

Determinants of Working Capital Management of Companies in Agriculture in the Czech Republic

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Abstract

The aim of the article is to evaluate determinants of working capital investment policy of companies in agriculture in the Czech Republic from 2013 to 2022. The aim of this article is to identify the main determinants that influence the management of working capital in agricultural enterprises in the Czech Republic and to analyze how these factors affect the operational efficiency and financial stability of these enterprises from 2013 to 2022. Comparative analysis, Granger causality test and generalized method of moments (GMM method) will be used to identify the determinants of working capital. The data base includes 2 516 enterprises operating in agriculture in the Czech Republic. The results showed that the agricultural sector has a relaxed investment policy with a high share of inventories, while in recent years there has been a positive improvement in the effectiveness of working capital management. This policy is significantly influenced by company size, growth opportunities and capital structure. The improvement in return on assets and equity contributed to better financial stability. Companies can optimize their investment policy and improve financial results through better analysis of these factors.

Keywords

Assets structure, capital structure, GMM method, growth opportunities, return on equity, size of the company, working capital investment policy.

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Introduction

The working capital management of the company is a system of the short-term decisions relating to financing and investment (Farooq et al., 2023). Thus, it is connected with optimization of the inventories volume and providing the sources of their funding (both account payable and bank credit) as well as establishing the payment discipline of the company regarding buyers and suppliers. Such day-to-day operations include ordering and delivery of supplies, production and sales processes, and combine both current assets and liabilities. Therefore, the working capital management can be considered as efficient, when company avoids excessive working capital investments and at the same time, secures their liquidity (Nastiti et al., 2019).

Due to the fact that working capital management includes different aspects of company's activity, too many factors influence it. The researchers define them at the microlevel, for example, size of the company and capital structure (Jaworski

and Czerwonka, 2022), growth opportunities and capital expenditures (Nastiti et al., 2019), profitability (Korent and Orsag, 2022), industrial level – size, leverage, cash conversion cycle of peer firms or median indicator throughout the industry (Jaworski and Czerwonka, 2022; Farooq, 2023; Mättö and Niskanen, 2021) and macrolevel – GDP, unemployment, consumer price index (Jaworski and Czerwonka, 2022; Nastiti et al., 2019; Korent and Orsag, 2022; Farooq, 2023) etc., and reveal different character of their influence for specific country or economic sphere.

As Zimon (2020) defines, working capital management demands from personal solving of repetitive everyday operations from purchase and optimization of raw materials to sale of finished goods and establishing the payment discipline. The latter is associated with the balancing between the payment delay to buyers and necessity of timely cash inflows in order to cover own current liabilities of the firm. Taking into account, that managing these components should be continued without interruption (Zimon and Zimon,

2020), it demands the flexibility and mobility from the financial management.

Moreover, so far as WCM includes both gross working capital (current assets) and net working capital (current assets – current liabilities) (Farooq, 2023), the company should pay attention to their surplus and shortage. In case of surplus of working capital, company can meet unnecessary costs but provides financial security. And vice versa, reducing the level of working capital can lead to insolvency (Zimon, 2020). Thus, in order to provide the sales and satisfy the customers, company influences its profitability, which should always be balanced with its liquidity, and as a result – its financial health. Existing researches reveal lots of endogenous and exogenous factors, influencing differently on the working capital management (WCM) within specific spheres of economic activities or countries. Determining the character of their impact on the material production sector of Czech Republic is important in order to prevent or at least reduce possible negative effect for domestic economy.

The internal factors influence working capital management (WCM) of the company on the micro level. They can be chosen by the firm, like its size, or can characterize the activity of the company and somehow be under its control, for example, the volume of cash flow, indebtedness, tangibility etc.

The size of the company is usually defined as natural logarithm (ln) of total assets (Jaworski and Czerwonka, 2022) or natural logarithm of sales income (Korent and Orsag, 2022). Usually, scale effect of large company increases the turnover of different elements of current assets, which decreases working capital investments. Such business entity due to the size can be allowed more flexible credit policy, that along with access to different financial resources can lead to reduction of cash conversion cycle and improving of working capital management (WCM).

Firm growth opportunities are determined as rate of sales change (Nastiti et al., 2019; Reyad et al., 2022) or natural logarithm of relationship between annual revenue and revenue of the previous year (Sharma et al., 2020). The character of influence of such factor is contradictory. Increasing sales can provoke growing volume of inventories and accounts receivable in order to satisfy the buyers. However, if latter elements will grow faster, than sales, their turnover can lengthen, that will negatively influence cash conversion cycle.

Next factor, which influence is analysed in different manuscript, is tangibility as a share of fixed assets

in total assets (Czerwonka and Jaworski, 2023; Mielcarz, et al., 2018). In this case, company often faces the trade-off effect, choosing between buying the current assets or allocating financial resources to capital investments, which explains possible negative relationship among tangibility and working capital management (WCM).

working capital management (WCM) is connected to daily operations, which should be provided financially. In case of high-leveraged firm, attraction of additional resources can be problematic due to constraints. There are several variants of leverage factor determining. Thus, the indebtedness can be found as total debts-to-total assets ratio (Jaworski and Czerwonka, 2022) or as the ratio of non-current liabilities to total assets (Mättö and Niskanen, 2020) or the ratio of short-term debt (short-term bank credit) to total assets (Afrifa et al., 2022).

Scientists reveal the role of cash flow factor in working capital management (WCM), using the share of operating cash flow into the total assets (Nastiti et al., 2019) or share of net profit with depreciation and amortization in the total assets (Jaworski and Czerwonka, 2022).

Different indicators of profitability are also taken into account, exploring the influence on working capital, from the ratio of net profit (or gross operating profit or EBIT (Earnings Before Interest and Taxes) (Farooq et al., 2023) to assets up to return on equity (Korent and Orsag, 2022). The character of influence of cash flow and profitability factors on working capital management in most cases is positive. If company is profitable and generates sufficient operating cash flow, it is a consequence of improved credit policy of the buyers. Accumulating internal resources increases the independence of the firm from external financing, that provides the liquidity.

Jaworski and Czerwonka (2022) revealed positive effect of the company's size and negative effect of its growth, tangibility and indebtedness on working capital management of European energy industry. Moreover, increasing of cash flow is followed by the lengthening of cash conversion cycle (CCC) and reducing of liquidity.

Research of Indonesian manufacturing enterprises, made by Nastiti et al. (2019), demonstrates, that sales growth shortens the cash cycle and higher leverage, on the contrary, lengthens it. The scientists do not find any difference in condition of working capital management, depending from the size of investigated Indonesian manufacturing enterprises.

The results of Korent and Orsag (2022) indicate that working capital management in the previous year, profitability, and financial constraints significantly positively impact working capital cycles of manufacturing, trade, and information and communication companies in Croatia. In contrast, there is a negative influence of size, growth and fixed investment on cash conversion cycle and the net trade cycle, making working capital management as more aggressive.

Provided results Sharma et al., (2020) prove, that tangibility, leverage, nature of business are observed as significant factors to forecast the future requirements of net working capital of companies, listed with the Bombay Stock Exchange, and presented in various industries. Return on common equity (ROCE), board size; indicate the positive association with gross working capital. On the other hand, tangibility, nature of business and size of the firm show a negative relationship with gross working capital requirements.

Afrifa et al. (2022) find, that larger European firms are more efficient with their working capital management than smaller firms, sales growth potential decrease working capital efficiency, which, in turn, increases with access to bank credit.

Within the activity of small and medium enterprises in Central and Eastern Europe company size exerts a positive impact, while company growth, tangibility, leverage, and cash flow have a negative effect on working capital management (Czerwonka and Jaworski, 2023).

Concentrating attention on corporations in emerging economy, Mielcarz et al. (2018) reveal, that the capital expenditures and working capital investments compete with each other for limited financial resources. So, companies are often forced to choose between modernization of the fixed assets and daily providing of current operating activity. Additionally, authors document a persistently negative impact of capital expenditures on the dynamics of cash holdings and trade payables.

Working capital management is a key element of financial management in all sectors, but it plays an even more crucial role in agriculture. Agricultural enterprises in the Czech Republic face specific challenges associated with a high level of seasonality, fluctuating income, variability of market demand and, last but not least, unpredictable weather fluctuations. Working capital, which includes inventories, receivables, short-term liabilities and other short-term assets and liabilities,

must be managed with these variable factors in mind. Optimizing working capital is therefore a crucial tool that allows agricultural enterprises to ensure smooth operations, stabilize cash flow and minimize the risk of financial distress. In the agricultural sector in the Czech Republic, working capital management is influenced by both internal factors (such as the structure of production, the length of the production cycle or the efficiency of supply) and external factors, such as government support and subsidies, developments in global commodity markets and access to bank financing. Government subsidies per hectare of land and agricultural commodity price indicators—such as the agricultural producer price index or the prices of individual products (grain, milk, meat)—are key external factors that can significantly influence corporate decisions regarding working capital investment. These variables reflect broader macroeconomic and market conditions that are not directly controllable by the enterprises themselves but have a crucial impact on their cash flow, production planning, and investment strategies. Given the agricultural sector's sensitivity to price fluctuations and policy measures, government support and price signals serve as important determinants of financial management.

Given the small or medium size of many agricultural enterprises in the Czech Republic and their limited access to external financing, working capital management often becomes a question of long-term sustainability and resilience of the enterprise to market and natural fluctuations.

Although the issue of working capital management has been the subject of numerous studies across various economic sectors, existing research has predominantly focused on industrial and commercial enterprises. In contrast, agriculture remains relatively neglected in this regard, despite its significant economic importance and unique characteristics. Agricultural enterprises face pronounced seasonality, dependence on natural factors, long production cycles, and a specific structure of assets and liabilities. These factors make working capital management in agriculture particularly challenging and require an approach tailored to the sector's conditions.

In the context of the Czech Republic, there exists a significant research gap in terms of a deeper understanding of the determinants of working capital investment policy in agricultural enterprises. There is a lack of comprehensive knowledge regarding which business-related factors most strongly influence working capital management,

how these factors have evolved over time, and what impact they have on working capital investment policy. Moreover, systematic empirical analysis of working capital in Czech agricultural enterprises is still missing—particularly in relation to firm size, growth potential, and capital structure.

This research gap is significant not only from a theoretical perspective but also in terms of practical implications. Without a clear understanding of the specific determinants, it is not possible to effectively design strategies for liquidity management, development, or support of this key sector. For this reason, the primary aim of this study is to identify and analyze the key firm-level determinants of working capital management in agricultural enterprises in the Czech Republic during the period 2013–2022. The study focuses on assessing the impact of factors such as firm size, growth opportunities, profitability, and capital structure on the level of investment in working capital and its efficient utilization.

To achieve this goal, the study employs comparative analysis, the Granger causality test, and the Generalized Method of Moments (GMM). These approaches allow for the identification of relationships between variables, as well as the analysis of their direction and strength over time. The dataset includes 2,516 agricultural enterprises operating in the Czech Republic, providing a robust foundation for drawing generalizable conclusions. The findings of this study can contribute not only to the theoretical development of financial management in agriculture but also serve as a practical tool for managers and business owners seeking to optimize their investment policies and enhance financial stability. The results may also prove valuable for policymakers focused on rural development and the agricultural sector.

This study responds to the identified research gap and aims to address the following main research question and related sub-questions:

- What corporate factors determine working capital management in agricultural enterprises in the Czech Republic?
 - What is the impact of firm size on working capital investment policy?
 - What is the impact of growth opportunities on working capital investment policy?
 - What is the impact of asset structure on working capital investment policy?
 - What is the impact of capital structure on working capital investment policy?

- What is the impact of return on assets on working capital investment policy?
- What is the impact of return on equity on working capital investment policy?

Materials and methods

This study investigates the determinants of working capital management in the agricultural sector of the Czech Republic during the period 2013–2022 using various analytical methods. To compare differences between firms and identify key characteristics influencing working capital management, a comparative analysis was conducted, employing median values to ensure a more robust comparison across enterprises.

To determine the directionality of relationships between variables, the Granger causality test was applied, allowing an assessment of whether one time series can predict the development of another. For the estimation of model parameters, the Generalized Method of Moments (GMM) was subsequently used, providing an effective solution to problems of endogeneity and heteroskedasticity commonly present in panel data. All calculations and econometric modeling were performed using EViews 10 software.

The data used in this research were drawn from the Orbis database, specifically from the unconsolidated financial statements of agricultural enterprises in the Czech Republic. Primarily, balance sheet and income statement data were utilized, with extracted financial variables including current assets, current liabilities, sales, fixed assets, total assets, net profit, and equity.

From these variables, indicators used in the models were calculated: Working Capital Investment Policy (WCIP), Size of the Company (SOC), Growth Opportunities (GO), Asset Structure (tangibility) (AS), Capital Structure (indebtedness) (CS), Return on Assets (ROA), and Return on Equity (ROE). The calculation of these indicators is presented in Table 1.

Additionally, two control variables reflecting external macroeconomic and institutional factors were included in the model: government subsidies per hectare of land and the agricultural producer price index. Government subsidies per hectare represent the level of support provided to agricultural entities by the public sector. The agricultural producer price index serves as an aggregated indicator of agricultural commodity price developments, allowing for the consideration

Variables	Calculation	Variable type
Working capital investment policy (WCIP)	$(\text{current assets} - \text{current liabilities}) / \text{sales}$	Dependent variable
Working capital investment policy (WCIP)	$(\text{current assets} - \text{current liabilities}) / \text{sales}$	Independent variable
Size of the company (SOC)	$\ln(\text{total assets})$	
Growth opportunities (GO)	$(\text{sales}_t - \text{sales}_{t-1}) / \text{sales}_{t-1}$	
Asset structure (tangibility) (AS)	$\text{fixed assets} / \text{total assets}$	
Capital structure (indebtedness) (CS)	$\text{current liabilities} / \text{total assets}$	
Return on assets (ROA)	$\text{net profit} / \text{total assets}$	
Return on equity (ROE)	$\text{net profit} / \text{total equity}$	
Government subsidies per hectare of land (SUB)	reflecting the institutional support of agriculture	Control variables
Agricultural producer price index (APPI)	aggregates the price trends of agricultural commodities and accounts for external price shocks	

Source: Own processing

Table 1: Description of used variables.

of the impact of external price shocks. Including these variables in the model enabled a more precise identification of the external environment's impact on working capital management and helped mitigate the risk of endogeneity in the estimates. These data were sourced from the Czech Statistical Office and the Ministry of Agriculture of the Czech Republic.

The dataset consists of panel data from 2,516 agricultural enterprises. The companies were stratified by size, and only medium, large, and very large enterprises were included in the final sample. This was done to eliminate differences in accounting practices and working capital management strategies typical of small family farms.

Table 1 indicates the description of the used variables in this research. This table includes variables such as working capital investment policy, size of the company, growth opportunities, asset structure (tangibility), capital structure (indebtedness), return on assets and return on equity.

Current Assets include inventories, receivables, cash, and other short-term assets that can be converted into cash within one year. Current Liabilities represent obligations due within one year, such as payables to suppliers, short-term loans, and tax liabilities. Fixed Assets include buildings, equipment, land, technology, and other assets with a useful life exceeding one year. Total Assets represent the sum of current and long-term assets. Net Profit represents profit after tax. Total Equity includes share capital, reserve funds, retained earnings, and similar items. Sales refers to the reported figure corresponding to "total sales," i.e., total revenues from products, services,

and goods as recorded in the income statement. Due to the nature of agricultural enterprises, this is an aggregate indicator without further breakdown by type of revenue.

Working capital is a key element in maintaining liquidity and operating efficiently for a company. The importance of variables such as company size, growth opportunities, asset structure, capital structure, return on assets, and return on equity are reflected in various aspects of working capital management.

Larger companies typically have larger amounts of working capital, which allows them to better manage their operating needs and weather seasonal fluctuations in demand. A company's size can also affect its ability to obtain credit and optimize supplier relationships, which are key to working capital management.

Companies with high growth opportunities often need more working capital to finance expansion, new product development, and market share expansion. Growth opportunities can lead to the need to invest in inventory and accounts receivable, which can affect liquidity and overall working capital management.

A higher proportion of tangible assets to a company's total assets often means that it can more easily secure financing through collateral. Tangible assets such as machinery and real estate can be used to secure loans, which improves a company's ability to manage working capital and respond to liquidity needs.

Higher levels of debt can affect a company's liquidity, as debt and interest payments can limit

available working capital. On the other hand, proper management of the capital structure can ensure that there are sufficient funds for operating activities and working capital investments.

Return on assets (ROA) shows how efficiently a company uses its assets to generate profit. A higher ROA indicates that a company is able to manage its working capital effectively and minimize waste, contributing to better financial stability and the ability to meet short-term obligations. Net profit (EAT) was used for this indicator for several reasons. In agriculture, government subsidies and tax benefits play a significant role and have a direct impact on the final profit (EAT). Using EAT thus better captures the true economic effect on the return on assets, accounting for all actual income and expenses, including taxes. Since the GMM model and the discussion include control variables such as government subsidies and commodity prices, which also affect net profit after tax, it was methodologically more consistent to use EAT. In models, where capital structure is included as a separate variable, using EAT is acceptable because the effect of interest expenses is captured elsewhere. EBIT is preferred where the debt structure is not explicitly controlled for.

Return on equity (ROE) is a key indicator for investors, as it shows how efficiently a company generates profits for shareholders. A high ROE can indicate that a company is successfully managing its working capital and is able to generate high returns on investments, which strengthens investor confidence and access to additional financing.

Each of these variables plays an important role in working capital management and affects a company's ability to maintain liquidity and operate efficiently. Proper analysis of these factors is key to strategic planning and optimization of working capital within a company.

Granger causality test helps to determine whether one time series or variable can be considered a predictor of another time series or variable. In this research, Granger causality test can be used to identify determinants that can influence working capital investment policy. Using Granger causality test, it is possible to determine whether determinants of working capital can predict or influence working capital management (working capital investment policy) of enterprises operating in agriculture in the Czech Republic. The following equations can be used to apply Granger causality test:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{\sigma} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{\gamma} \beta_{2i} \Delta X_{t-1} + \varepsilon_{1t} \quad (1)$$

$$\Delta X_t = \varphi_0 + \sum_{i=1}^{\gamma} \varphi_{1i} \Delta X_{t-i} + \sum_{i=1}^{\gamma} \varphi_{2i} \Delta Y_{t-1} + \varepsilon_{2t} \quad (2)$$

Y_t represents working capital investment policy, X_t represents determinants of working capital investment policy such as size of the company, growth opportunities, assets and capital structure (tangibility and indebtedness), return on assets and return on equity. Two important control variables are also included in the model: government subsidies per hectare of land and the agricultural producer price index, which account for the macroeconomic context and support for agriculture. β_0, φ_0 jsou konstantní členy, $\beta_{1i}, \beta_{2i}, \varphi_{1i}, \varphi_{2i}$ jsou koeficienty odvozené z modelu, $\varepsilon_{1t}, \varepsilon_{2t}$ jsou náhodné složky.

The Generalized Method of Moments (GMM method) is a statistical technique used to estimate the parameters of economic and statistical models. It is based on the theory of moments, where it is assumed that certain moments should correspond to empirical data. The main goal of the GMM method is to minimize the differences between the theoretical and empirical moments, which allows for efficient and robust estimation even in the presence of heteroskedasticity or endogeneity.

To ensure the explanatory power of the obtained results, all variables will be tested for statistical significance at 1%, 5%, and 10% significance levels. Additionally, the robustness of the model will be validated using the Sargan/Hansen J-test. The model is considered robust if the results of the Sargan/Hansen test exceed 0.05. The following equation can be used to find the determinants of working capital of companies in Agriculture in the Czech Republic.

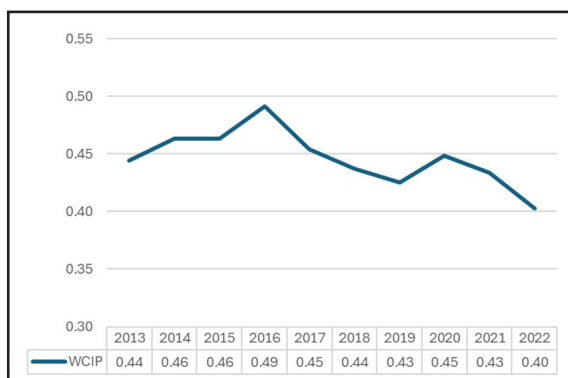
$$WCIP_{it} = \alpha_1 + \beta_1 * \Delta WCIP_{i,t-1} + \beta_2 * X_{1it} + \beta_3 * X_{2it} + \dots + \beta_n * X_{nit} + \varepsilon_{it} \quad (3)$$

The dependent variable $WCIP_{it}$ represents the working capital investment policy in Agriculture in the Czech Republic at time t , $WCIP_{i,t-1}$ is a lagged dependent variable, X_{nit} represents size of the company, growth opportunities, assets and capital structure (tangibility and indebtedness), return on assets and return on equity. The model also incorporates two important control variables: government subsidies per hectare of land and the agricultural producer price index, which reflect the macroeconomic context and support for the agricultural sector. β_0 and ε_t is the model constant and the residual component of the model.

Results and discussion

Within this part of the article, you can find the results of the comparison method, Granger causality test and GMM method, including the evaluation of the achieved or found results. Median values of the individual variables were used for the comparative analysis and the subsequent graphs.

Figure 1 illustrates the development of the working capital to sales ratio (WCIP), a key indicator of companies' financial strategy in managing short-term assets and liabilities. This ratio is calculated as the difference between current assets and current liabilities divided by sales, allowing for monitoring how intensively companies invest in working capital relative to their performance.



Notes: The x-axis represents the individual years for which the data are analyzed, the y-axis shows the development of the working capital investment policy indicator as a ratio variable

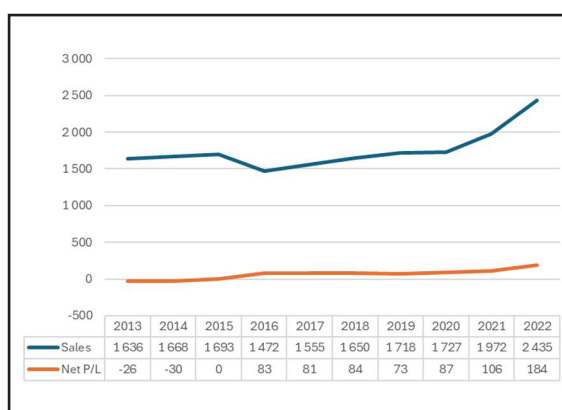
Source: Own processing based on data from the Orbis database

Figure 1: Development of working capital investment policy in Agriculture in the Czech Republic for the period 2013 to 2022 (ratio variable).

During the analyzed period, WCIP increased from 0.44 in 2013 to 0.49 in 2016, which may indicate a more expansive working capital policy associated, for example, with company size growth (SOC) or higher return on assets (ROA). However, since 2016, the ratio has gradually declined, with a slight fluctuation in 2020, reaching 0.40 in 2022. This trend may reflect an increasing share of fixed assets (AS), rising indebtedness (CS), or limited growth opportunities (GO), leading companies to adopt a more restrictive approach to working capital management. The trend also reflects the impact of external economic conditions such as subsidy policies, market uncertainties, and commodity price fluctuations. Overall, the graph highlights the dynamic nature of WCIP and underscores the importance of its

management in relation to the internal and external determinants identified in the study.

Figure 2 depicts the development of sales and net profit/loss (Net P/L) in the agricultural sector in the Czech Republic during the years 2013 to 2022. Sales in the sector show a gradual increase with a slight decline in 2016, followed by stabilization and a significant rise in 2021 and 2022. While sales amounted to 1,636 million CZK in 2013, they reached 2,435 million CZK in 2022, representing an increase of nearly 49% over the observed period. This trend signals growing production capacity in the sector or favorable developments in agricultural product prices.



Notes: The x-axis represents the individual years for which the data are analyzed, the y-axis shows the development of revenue and net P/L in absolute values in million CZK (median)

Source: Own processing based on data from the Orbis database

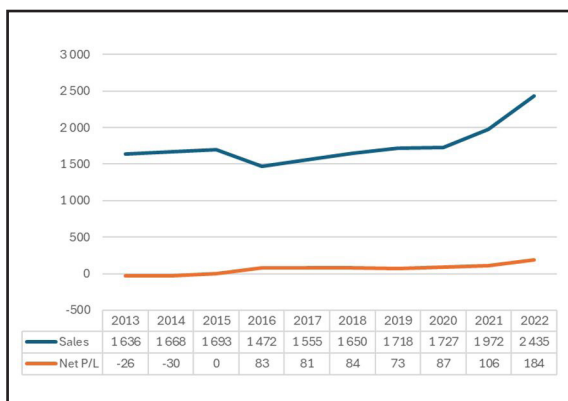
Figure 2: Development of growth opportunities in Agriculture in the Czech Republic for the period 2013 to 2022 (in mil. CZK).

The net profit/loss trend shows a positive turnaround after loss-making years in 2013 and 2014. From 2015 onward, Net P/L stabilizes in positive territory, with notably higher profits recorded in the last three years, peaking at 184 million CZK in 2022. This development may result from more efficient management, optimization of cost structures, or increased mechanization and technological innovations. At the same time, lower profits in years with rising sales (e.g., 2018) may indicate higher working capital requirements or volatility in input costs.

Overall, the graph reveals a positive growth trend and improved financial performance of the agricultural sector during the period, although a certain degree of volatility typical of the primary sector remains evident. These findings can contribute to a deeper understanding of the dynamics of growth opportunities and financial stability in agriculture and serve

as input for the development of appropriate policies in agricultural financing.

Figure 3 presents the development of the rate of sales growth in agriculture in the Czech Republic for the period 2013 to 2022. The growth rate exhibits significant volatility, with low or negative values prevailing in the first half of the period (2013–2016), which may be related to unstable market conditions in the agricultural sector, including commodity price fluctuations and climatic impacts.



Notes: The x-axis represents the individual years for which the data are tracked, the y-axis shows the percentage change in the rate of sales growth

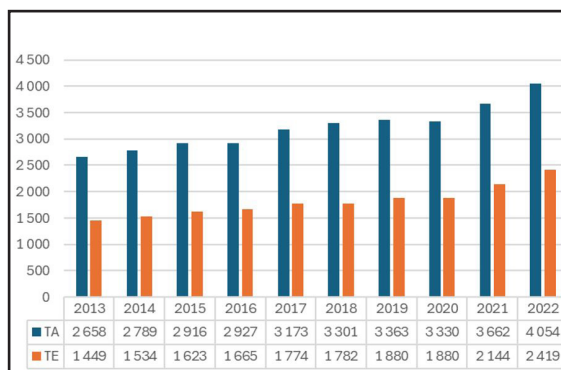
Source: Own processing based on data from the Orbis database

Figure 3: Development of rate of sales growth in Agriculture in the Czech Republic for the period 2013 to 2022 (in %).

In 2017, there was a temporary increase (11.29%), followed by a renewed decline and stagnation during 2018–2020, when growth was again suppressed (e.g., -0.83% in 2020), likely influenced by the COVID-19 pandemic. Conversely, the years 2021 and 2022 show a marked improvement with growth rates of 14.28% and 25.63%, respectively, indicating a renewed growth potential in the sector. These results support the article’s conclusions about the positive development in the efficiency of working capital management in recent years and suggest that growth opportunities, which are among the key determinants of working capital investment policy, have played a significant role in improving the financial stability of agricultural enterprises.

Figure 4 presents the development of the size of companies in agriculture in the Czech Republic for the period 2013 to 2022. The development of total assets and equity during 2013–2022 shows a stable upward trend, which accelerates particularly in 2021 and 2022. The value of assets increased from CZK 2,658 million in 2013 to CZK 4,054 million in 2022, while equity grew

from CZK 1,449 million to CZK 2,419 million. This growth indicates an improving asset structure of companies and strengthening financial stability of the sector. The increasing value of equity may also reflect better company management, positive developments in profitability indicators (e.g., ROA and ROE), and a more responsible approach to financing.



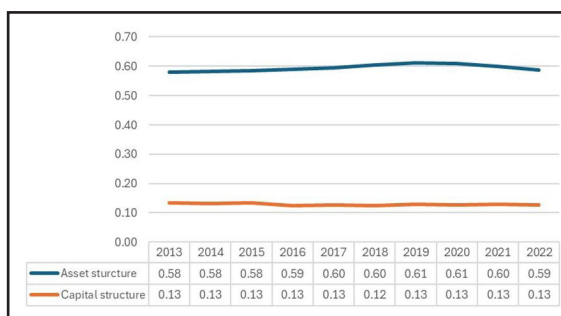
Notes: TA = total assets, TE = total equity, the x-axis represents the individual years for which the data are analyzed, the y-axis represents total assets and total equity in absolute values in million CZK (median)

Source: Own processing based on data from the Orbis database

Figure 4: Development of size of the company in Agriculture in the Czech Republic for the period 2013 to 2022 (in milion CZK).

The cumulative growth of these variables may also result from more efficient working capital management, supporting the claim that effective WCIP contributes to the long-term stability and development of agricultural enterprises in the Czech Republic.

Figure 5 represents the development of asset structure and capital structure in agriculture in the Czech Republic for the period 2013 to 2022.



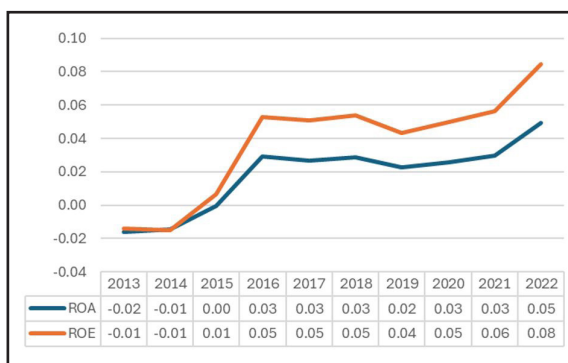
Notes: The x-axis represents the individual years for which the data are analyzed, the y-axis shows the development of the ratio variables asset structure and capital structure

Source: Own processing based on data from the Orbis database

Figure 5: Development of assets structure and capital structure in Agriculture in the Czech Republic for the period 2013 to 2022 (ratio variable).

The asset and capital structure of agricultural enterprises remained relatively stable during 2013–2022. The proportion of fixed assets to total assets ranged between 0.58 and 0.61, with the highest value recorded in 2019 (0.61), followed by a slight decline to 0.59 in 2022. This stability indicates consistent investment behavior by companies in long-term assets. The capital structure hovered around 0.13 throughout the observed period, reflecting a relatively low level of indebtedness and a conservative financial policy. This consistent development may signal that the sector’s financial stability is supported by a sustainably maintained capital structure and that the chosen investment policy shows no significant fluctuations, which aligns with the "relaxed investment policy" characteristic mentioned in the abstract. Such stability creates conditions for increasing profitability and efficiency in working capital management over the long term.

Figure 6 represents development of ROA and ROE in Agriculture in the Czech Republic for the period 2013 to 2022. The dynamics of ROA and ROE is similar so far as rate of assets and equity growth is the same. Unlike other sectors of material production, the agriculture has low level of profitability as well as losses in 2013 and 2014. Still, ROA and ROE increase and as of 2022 respectively are 5% and 8%.



Notes: The x-axis represents the individual years for which the data are analyzed, the y-axis shows the development of the ratio variables ROA and ROE
Source: Own processing based on data from the Orbis database

Figure 6: Development of ROA and ROE in Agriculture in the Czech Republic for the period 2013 to 2022 (ratio variable).

However, there is no evidently close connection between profitability and WCM. Thus, during 2013-2016 growing working capital-to-sales ratio was accompanied by rising of financial results from loss 26 th. Euro in 2013 to net profit 83 th. Euro in 2016. From 2020 to 2022 tendency was opposite so far as improving of WCM through

faster turnover of current assets also brought to increasing of ROA and ROE, respectively from 3% to 5% and from 5% to 8%.

Table 2 presents the results of the Granger causality test. The results of the Granger causality test reveal causal relationships between the analyzed variables and the working capital investment policy (WCIP).

Granger causality test	F-Statistic	Probability
SOC \Rightarrow WCIP	23.2459	1e-6*
WCIP \Rightarrow SOC	3.10948	0.0779***
GOP \Rightarrow WCIP	13.9502	0.0002*
AS \Rightarrow WCIP	22.7520	2e-6*
WCIP \Rightarrow AS	28.6127	9e-8*
CS \Rightarrow WCIP	152.120	1e-34*
WCIP \Rightarrow CS	218.688	5e-49*
ROA \Rightarrow WCIP	32.2328	1e-8*
WCIP \Rightarrow ROA	39.7218	3e-10*
WCIP \Rightarrow ROE	151.905	1e-34*

Notes: * = 1% statistical significance, ** = 5% statistical significance, *** = 10% statistical significance
Source: Own processing

Table 2: Results of the Granger causality test between the analyzed variables.

The results of the Granger causality test indicate that there is a relationship between working capital investment policy (WCIP) and size of companies (SOC). Based on these results, it can be concluded that company size has a statistically significant causal effect on working capital investment policy, which suggests that changes in company size can predict changes in WCIP. Conversely, WCIP does not have a statistically significant effect on company size (SOC), although there is a weak indication of a relationship. Furthermore, the results indicate that growth opportunities (GOP) have a significant effect on WCIP. Thus, GOP can predict changes in working capital investment policy (WCIP). Furthermore, it was found that asset structure (AS) is a significant factor influencing WCIP, which suggests that changes in asset structure can predict changes in working capital investment policy. The results also show that WCIP also influences asset structure (AS), which means that there is a mutual causality between WCIP and asset structure. Another variable analyzed was the capital structure (CS) in relation to the working capital investment policy (WCIP). The results indicate a two-way relationship between the above-mentioned variables. Capital structure has a strong causal effect on WCIP, i.e. the company's debt is a significant factor influencing the working capital investment policy and vice versa. Furthermore,

a two-way relationship was demonstrated between return on assets (ROA) and WCIP. On the contrary, only a one-way relationship was found between WCIP and return on equity (ROE). The results show that WCIP has a strong causal effect on return on equity (ROE).

The tests suggest that there is significant causality between working capital investment policy and most of the factors analyzed, with some relationships being bidirectional (e.g. WCIP and asset structure or WCIP and capital structure). These results underscore the importance of these variables for effective working capital management, as changes in them can lead to adjustments in WCIP and vice versa. The Granger causality test first helps determine whether causal relationships exist between the examined variables. If these relationships do exist, the GMM method is then used to more accurately model these relationships and to eliminate potential distortion caused by endogeneity. Table 3 presents the results of the GMM method.

The results of the GMM estimation provide a comprehensive view of the factors influencing working capital policy (WCIP) in the agricultural sector of the Czech Republic.

The lagged value of WCIP exhibits a strong and statistically significant positive effect (coefficient = 0.30, $p = 0.001$), indicating that working capital decisions have strong dynamics and past policy significantly influences current firm behavior. This result is consistent with the findings of García-Teruel and Martínez-Solano (2007), who emphasize the persistence of working capital

in firms. It also highlights that firm management often maintains a consistent approach to managing liquidity and short-term assets. These findings correspond with recent studies, such as Vučković et al. (2017), who stress that agricultural enterprises exhibit high persistence in working capital management due to production seasonality and the risky nature of the sector. Similarly, research by Yıldız et al. (2023) confirms that persistent working capital management strategies in agricultural firms are driven by transaction costs and the specific liquidity needs associated with production cycles.

The size of the company (SOC) also has a positive effect (coefficient = 0.11, $p = 0.001$). According to Baños-Caballero et al. (2012), larger firms have better financing options, improved access to loans, and more sophisticated financial instruments. Consistent with the findings of Dalci et al. (2019), larger companies also have a greater ability to efficiently manage inventories and receivables, which enhances their capacity to maintain higher levels of working capital. Similar conclusions were confirmed by Mardones (2021) and Khan et al. (2024), who highlight that larger agricultural enterprises have better access to bank financing and thus are better able to manage inventories and receivables. They also emphasize the superior financial capacity of larger agricultural entities, which leads to greater working capital holdings.

Growth opportunities (GO) show a negative relationship (coefficient = -0.05, $p = 0.005$), which corresponds to the findings of Deloof (2003). Firms with high growth potential tend to minimize

Variable	Coefficient in relation to WCIP	Probability	Studies
Lagged WCIP	0.30	0.001	García-Teruel and Martínez-Solano (2007), Yıldız et al. (2023)
Size of the company (SOC)	0.11	0.001	Baños-Caballero et al. (2014), Dalci et al. (2019)
Growth opportunities (GO)	-0.05	0.005	Deloof (2003), Shakila and Mohiuddin (2021)
Asset structure (tangibility) (AS)	-0.28	0.001	Nazir and Afza (2009), Baños-Caballero et al. (2014)
Capital structure (indebtedness) (CS)	-0.25	0.001	Qiao (2023), Myers (2001)
Return on assets (ROA)	0.19	0.004	Jamalinesari and Soheili (2015), Nazir and Afza (2009)
Return on equity (ROE)	-0.16	0.015	Baños-Caballero et al. (2014), Nazir and Afza (2009)
Government subsidies per hectare of land (Subsidy)	0.09	0.020	Latruffe (2010), Banga (2016)
Agricultural producer price index (AgriPriceIndex)	0.07	0.030	Galko and Jayet (2011), Latruffe (2010)
J-statistic	25.84		

Source: Own processing

Table 3: Results of the GMM method between the analyzed variables .

inventories and other components of working capital in order to invest more in development and expansion. During growth periods, companies tend to adopt a strategy aimed at minimizing working capital. This negative relationship between growth opportunities and working capital reflects a resource optimization strategy focused on capital investments, as noted in the recent meta-analysis by Shakila and Mohiuddin (2021), which confirms that firms with high growth potential often reduce inventories and short-term receivables to free up resources for fixed investments. This phenomenon is particularly prominent in the agricultural sector, where investments in technology and land are key for long-term growth (Harkness et al., 2021). The results are also consistent with the pecking order theory (Myers & Majluf, 1984) in the modern agricultural context.

The negative coefficients for asset structure (AS) (-0.28, $p = 0.001$) and capital structure (CS) (-0.25, $p = 0.001$) indicate that a higher share of fixed assets and greater indebtedness reduce liquid assets, which aligns with the theories of Nazir and Afza (2009) and Myers (2001). Higher debt levels often mean a limited ability for firms to maintain large inventories or extend trade credit. The negative impact of a high proportion of fixed assets and leverage on working capital is also supported by Flannery and Öztekin (2024), who showed that firms with large volumes of fixed investments have less flexibility in managing liquidity, leading to reduced working capital. This finding is further corroborated by the study by Qiao (2023), which analyzed the impact of capital structure in agricultural firms and emphasized the constraints imposed by high leverage in working capital management.

In terms of profitability, the results confirm that return on assets (ROA) shows a positive effect (coefficient = 0.19, $p = 0.004$), meaning that efficient use of assets supports higher working capital, as it enhances the firm's capacity to maintain liquidity. This is consistent with the findings of Jamalinesari and Soheili (2015), who observed that effective asset utilization contributes to a greater ability to hold working capital.

On the other hand, return on equity (ROE) has a slightly negative effect (coefficient = -0.16, $p = 0.015$), which may suggest that firms with high financial efficiency tend to reduce the need to hold large reserves of working capital (Baños-Caballero et al., 2014). This negative influence may indicate that firms with higher ROE optimize short-term assets and liabilities to improve financial efficiency.

Similar conclusions were drawn by Alvarez et al. (2021).

Government subsidies per hectare of land and the agricultural producer price index were included as control variables. Both variables show a statistically significant positive effect (subsidies: coefficient = 0.09, $p = 0.020$; price index: coefficient = 0.07, $p = 0.030$). This confirms the conclusions of Latruffe (2010) and Banga (2016), who found that government subsidies improve the financial health and liquidity of agricultural enterprises, enabling them to maintain higher levels of working capital.

The significant positive effect of government subsidies per hectare of land on working capital investment policy is consistent with the findings of Kumbhakar et al. (2023), who showed that subsidies improve liquidity and allow for higher working capital levels, which is crucial in agriculture for managing seasonal fluctuations. This aligns with the conclusions of Latruffe (2010) and Banga (2016), who found that government subsidies improve the financial health and liquidity of agricultural enterprises, enabling them to maintain higher levels of working capital.

The agricultural producer price index, as an indicator of market conditions, also shows a significant effect. This is supported by a recent study by Galko and Jayet (2011), which shows that rising commodity prices increase the available financial resources of agricultural businesses and enhance their liquidity.

The Sargan/Hansen test confirms the robustness of the model used in this analysis. All results were tested at the 1% significance level (probability = 0.0000). The test statistic value of 25.84 indicates model robustness when checking for over-identifying restrictions, confirming the correctness of the model specification.

Compared to recent studies, the results of this research are consistent with the general trend of findings that working capital management in agriculture is influenced by both internal firm factors (such as size, asset structure, and growth opportunities) and external forces (such as government support and commodity prices). Studies like Yıldız et al. (2023), Khan et al. (2024), and Kumbhakar et al. (2023) support the conclusion that a comprehensive approach to financial resource management is essential to maintain the competitiveness of agricultural enterprises.

An important contribution of this study is the confirmation of the significance of government subsidies and price indices as control variables, which were not always explicitly included in previous research (see Flannery and Öztekin, 2024; Galko and Jayet, 2011).

Conclusion

This article examined the key determinants of working capital in Czech agriculture in the years 2013 to 2022 and analyzed their impact on the efficiency and stability of enterprises. The comparison method was used to compare different entities and identify key characteristics affecting working capital management. To determine the causal relationships between variables, the Granger causality test was applied, which helps to identify whether one time series can predict the values of the other. Furthermore, the GMM (Generalized Method of Moments) method was used to estimate the model parameters, which allowed to take into account endogeneity and heteroskedasticity in the data. All analyses were performed on the basis of annual data obtained from the Orbis database, which provided a robust basis for examining the dynamics of working capital in Czech agriculture. Most of the analyses were performed using the Eviews 10 program. 2 516 enterprises operating in agriculture in the Czech Republic were included in the research.

Working capital management in agricultural enterprises in the Czech Republic during the years 2013–2022 exhibits a variable but generally positive trend in the second half of the period. There is an improvement in efficiency and stabilization of key indicators, with the ratio of working capital to sales (WCIP) slightly declining after 2016. Conversely, improvements in return on assets (ROA) and return on equity (ROE), along with increasing equity, indicate higher quality of management. The development of sales and profit confirms growing production capacity and better financial performance of the sector, although the sector remains sensitive to external shocks, reflected in higher volatility. A stable asset structure and conservative capital structure support long-term financial stability and suggest a sustainable investment approach.

Results of the Granger causality test indicate that firm size (SOC) has a statistically significant causal effect on working capital investment policy (WCIP), meaning that changes in firm size predict changes in working capital management. Growth opportunities (GOP) also significantly

influence WCIP, with firms possessing higher growth potential tending to reduce working capital to enable greater investment in development. Asset structure (AS) and capital structure (CS) are additional significant factors affecting WCIP, with bidirectional causality observed between WCIP and both AS and CS. WCIP has a strong positive effect on return on equity (ROE), whereas the reverse effect is less pronounced.

The results of the GMM method provide a more detailed insight into the factors influencing working capital policy in the agricultural sector. The lagged value of WCIP shows a strong and statistically significant positive effect, indicating that working capital decisions exhibit high persistence and past policies significantly influence current firm behavior. Firm size (SOC) also has a positive impact on WCIP, which aligns with the view that larger firms have better access to financing and more efficiently manage inventories and receivables. Conversely, growth opportunities (GO) exhibit a negative relationship with WCIP — firms with greater growth potential tend to minimize working capital to free up resources for investment. Asset structure (AS) and capital structure (CS) have negative coefficients, meaning that a higher share of fixed assets and greater indebtedness reduce liquid assets and thus working capital. This phenomenon can be explained by the limited ability of firms to hold inventories or offer trade credits when facing high debt levels and fixed investments.

In terms of profitability, return on assets (ROA) has a positive influence on WCIP, while return on equity (ROE) has a slightly negative effect, suggesting that firms with higher financial efficiency optimize their short-term assets and liabilities. Two control variables, government subsidies per hectare and the agricultural producer price index, were included, both showing a statistically significant positive impact on WCIP. Subsidies improve the liquidity of agricultural enterprises, enabling them to maintain a higher level of working capital and better manage seasonal fluctuations. Rising prices of agricultural products increase the value of inventories and working capital, which is consistent with recent research highlighting the positive impact of commodity prices on the financial health of agricultural firms. Statistical tests (Sargan/Hansen) confirmed the robustness of the model.

The study thus demonstrates that effective working capital management in agriculture requires a comprehensive approach that reflects both the internal characteristics of enterprises

and external macroeconomic and institutional conditions. Unlike more general studies, this article includes not only standard internal factors (such as firm size, asset structure, and profitability) but also significant external variables, especially government subsidies and agricultural commodity prices, enabling a more detailed analysis of the influences on financial stability and liquidity of agricultural enterprises. For the scientific community, it contributes by extending the methodological framework and emphasizing the specifics of the agricultural sector, opening avenues for further research, for example, through the use of advanced causal analysis techniques or segmentation by firm size.

Among the main limitations of the study are its restricted geographic scope limited to the Czech sector, the exclusion of some macroeconomic factors (e.g., inflation, interest rates), and the fact that the applied Granger causality test does not imply true causation, highlighting the need for further research employing more advanced methods.

For policymakers, the study offers concrete recommendations on how to optimize agricultural support: focus on targeted subsidy programs that respond to market and seasonal conditions, promote the growth of medium and larger enterprises to enhance their financial resilience, and integrate macroeconomic indicators into the planning

and evaluation of interventions.

Stakeholders, especially farmers and managers of agricultural enterprises, gain guidance for strategic working capital management with regard to seasonal fluctuations and external financing sources, optimizing capital structure, and maximizing the use of available subsidies.

Future research should expand the geographic and data scope, introduce more detailed segmentation of enterprises, and utilize advanced causal analysis techniques (e.g., impulse response analysis, network analysis) to better understand the complex interactions between internal and external factors and provide even more relevant practical recommendations.

Overall, the study emphasizes the importance of integrated financial management that links internal factors with external macroeconomic influences and government support as a key tool for sustainable and efficient working capital management in agriculture.

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