknowledged. Although the model includes relevant macroeconomic controls, other company-level determinants of profitability identified in previous research, such as financial leverage, investment activity, sales growth, liquidity indicators, and other financial characteristics, were not included. Future research could incorporate these variables to provide a more comprehensive explanation of profitability.

Future studies could also examine the cash conversion cycle (CCC) as a composite measure of working capital management and investigate potential non-linear relationships between working capital management and profitability. Furthermore, future research could extend the analysis beyond the pharmaceutical wholesale sector itself and examine how the efficiency of pharmaceutical distribution influences the broader healthcare system.

Attention should also be devoted to inventory management practices in pharmaceutical supply chains, given the importance of ensuring the continuous availability of medicines. Unlike many other wholesale sectors, pharmaceutical wholesalers operate in an environment where inventory shortages may have serious consequences for public health. Consequently, future research could explore optimal inventory management models capable of balancing cost efficiency with supply reliability and healthcare system needs.

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Pravilnik o dobroj praksi u prometu lijekova, davanju dozvola za promet na veliko lijekovima, davanju dozvola za posredovanje lijekovima i davanju potvrde o dobroj praksi u prometu lijekovima na veliko [Ordinance on good distribution practice for medicinal products, wholesale authorisations, medicinal product brokerage, and certificates of good distribution practice], Narodne novine br. 83/2013 (2013). https://narodne-novine.nn.hr/clanci/sluzbeni/2013_07_83_1800.html

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Učinci upravljanja obrtnim kapitalom na profitabilnost veleprodajnih farmaceutskih poduzeća u Hrvatskoj

Darija Prša[1]

Sažetak

Glavni cilj ovog rada je ispitati odnos između upravljanja obrtnim kapitalom i profitabilnosti poduzeća koja se bave veleprodajom farmaceutskih proizvoda za ljekarne, bolnice i druge zdravstvene ustanove u Hrvatskoj. Ovaj cilj proizlazi iz istraživačkog pitanja ima li upravljanje obrtnim kapitalom jednak učinak na profitabilnost mikro i malih poduzeća u odnosu na srednja i velika poduzeća. Na temelju uzorka od 157 poduzeća promatranih u razdoblju od 2015. do 2024. godine, provedena je analiza panel podataka kako bi se ispitao utjecaj, intenzitet i smjer ključnih čimbenika upravljanja obrtnim kapitalom, kao što su dani naplate potraživanja (DNP), dani vezivanja zaliha (DVZ), i dani plaćanja obveza prema dobavljačima (DPD), na profitabilnost mjerenu povratom na imovinu (ROA). Rezultati pokazuju da DNP, DVZ i DPD imaju negativne učinke na ROA, pri čemu je učinak DPD-a najkonzistentniji. Pandemija COVID-19 i inflacija dodatno su smanjile ROA. Važno je napomenuti da veličina poduzeća moderira učinak DPD-a, pri čemu učinak ostaje negativan za mikro i mala poduzeća, a postaje pozitivan za srednja i velika poduzeća. Podaci su prikupljeni iz Registra godišnjih financijskih izvještaja FINA-e, dok su podaci o BDP-u i inflaciji preuzeti s internetskih stranica Državnog zavoda za statistiku.

Ključne riječi: *veleprodaja, farmaceutski proizvodi, obrtni kapital, profitabilnost, Covid-19*

JEL klasifikacija: *G30, G32, G39*

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