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Working Capital and Corporate Performance

Empirical Evidence from Three Manufacturing Industries

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ABSTRACT :
This master's thesis aims to investigate the optimal working capital level for the manufacturing industry in the mining, quarrying, and construction segment between 2013-2021. The sample includes all geographical regions. In addition, the thesis tries to find a benchmark for the multinational company in this industry. The availability of cash is also included in the study because it is essential part in investing in working capital.

The study uses fixed-effect panel analysis to investigate the relationship between working capital and corporate profitability. The sample includes 809 observations. Return on assets (ROA) measures profitability, while cash conversion cycle (CCC) measures working capital management. The control variables are size, leverage, and growth. Cash flow and cash holding measurements evaluate the availability of cash flow.

The results show a convex relationship between working capital and profitability. On average companies should adopt aggressive working capital management. This action aims to shorter the CCC, and specifically DIO and DSO. DIO and DSO have the most significant impact on profitability, and the firms should focus on shortening these two components to achieve superior profitability.

KEYWORDS: working capital, cash conversion cycle, cash flow, manufacturing, mining

TIIVISTELMÄ :
Tämän pro gradu -tutkielman tavoitteena on selvittää optimaalista käyttöpääomatasoa kaivos-, louhinta- ja rakennussegmentissä vuosina 2013-2021. Otos sisältää kaikki maantieteelliset alueet. Lisäksi opinnäytetyössä pyritään löytämään vertailukohta alan monikansalliselle yritykselle. Myös käteisen saatavuus sisältyy tutkimukseen, koska se on olennainen osa käyttöpääomaan sijoittamisessa.

Tutkimuksessa käytetään paneelianalyysiä käyttöpääoman ja yrityksen kannattavuuden välisen suhteen tutkimiseen. Otos sisältää noin 809 havaintoa. Tutkimuksessa ROA mittaa kannattavuutta, kun taas CCC mittaa käyttöpääoman hallintaa. Ohjausmuuttujat ovat koko, vipuvaikutus ja kasvu. Kassavirran ja kassavarojen muuttujat testaavat kassavirran saatavuutta.

Tulokset osoittavat kuperan suhteen käyttöpääoman ja kannattavuuden välillä. Toisin sanoen yritysten tulisi omaksua aggressiivinen käyttöpääoman hallinta. Tällä toimella pyritään lyhentämään käyttöpääomasykliä ja erityisesti varastonkiertoa ja myyntisaamisia. Varastonkierolla ja myyntisaamisella on merkittävin vaikutus kannattavuuteen, ja yritysten tulisi keskittyä näiden kahden komponentin lyhentämiseen erinomaisen kannattavuuden saavuttamiseksi.

AVAINSANAT: käyttöpääoma, kassan muuntosykli, kassavirta, kaivostoiminta

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Abbreviations

AP Accounts Payable

AR Accounts Receivables

CCC Cash Conversion Cycle

DAP Delivered-at-Place

DPO Days in Accounts Payable

DIO Days in Inventories

DSO Days in Accounts Receivable

EBIT Earnings Before Interest and Taxes

NTC Net Trade Cycle

NWC Net Working Capital

ROA Return on Assets

SCF Supply Chain Finance

VIF Variance Inflation Factor

WCM Working Capital Management

1 Introduction

The aim of corporate finance theories and measurements is to determine the best investment strategies for a business entity. It includes long-term and short-term planning and strategies. The strategies function as action plans to achieve company's goals. Tactics are more specific actions to achieve a goal. The long-term financial management literature covers, for example, capital budgeting and capital structure. This field is having better focus on empirical research than short-term. Working capital management is part of short-term planning. This action aims to find an optimal trade-off between profitability and risks. The working capital levels significantly affect a company's financial performance and are also an essential source of profit.

The empirical research on this topic woke up after the financial crisis in 2008. This event was a turning point for companies to focus on short-term strategies. Currently, the working capital is a point of discussion due to the different crises beginning in 2020. It started with the COVID-19 followed by the rising logistics and raw costs in 2021. Furthermore, the Russian war against Ukraine made the situation worse. For instance, many western companies left Russia, losing a valuable market. The crises have created new challenges for companies, for example, a lack of raw materials and expensive logistics. These issues have created, for instance, a panic overstocking of materials in inventories to secure the availability of goods. The working capital ratios have recovered from the crises, but there are some obstacles to boost corporate efficiency (PWC, 2022). Currently, companies are facing macroeconomic headwinds due to inflation. This circumstance creates new challenges, such as more expensive funding for firms. For companies, it is necessary to have now an essential focus on working capital management because of the uncertain future. Optimizing working capital during crises helps firms to improve profitability and keep operations running.

The current empirical research focuses on the relationship between working capital management and corporate profitability. The most used ratios for working capital management are cash conversion and net trade cycles. The research has also developed

to add other variables influencing working capital levels and profitability. For instance, Baños-Caballero et al. (2014) investigated how financial constraints affect this relationship. Another research direction is the influence of the availability of cash flow (Afrifa, 2016). Moreover, there has been research on working capital levels in the supply chain network. Hofmann & Wetzel (2019) studied how supply chain partners affect a focal company's working capital.

There are at least four schools of thought for working capital management: traditional, alternative, progressive, and supply chain finance oriented. The traditional school of thought proposes aggressive working capital management. The aim is to minimize the cash conversion cycle to increase profitability. Usually, this means that payment terms towards customer and days in inventories are as short as possible. Simultaneously, the payment terms towards the suppliers should be as long as possible. Most studies support this view (Deloof, 2003; Jose et al., 1996). The alternative school of thought proposes a different view of the relationship. The higher investment in working capital should increase profitability. In other words, a positive relationship between profitability and working capital levels. The progressive school of thought combines two previous views. It argues that there is an optimal level of working capital. The relationship should be inverted U-shaped between working capital and profitability. The last school of thought, supply chain finance oriented, argues that working capital management should consider the whole supply lane. This network includes suppliers' and customers' working capital management (Hofmann & Wetzel, 2019).

1.1 Objective of the study

The aim of this master's thesis is to investigate the optimal working capital level for the manufacturing industry for the mining, quarrying, and construction segments. The industry selection is based on NACE rev. 2 core code 2892. Moreover, the thesis tries to optimize the working capital for multinational company in this industry. The company has noticed the need to release cash from working capital due to uncertain times. The

crisis phase created by the pandemic and disruption in supply chains has changed the approach to 'just-in-case' and thus overstocking materials. The inventory levels have increased sharply, requiring more investment in inventory. The end-customers are also facing full inventories, and this influences the manufacturing side. For instance, decrease in customer orders.

Moreover, higher inventory levels create more expenses for the company, for example, storage costs. The benchmark will help the company to optimize its working capital management. Furthermore, the results help to develop a benchmark for all business lines in the company and optimize their supply chain. The following research questions will be answered in the thesis:

RQ1: *Do companies optimize their working capital to achieve superior financial performance?*

RQ2: *Which working capital component has a positive (negative) effect on profitability?*

Additionally, the hypotheses are formed based on empirical literature and findings. The hypotheses are developed in the theoretical framework chapter 3.6. The hypotheses will be assessed in the empirical part. Furthermore, the regression analysis results will be used to analyze the hypotheses.

The panel data will be used to investigate the relationship between working capital and profitability. The data was based on the company's industry. The period was determined based on data available from its major competitors. Hence, the sample included data from 2013 to 2021. The geographical selection was global because the company and its competitors operate worldwide. Together there were 809 observations.

1.2 Structure of the study

This thesis is divided into the theoretical framework and the empirical part. The first chapter in the theoretical framework presents the definition of working capital and its components. Moreover, the financial ratios and the relationship between profitability and working capital management will be discussed. The chapter is followed by the literature review chapter. This section presents the previous research and theories explaining the relationship between working capital and financial performance. At the end of the chapter, the hypotheses will be presented. The next stage in this thesis is the empirical part, and the first chapter will be related to data and the research methodology. In this chapter, the data, measurement, and formulas are outlined. In addition, descriptive statistics will be presented. The last chapter will present the regression analysis results and discussion on results. The conclusion concludes the thesis.

2 Working capital management

This chapter will give overview of working capital management. Firstly, explain the main terms related to this topic, components that influence decisions, and different measures to calculate working capital cycle, for example, cash conversion cycle. The relationship between working capital and profitability will be discussed before last section. The chapter is concluded by investment in working capital.

2.1 Definition of working capital management

Working capital is defined by the balance sheet's differences between current assets and current liabilities. The current assets are, for example, accounts receivable, cash, inventories, and prepaid expenses. At the same time, current liabilities cover, for example, accounts payable, accrued liabilities, and short-term debt. The working capital measures the company's operational efficiency and financial healthiness. A positive working capital is seen as a positive sign because it indicates a stable financial position. However, high values can indicate problems with inventories. Also, a negative working capital does not always mean a poor financial position if a company can have prepayments and has power over suppliers. Working capital management is short-term financial management is often a source of profit (Chang, 2018). The short-term is defined as a time that is less than one year, while the long-term is a time of more than a year. The working capital may vary by industry (Filbeck & Krueger, 2005). This difference is due to the nature of the industry. According to Filbeck and Krueger (2005), the industry may affect inventory management, credit policy, and pay actions. According to Pratap Singh and Kumar (2014), working capital can be divided into gross and net working capital.

There are different possibilities for calculating this financial ratio, for example, in a cycle or value. Deloof (2003) calculated working capital management in the cash conversion cycle (CCC). Net working capital (NWC) is calculated by the difference between current assets and liabilities, while gross working capital is the sum of all current assets (Pratap

Singh & Kumar, 2014). The different methods to measure the working capital cycle will be explained later in this thesis in chapter 2.3. Moreover, this thesis will measure the working capital management in days.

2.2 Components of working capital in industrial companies

There are three main components in the working capital cycle. The cycle starts with accounts payable. Inventory is between, and the cycle ends with accounts receivable. According to Baños-Caballero et al. (2014), The investment in receivable accounts and inventories is the most important parts in assets.

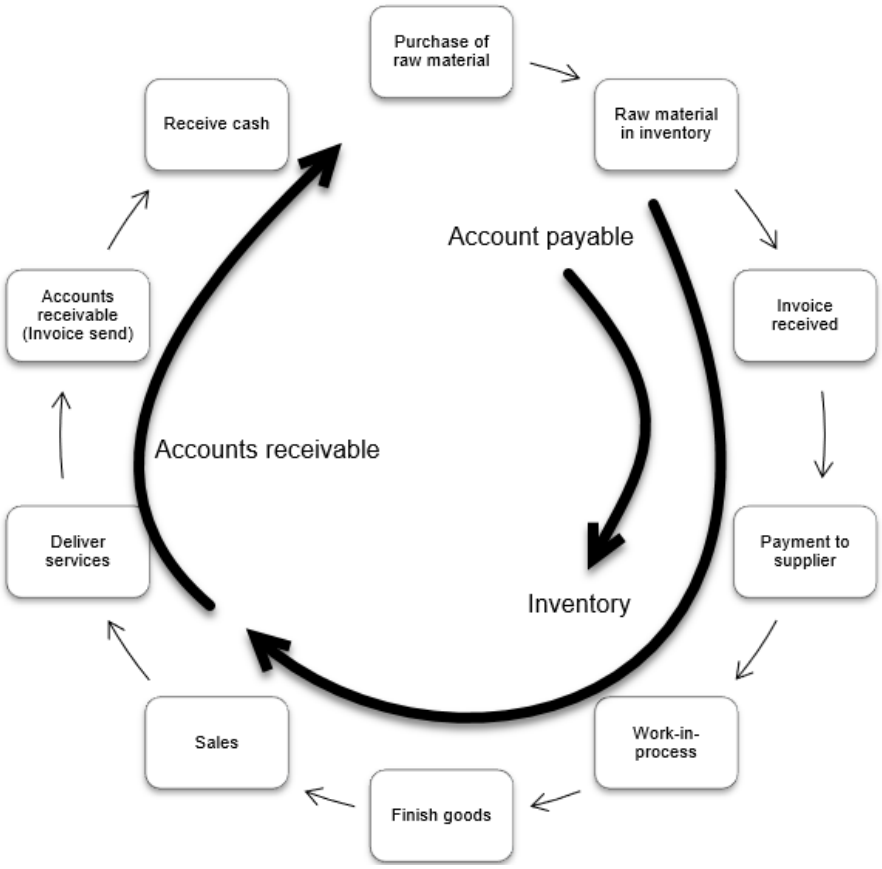

Figure 1. Operating cycle and the components of working capital (Monto, 2013).

Accounts Payable (AP) is the payments that the company owes to its suppliers. In other words, how much suppliers are financing the firm's assets. Longer payment terms to suppliers help a company to have access to the products before paying them. This method can be a cheap and flexible source of financing (Deloof, 2003). A higher value indicates that vendors are financing the operating cycle. This belief is a joint statement in financial literature, but many empirical studies show an inverse relationship between AP and profitability. According to Deloof (2003), less profitable firms are waiting longer to pay their payments.

Moreover, late payments can be costly if a firm is proposed a discount for early payments. The company may acquire early payment discounts when it reduces supplier financing (Baños-Caballero et al., 2014). Hence, a quicker payment to suppliers could improve profitability. Also, discounts on payments can have a better effect than long credit terms.

Another critical component in working capital is inventories. This phase includes all raw materials, working-in-process, and finished goods in the company. Investments in inventories may increase firms' profitability. A firm can benefit from having a higher inventory to have smooth goods availability to customers. High inventory investment may reduce supply costs, the risk of running out, and hedging against price movements (Blinder & Maccini, 1991). In addition, it can improve delivery management. Overall, a company can serve its customers and manage production costs. However, there can be unfavorable effects of having high inventory levels. There are costs related to having stock available, for example, storage costs and insurance. These expenses tend to increase when stock levels are growing. Higher investments in inventories mean that more money is tied to working capital. Most literature on inventory management is related to lead time and capacity.

However, there has been an increase in scientific research on the financial aspects of inventory management. Some aspects from the finance side are, for example, inventory policies, economic order quantity, and financial risk management. Moving inventories

upstream at the inter-organizational level could decrease financing costs (Viskari & Kärri, 2012). The study states that the value of a product is smaller at the beginning of the value chain. Therefore, fewer costs are committed to the product. Viskari and Kärri (2012) argue that financial cost decreases in the last company of the value chain due to the shorter cycle time in inventories. Collaborative inventory management along the supply chain network can critically impact financial performance. Its dimmish capital commitment cost and friction and increases efficiency (Hofmann & Wetzel, 2019).

Accounts receivable (AR) is the last component of the working capital cycle. This phase includes the credit sales from a customer which have not yet been received. In other words, the customer is expected to pay in the future. A shorter credit term to customers indicates a smaller investment in working capital management. On the one hand, better trade credit may increase sales because customers have assessed product quality before paying (Deloof, 2003; Deloof & Jegers, 1996). Providing trade credit may have a negative effect. For instance, money is tied up in working capital. The AR should increase if a company is receiving higher profits. However, a long collection period can indicate issues in liquidity and payment recovery (Chang, 2018). Therefore, a company should decrease investment in AR if they have a shortage of cash (Deloof & Jegers, 1996). Viskari and Kärri (2012) found that shorter payment terms would optimize internal financial flows in the value chain. Furthermore, this could give a competitive advantage in the supply chain.

Trade credit policies cover both AP and AR. It allows for more flexibility in these two components and optimizes working capital management. Utilizing the trade credit policies is more attractive in countries that have poorer investor protection. Therefore, companies can use suppliers to finance growth if it has access to informal credit (Deloof, 2003).

2.3 Measuring working capital

There are different measurement methods to calculate working capital management. The measurements are traditional ratios, cash conversion cycle, and net trade cycle. Most of the literature uses cash conversion cycle. For instance, Deloof (2003) used this method when investigating Belgian non-financial firms. Moreover, the measurement is more accessible for empirical research than the others.

2.3.1 Traditional ratios

The current ratio, quick ratio, and the ratio of NWC to current liabilities are traditional measures of corporate liquidity. However, these ratios do not implement relevant indicators from a cash-flow standpoint (Jose et al., 1996). Therefore, the ratios cannot give meaningful results because operating cash flow is central to liquidity analysis. Richards and Laughlin (1980) argue that the static indicators fail to provide adequate information on the cash flow process. The ratios present the liquidation rather than an approach to liquidity analysis. Moreover, they outlined that the focus should be on the firm's ability to cover its obligations with cash flows from inventory and AR—secondly, the sensitivity of operating cash flows to declining sales and earnings. Hence, operating cash flow is more critical in liquidity analysis than asset liquidation value (Richards & Laughlin, 1980).

2.3.2 Cash conversion cycle

The cash conversion cycle (CCC) method is one of the famous measures of working capital management. The measurement can give an insight into supply chain efficiency. It was first presented by Gitman (1974) and is derived from the difference between purchasing raw materials and paid finished goods. The measurement is based on accrual accounting and is indirectly related to the company's valuation (Gentry et al., 1990).

According to Jose et al. (1996), the CCC is dynamic because it combines balance sheet and income statement data.

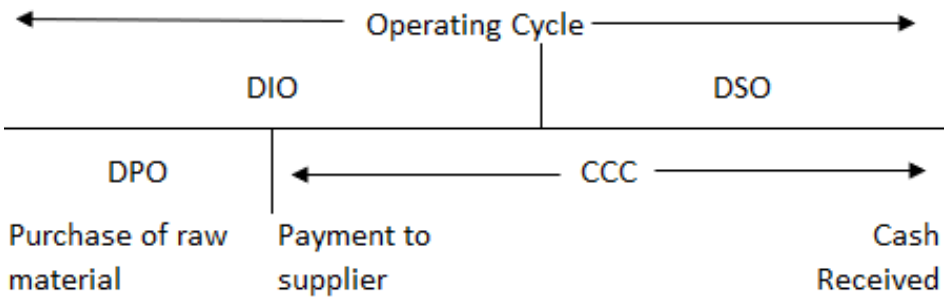

Figure 2. The cash conversion cycle (Richards and Laughlin, 1980).

Figure 2 illustrates the CCC relation between AP, AR, and inventory management. The main components of the CCC are days in inventories (DIO), days in receivables (DSO), and days in payables (DPO). The CCC is calculated by using this formula (Deloof, 2003; Jose et al., 1996):

$$CCC = Days\ in\ Inventoy + Days\ in\ Receivables - Days\ in\ Payables \quad (1)$$

where,

$$Days\ in\ Inventory = \frac{(Inventories\ \times 365)}{Cost\ of\ Sales}$$

$$Days\ in\ Receivables = \frac{(Accounts\ Receivable\ \times 365)}{Sales}$$

$$Days\ in\ Payables = \frac{(Accounts\ Payable\ \times 365)}{Cost\ of\ Sales}$$

The CCC is measured by the number of days it takes a firm to convert its investment in inventory into cash after a sale to a customer. DIO illustrates the efficiency of inventory management. It outlines how many days the firm is holding its inventory on average. DSO shows how many days, on average, it takes a firm to receive cash from a customer after the shipment of goods. Lastly, DPO is the average number of days a firm pays its supplier after receiving the materials.

Firms that use an aggressive approach to working capital management result from a shorter CCC. This approach is made by reducing the days in the inventories and increasing the DIO. When a company wants to increase the CCC, it can increase the DIO and decrease DPO. Managing the CCC involves tradeoffs between liquidity and profitability (Jose et al., 1996). There are different definitions for liquidity. Market liquidity determines how quickly investment can be sold, while financial liquidity explains the ability to face financial obligations. corporate Moreover, it can create different issues in deciding between the components. If the DIO is diminished for too long, a company could lose sales due to running out of stock. Decreasing DSO could lead to losing sales from customers requiring a credit. On the other hand, reducing too much can lead to a loss of discounts for early payments (Jose et al., 1996).

Previous arguments state that a lower CCC is related to higher profitability. A lower value might indicate that a firm can efficiently convert cash to assets and back to cash. Moreover, managers can minimize the holdings in unproductive assets (Jose et al., 1996). A low CCC can indicate the company's debt capacity because there is smaller need for short-term financing is required to support liquidity. There are other advances to aim low CCC. For instance, it can correspond to a better present value of net cash flows from a company's assets (Jose et al., 1996).

The movement towards a longer CCC can lead to a higher need for more significant investments in working capital (Deloof, 2003). Hence, long CCC can affect the current ratio more (Richards & Laughlin, 1980). It can also decrease in flexibility of available cash flow during economic distress. Moreover, companies can be locked with high inventories and uncollectible receivables investment. This issue leads to an opportunity cost, and a company cannot spend on profitable investments. Therefore, companies may need to be more flexible to face maturing obligations. This issue may increase liquidity management issues if the revenue stream is volatile (Chang, 2018).

Moreover, it can be a fundamental reason for bankruptcy. A firm could improve its profitability by reducing its CCC (Pratap Singh & Kumar, 2014). On the other hand, long CCC can also lead to higher profitability because there is more investment to increase sales. Moreover, older companies and firms with higher availability of cash flow have longer CCC (Baños-Caballero et al., 2010).

The CCC can differ depending on the industry. Jose et al. (1996) found out that the lowest mean value of the CCC is initiated in services, while the highest value is in the construction industry. Moreover, the service industry has the highest interindustry volatility of CCC.

2.3.3 Net trade cycle

Another way to calculate working capital management is the net trade cycle (NTC). Shin and Soenen (1998) developed this approach, and NTC has been used in further research to investigate the relationship between profitability and working capital management (Baños-Caballero et al., 2014). Moreover, the ratio is also a dynamic measure of ongoing liquidity management. According to Baños-Caballero et al. (2014), a shorter NTC indicates a smaller investment in working capital. Baños-Caballero used the following formula et al. (2014), which was developed by Shin and Soenen (1998):

$$NTC = \left(\frac{Accounts\ Receivable}{Sales}\right) \times 365 + \left(\frac{Inventories}{Sales}\right) \times 365 - \left(\frac{Accounts\ Payable}{Sales}\right) \times 365. \quad (2)$$

Other dynamic approaches to measuring working capital management are rarely used in previous literature, such as, the modified cash conversion cycle and weighted cash conversion cycle (Talonpoika et al., 2014; Gentry et al., 1990). Usually, the measurements are developments from the traditional CCC. The ratios give better insight into working capital management because they require more information to calculate. Usually, the

information can be internal and thus challenging to investigate empirically. Therefore, there may be a need for more analysis of these ratios.

The first extension to the traditional CCC is the modified cash conversion cycle (MCCC) by Talonpoika et al. (2014). Scholars argue that advance payments should be added to the CCC calculation because it follows a firm's actual cash movements. In addition, many companies have large amounts of advance payments (Talonpoika et al., 2014). There are advances in using this method over the traditional one. For instance, the MCCC value can be smaller than CCC if a company receives advance payments from its customers. This information would be helpful for industries that depend on customers' projects. The limitations of using this approach include the lack of information on advance payments in financial statements.

The weighted cash conversion cycle (WCCC) focuses more on the timing and the number of funds used in segments of the cycle. WCCC was first presented by Gentry et al. (1990). It gives insight into short-run financial management performance. The ratio is divided into a two-stage process:

1. The weighted number of days funds are tied up in an operating cycle.
2. Subtract the weighted payable effect from the first phase. According to Gentry et al. (1990), the method gives a deeper understanding of operating and cash conversion cycles than the traditional approaches.

It can provide improvement in the quality of short-term financial forecasts. However, the formula has components that may require internal information that would not be available to external individuals.

2.4 Measures of profitability

Profitability is one key indicator to state the performance of a company. It presents the ability of a firm to use its assets to generate revenue to cover its operational costs. There are different approaches to calculating this measurement. For instance, return on assets (ROA), return on equity (ROE), and gross operating profit (GOI). It is widely accepted that working capital management affects firm value, even though the empirical findings are scarce (Baños-Caballero et al., 2014). Previous studies have found different relationships between profitability and working capital management. These schools of thought will be discussed in chapter 3. Nevertheless, the relationship between profitability and working capital is the most popular topic in financial literature.

The ROA is one of the most used ratios for profitability in working capital management literature. It is defined as how well a firm's assets are generating sales. This measurement usually focuses more on operating efficiency than capital structure differences (Jose et al., 1996). According to Deloof (2003), ROA is not the best ratio to calculate Profitability. The reason is related to the financial assets in the balance sheet. Therefore, the operating activities will have a negligible effect on the ROA (Deloof, 2003). ROA is computed by earnings before interest and tax (EBIT) divided by total assets:

$$ROA = \frac{EBIT}{Total\ Assets} \qquad (03)$$

The EBIT value is not influenced by changes in tax laws and tax accounting and is free of interest payments (Jose et al., 1996). The EBIT can be found in income statement, while total asset is found from balance sheet. The difference between ROA and ROE is the capital structure differences. Therefore, this ratio has not been popular in working capital management studies. The ROE illustrates how efficiently a company generates profit from its equity financing. In addition, EBT comes from earnings before taxes and it can be found from income statement, while equity is in balance sheet. ROE is calculated with this formula:

$$ROE = \frac{EBT}{Equity} \quad (04)$$

Deloof (2003) used gross operating income to calculate profitability and it focuses more on a firm's core business activities. The sales and cost of goods sold can be found from income statement, while total asset and financial assets is balance sheet. The cost of goods sold is defined by the direct cost related to goods sold by a firm. The financial assets are non-physical assets, for example, cash and stocks. The following formula was used in Deloof (2003) study:

$$GOI = \frac{Sales - Cost\ of\ Goods\ Sold}{Total\ Assets - Financial\ Assets} \quad (05)$$

The profitability can increase if working capital increases because there are more investments to provide customer needs. According to most research, increase in working capital decreases the profitability. In this case, the cost of larger investment in working capital increase quicker than the benefits of holding more inventory and providing trade customers (Deloof, 2003). Moreover, profitability can influence the working capital components, for example, AP policy. There can be a negative relationship between profitability and inventory. This relationship can be explained by high inventory levels due to loss of sales.

The industry characteristics can have impact on the relationship between profitability and working capital management. The relation can be sensitive to industry indicators, for example, capital intensity, product durability, and production process (Jose et al., 1996). Moreover, the correlation between these two ratios can depends on the industries.

2.5 Investment in working capital management

The working capital can be sensitive to cash-flow fluctuations (Fazzari & Petersen, 1993) and it depends on financial factors. For instance, the availability of internal funding, cost of financing and the possibilities to entry to financial markets (Afrifa, 2014; Fazzari et al., 1988).

The financial markets are imperfect, and there is asymmetric information between companies and the capital market. Moreover, this could lead to the differences between the cost of external and internal financing (Baños-Caballero et al., 2014). Companies may prefer internal funding rather than external. Usually, larger companies have better access to external funding than smaller companies. For instance, they have better borrowing capacity and can source cheaper finance. Therefore, external funding could be more costly for a company than internal. Hackbarth et al. (2007) state that financially constrained companies support their operations with bank debt, while more substantial companies use mixed debt from banks and markets. Therefore, smaller companies may be more financially constrained. This situation is becuase younger companies are more exposed to financial capital imperfections (Almeida et al., 2004). Usually, the cost of financing harms in the investment on working capital (Baños-Caballero et al., 2010). At the same time, better information on financial markets can boost investment in working capital. Baños-Caballero et al. (2014) found that financial constraints may impact a company's working capital. Financially constrained firms are likelier to have a lower optimal working capital than less constrained firms. The higher working capital levels require larger investing because it creates additional costs for a company. Therefore, financially constrained firms may not invest in profitable projects due to insufficient internal funds. The higher growth expectations could increase the investments in working capital. In summary, investments in working capital can be influenced by internal and external funding, capital market, and financial distress (Baños-Caballero et al., 2014).

Afrifa (2016) argues that cash flow positively influences investment in working capital. Cash flow enables companies to extend trade credit to customers and increase advance payments to suppliers. Advance payments can increase the benefits of cash discounts. A positive cash flow can increase investments in working capital and thus increase profitability. In case of poor cash flow, the companies should decrease the investments in working capital.

3 Literature review

The third chapter will explain the current state of empirical research on the relationship between working capital management and profitability. Secondly, all the school of thoughts will be discussed and studies that support each view. The chapter will be closed by the hypotheses, which are developed based on the previous findings.

3.1 Current state of research

There are different views of working capital management because previous findings have concluded mixed results on the topic. These schools of thought are a single-company perspective and a supply chain approach (Hofmann & Wetzel, 2019). The first view focuses more on financial literature on one corporate entity. The studies, in this view, focus on the functional form of the relationship between investment in working capital and corporate performance. Usually, the scholar analyzes the relationship between working capital and profitability. This investigation can be done by utilizing regression analysis. This approach was made by Deloof (2003). The study focused on over 1 000 Belgian non-financial companies from 1992 to 1996. The measurement for working capital management was the CCC, while profitability was measured by gross operating income and net operating profit. Another way to study is to examine the determinants of working capital and how those influence the working capital requirements (Hofmann & Wetzel, 2019). Lastly, other scholars have examined firms' practices and strategies for managing their working capital. This exploration is done by using surveys and questionnaires.

The second approach focuses more on how supply chain and its effect on working capital management. According to Hofmann and Wetzel (2019), working capital analysis and optimization should occur at the inter-organizational level. The company's working capital should consider the up – and downstream supply chain partners. This stream can

be defined as "supply chain finance" (SCF). This field of study has researched more recently, and understanding the idea is still inadequate (Hofmann & Wetzel, 2019).

A different school of thought teaches the relationship between performance and working capital. The first three perspectives focus on a single company view. The categories are traditional, alternative, and progressive schools. In addition, the supply chain (network) perspective will be outlined to give a different side to a single company view. Previous empirical research has found three relationships: linear negative, positive, and nonlinear. In a nonlinear relationship, the relation will change according to optimizing the working capital level.

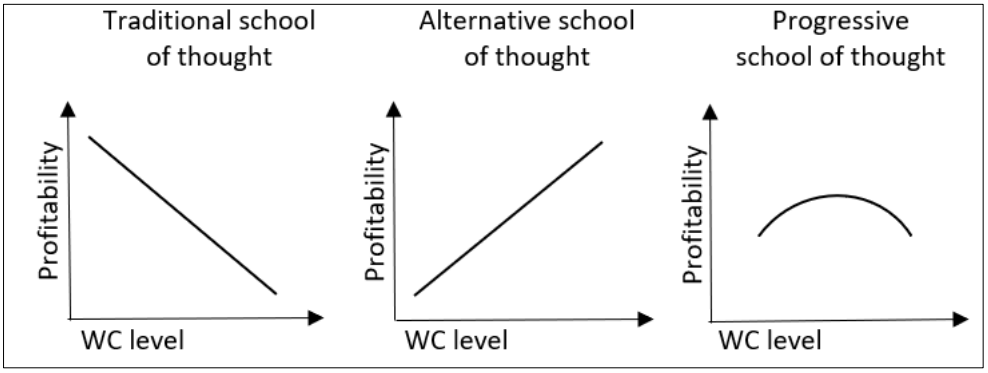

Figure 3. Relationship between working capital management and profitability in a single company view (Hofmann & Wetzel, 2019).

Figure 3. presents three single-company schools of thought. The traditional school of thought argues that the relationship between working capital and profitability is a negative linear. In this view, the companies should aim to reduce the investment in working capital to increase profitability. Moreover, most of the research are supporting this view. The second view, the alternative, proposes a positive relationship between working capital and profitability. In other words, the firms should increase the investment in working capital to maximize profit. The last school of thought companies these two previous views. Moreover, the view states that there is a trade-off between working capital and profitability. In lower (higher) levels of working capital, the companies should increase (decrease) investment in working capital. The theories are in

more detailly explained in the next sections. Moreover, it outlines the main research and findings.

3.2 Traditional school

The traditional school of thought states that the relationship between profitability and the level of working capital is a linear negative. Many studies support this theory, which is the most spread theory in the empirical literature. Traditional school is an aggressive working capital policy, and it aims to shorter the length of the working capital cycle. The view is earned support from many scholars, for example, Deloof (2003), Jose et al. (1996), and Chang (2018).

Deloof (2003) investigated a sample of 1009 large Belgian non-financial companies during the 1992-1996 period. This study used the gross operating income to determine profitability. The results indicate that managers can raise profitability by decreasing the number of days in AR, and inventories. In other words, less profitable companies take longer to pay their bills (Deloof, 2003). Moreover, other components of the working capital cycle also had a negative relationship with profitability. The main conclusion from this research is that there is a significant negative relationship between gross operating income and working capital management in Belgian firms.

Moreover, Jose et al. (1996) found a negative association between working capital management and CCC in a sample of 2718 firms during of 20-year period from 1974 to 1993. ROA and ROE measured the profitability. This study included the differences between different industries. Their findings show that most industries had a negative linear relation between CCC and profitability. Therefore, aggressive liquidity management can influence higher profitability in several industries. Additionally, the relationship is not affected by the size of the company. The findings were identical for both profitability measurements.

Chang (2018) investigated the relationship between corporate profitability and the CCC globally. In addition to corporate variables, the study included macro-econometric variables. The final sample includes 46 countries, over 31 000 firms, and observations from 17-year period. The study included two measurements for profitability: ROA and Tobin's Q. Tobin's Q ratio is a measurement between a physical asset's market value and replacement value. The results show that most countries have a negative association between corporate profitability and CCC.

Moreover, majority of industries exhibit negative relationships. The findings support that the aggressive liquidity policy positively affects operating profit. Chang (2018) states that a conservative working capital management policy could harm company's profitability.

There are theoretical expressions for this negative relationship between profitability and working capital management. Firstly, companies may need to take investments from valuable projects because they have too much capital locked up in working capital (Deloof, 2003). Moreover, there are lower financing and interest costs when the working capital levels are low (Brandenburg, 2016).

3.3 Alternative school

The Alternative school of thought proposes a positive linear association between working capital and corporate profitability. In other words, higher investment in working capital management increases profitability. This approach is also known as the conservative strategy. Moreover, some empirical researchers have found support for this view. For instance, Sharma and Kumar (2011) found a positive relationship between profitability and working capital in Indian companies. Alarussi and Alhaderi (2018) discovered similar results in Malaysian companies. Most of the empirical research findings are discovered in developing countries. Moreover, there can be industry differences. For example, Jose et al. (1996) found a positive relationship between profitability and the CCC in the construction industry.

Sharma and Kumar (2011) investigated 263 non-financial companies in India. The sample included 15 industries from 2000 through 2008. ROA measured the profitability, while CCC defined working capital management. Inventories and AP had a negative relation with corporate profitability. Furthermore, there was a positive relationship between financial profitability AR and CCC. Sharma and Kumar (2011) argue that the companies have higher AR and, as a result, longer CCC. Generous trade credit policy may increase the DSO.

Alarussi and Alhaderi (2018) research focused on factors affecting profitability in Malaysian-listed companies. The sample included 120 non-financial companies listed in Bursa Malaysia, and the data was gathered from 2012 to 2014. They used two different measurements for profitability earnings-per-share (EPS) and ROE. The results show a significant relationship between profitability (EPS) and working capital.

Different theoretical explanations can explain the positive relationship. Firstly, high inventory levels can increase sales opportunities. Moreover, more extensive stock helps to fight against price fluctuations, the risk of running out, and improving the delivery process (Blinder & Maccini, 1991). Increasing customer payment terms can help boost sales during uncertainty (Emery, 1984). If financial markets are imperfect, it creates new possibilities for companies to extend trade policies to their customers. For example, they can increase the rate of return on liquid reserve. Moreover, trade credit can be seen as advertising to differentiate a product from the market (Blazenko & Vandezande, 2003). Therefore, providing more extended credit trade for a customer can improve product exposure in a competitive market.

3.4 Progressive school

The progressive school of thought will combine traditional and alternative schools of thought. The primary purpose of working capital management is to have both high and low working capital levels. In other words, a firm needs to regulate a trade-off capital locked up in, for example, inventories and loss of sales due to low investment in operating business. The view proposes an inverted U-shaped relationship between working capital management and corporate profitability. Much empirical research has supported this trade-off (Baños-Caballero et al., 2014; Afrifa, 2016; Laghari & Chengang, 2019).

Baños-Caballero et al. (2014) investigated the trade-off between profitability and working capital in non-financial companies in the United Kingdom. The sample included 258 companies, and the data was gathered from 2001 to 2007. The working capital was measured by the NTC, while corporate performance by the sum of the market value of equity and the book value of debt to the book value of assets. The findings show an inverted U-shaped association between working capital and corporate profitability. In other words, increasing investment in working capital at lower levels positively impacts profitability. At the same time, investments at higher working capital levels will have a negative effect. Therefore, there is an optimal level of investment in working capital where costs and benefits are balanced to maximize a company's performance. The authors argue that managers should prefer investment in working capital to increase sales and discounts for early payments from suppliers. There are some adverse effects when the company enders to high working capital, such as higher interest expenses. This situation can lead to a higher probability of bankruptcy and credit risk (Baños-Caballero et al., 2014). Therefore, firms should keep as close to the optimal level as possible to maintain good performance and avoid any adverse effects. Financially constrained firms are likelier to have a lower optimal working capital than less constrained firms.

Afrifa (2016) investigated the impact of cash flow on the relationship between NWC and financial performance. The sample included around 7 000 non-financial companies from

the UK from 2004 to 2013. In addition, all companies were small to medium-sized enterprises, and they divided their sample by industries. ROA measured the profitability. The results show that the mining industry has a mean ROA of 8 percent, the third-best value in this sample.

Moreover, the highest working capital was in wholesale and followed by mining. The cash flow was better in industries where ROA and working capital were high. The findings from this study are like Baños-Caballero et al. (2014). For instance, there is an optimal level of working capital for all industries. This optimal level can increase financial performance. However, considering the cash flow availability, the relationship between WC and profitability becomes convex. In case of cash flow unavailability, a company should reduce invest in working capital.

Similar results are also discovered in non-financial companies in China from 2005 to 2015. Laghari and Chengang (2019) investigated the relationship between working capital management and corporate performance. ROA measured corporate performance, while NTC measured working capital management. The results show an inverted U-shaped relationship between profitability and working capital management.

3.5 Supply Chain Finance-oriented school

The progressive school of thought has been further developed into the supply chain-oriented school of thought (SCF). This orientation focuses on managing working capital influence on the supply chain level (Hofmann & Wetzel, 2019). Moreover, it considers the working capital components in the supply chain network. Also, the components are on the supplier and customer sides. SCF-oriented research can investigate inter-organizational context, while other schools of thought focus only on a single company level. Scholars argue that it is not enough to focus on a particular company. Hence, it is crucial to study inter-organizational supply chains to optimize working capital and

balance cost at a whole level. SCF proposes a non-linear relationship between profitability and working capital management.

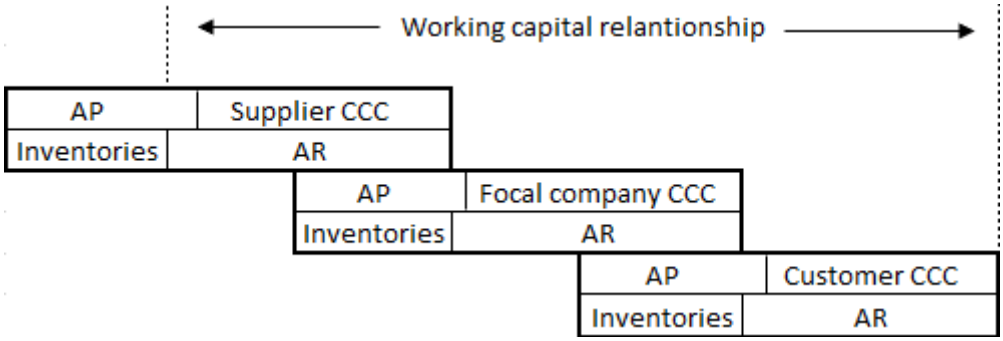

Figure 4. SFC-oriented working capital relationship (Hofmann & Wetzel, 2019).

Hofmann and Wetzel (2019) investigated the relationship between working capital management and corporate profitability in an inter-organizational supply chain. They considered that a focal company's financing relationship is restricted to the supply chain network. They had three models to investigate the association between a focal firm and a supply chain network. The first model included the functional form of working capital management and performance on the overall supply chain. The second model focuses only on the upstream supply chain partners. The last model investigates the influence of downstream effects on a focal company. The upstream supply chain partners are suppliers, while the downstream are customers. Hofmann and Wetzel (2019) test whether suppliers limited financial resources affect a focal company's financial performance. The sample included 2137 companies, where 871 companies were customers and 973 represented suppliers, and 293 were focal firms.

Furthermore, there were together 71 completed supply chain networks. One completed network included five suppliers, five customers, and one focal firm. They excluded a focal company's CCC because it is affected by supply chain partners.

The findings in Hofmann and Wetzel (2019) study show an inverted U-shaped relation between corporate profitability and working capital in all three models. The results

outline that companies maintain a trade-off between profitability and working capital. The profit-maximizing level of working capital may increase for a focal company if supply chain partners financially constrain them. Hofmann and Wetzel (2019) argue that disinvestment in working capital may harm a firm's profitability. Therefore, moving credit risk and capital costs toward suppliers can have a negative effect. Also, their findings support the idea that collaborative working capital approaches can improve cost-saving and financial performance. It can be beneficial for a firm to operate at the same level of working capital as its partners (Hofmann & Wetzel, 2019). In other words, the working capital should be at the same or lower level in the supply chain network.

Furthermore, the working capital cost should be "balanced" across the supply chain. The results support a long CCC, and a focal company could improve its profitability if its suppliers and customers have limited financial resources. Collaborative inventory management positively impacts WCM, and on average firms should keep inventory at low levels (Hofmann & Wetzel, 2019).

Expanding payment terms toward suppliers will transfer working capital and financing expenses to other phases in the supply chain network (Hofmann & Kotzab, 2010). In addition, shortening payment terms toward customer moves expenses to other stages. Collaborative working capital management could lead to significant cost savings and improve supply chain network performance (Hofmann & Kotzab, 2010). Hofmann and Wetzel (2019) argue that firms should focus more on the tied-up working capital with suppliers and increase collaboration to reduce working capital. Supply chain finance instruments can achieve this. Furthermore, the burden of inventories in the upstream supply chain could positively affect corporate performance.

According to Hofmann and Wetzel (2019), the future search in SFC should focus on, for example, relevant theories, factors influencing a focal firm's profit-maximizing level of working capital, and the impact of the SFC-oriented WCM technique. The SFC literature presents a cross-disciplinary research field that combines finance, logistics, and supply

chain management literature. Hofmann and Wetzel (2019) argue that further research should focus on significant theories from different academic literature fields. Secondly, the research could examine the factors determining a focal company's financial performance when optimizing working capital. For instance, the internal and external factors. An external factor could be, for example, limited financial resources along the supply chain network (Hofmann & Wetzel, 2019). There are not enough theoretical explanations for collaborative working capital management. For instance, dynamic discounting or reverse factoring could increase suppliers' financial profitability. Therefore, further research could focus on the cause-and-effect association of SCF instruments at the supply chain level (Hofmann & Wetzel, 2019).

3.6 Hypotheses development

The null hypothesis for this thesis states that there is no relationship between profitability and working capital. In other words, investing in working capital would not have any effect on corporate performance. Furthermore, other variables have an influence on financial performance. The following null hypothesis for this thesis is:

H0: *There is no trade-off between working capital and profitability.*

In case of rejection of null hypothesis, we can assume that there is a relationship between working capital and profitability. The progressive school of thought considers both alternative and traditional perspectives. This view proposes an inverted U-shaped relationship between financial performance and the level of working capital and corporate performance. In other words, firms with higher (lower) working capital levels should decrease (increase) the working capital. Recent research supports this optimal level between profitability and WCM (Baños-Caballero et al., 2014; Afrifa, 2016; Laghari & Chengang, 2019). In addition, similar results have been found in supply chain networks (Hofmann & Wetzel, 2019). Therefore, the following hypothesis will be developed:

H1: *There is an optimal level between profitability and working capital management.*

Previous studies have shown a positive relationship between size and profitability. Moreover, larger companies have more resources to invest in working capital management. For instance, Alarussi and Alhaderi (2018) show that larger companies manage their assets more efficiently. Hence, they can improve their profitability. Moreover, they can require cheaper external financing to finance their operations. The smaller companies usually face higher informational asymmetry and agency costs. Therefore, the size of a firm can have an impact on its financial performance.

H2: *A company size has a positive influence on profitability.*

Financial leverage is part of the capital structure of companies. This component creates a trade-off between debt and equity, and business and financial risk. The leverage can see as a tax shield for companies, thus increasing profitability. On the other hand, profitable companies prefer using internal funding before external. This statement is because internal funding is a cheaper alternative for firms. Higher debt levels lead to smaller income taxes, but the financial risks are higher (Myers, 1984). Less profitable companies are more committed to debt than profitable companies because of the costs and risks.

Furthermore, the cost of financing can have a negative impact on a company's working capital levels (Baños-Caballero et al., 2010). Alarussi and Alhaderi (2018) found a negative and significant relationship between company leverage and profitability in Malaysian firms. Hence, hypothesis three states that financial leverage will have a negative effect.

H3: *The financial leverage has a negative effect on profitability.*

The availability of cash flow is essential for the company and its profitability. Higher cash levels can improve a firm's profitability because it has more investment possibilities (Moyen, 2005). Moreover, constrained firms need to decide whether invest cash or pay dividends. Higher cash flow can help companies to pay suppliers upfront, and that way, the companies can enjoy cash discounts (Deloof, 2003). In addition, the firms can extend trade credit to a customer, increasing sales. The trade-credit may boot the company's sales in case of low demand or a highly competitive market. Cash flow can reduce the cost of external funding (Greenwald et al., 1984). During the unexpected event and financial distress, the cash flow can function as a buffer (Afrifa, 2016; Opler et al., 1999).

The working capital needs to be financed, and thus firms with limited cash flow need to reduce their investment in working capital. At the same time, a firm with available cash flow should increase its investment in working capital. In case of low cash flow levels, the companies should decrease the investment. Baños-Caballero et al. (2014) found that the availability of cash flow leads to higher investment in working capital. Moreover, companies with higher cash flow levels might have higher CCC Baños-Caballero et al. (2010). Hypotheses four and five follows Afrifa's (2016) research on NWC, cash flow, and performance:

H4: *Cash flow availability has a positive influence on working capital and profitability at higher levels of working capital.*

H5: *Cash flow availability has a positive influence on working capital and profitability and negatively at lower levels of working capital.*

Table 1. Summary of previous research on WCM

Authors	Journal	Country	Sample size	Years	Dependent variable	Independent variables	Research results
Deloof (2003)	*Journal of Economics and Finance*	Belgium	1 009	1992-1996	GOP and NOP	CCC, size, growth, financial debt, and fixed financial asset	Profitability increases when decreasing DIO and DSO.
Afrifa (2016)	*Review of Accounting and Finance*	United Kingdom	6 926	2004-2013	ROA and Tobin's Q	NWC, growth, cash flow, cash holdings, age, size, tangible fixed assets, and leverage	Cash availability should be taken into consideration when maximizing profitability.
Baños-Caballero. (2014)	*Journal of Business Research*	United Kingdom	258	2001-2007	Tobin's Q	NTC, NTC^2, size, leverage, growth, and ROA	There is an inverted U-shaped relation between profitability and working capital.
Alarussi and Alhaderi (2018)	*Journal of Economic Studies*	Malaysia	120	2012-2014	ROE and EPS	working capital, size, liquidity, leverage, and asset turnover	A strong positive relationship between WCM and profitability.

4 Data and research methodology

This chapter will present the sample and research methodology for this thesis. The chapter starts with data and sample selection. It includes the main reasons behind choosing this sample for the thesis. The following section outlines the measurements for the regression analysis. It will cover the formulas and motives for dependent, independent, and control variables. The methodology will be discussed, and the motive for panel data analysis. In addition, correlation actions will briefly be stated.

Furthermore, the regression model will present, and correlation analysis will be briefly stated. The chapter will be closed with descriptive statistics. This will include the summary for both the sample and correlation coefficient matrix.

4.1 Data and sample selection

The data were chosen based on the company's industry. This company provides technology for mineral processing and metallurgical customer. The technology could be, for example, plants, equipment, and services for each investment. The data was gathered from the Bureau Van Dijks Orbis database. The sample consists of firms operating in manufacturing machinery for the mining, quarrying, and construction industry (NACE Rev. 2 code 2892). As previously stated, the industry is chosen according to the firm’s preference and there is not much information on this manufacturing industry. It includes all companies globally because all its competitors are operating worldwide. Moreover, the recent information for most of the companies is 2021, and some competitors had data from 2013 onwards. In addition, the aim was to have the most recent information on the companies. The period for this research is nine years, from 2013 to 2021. All firms with missing values, cases with errors in the accounting data, and extreme values were excluded from the sample (Baños-Caballero et al., 2014). However, excluding all extreme values was impossible due to the risk of biased data. The data will be presented in the whole manufacturing industry and a specific focus on the

study and its competitors' results. The main competitors are chosen according to the company's preferences. The company sample is also included in a larger sample. The data results in an unbalanced panel data with a total of 102 companies over nine years, including a total of 809 observations. The first idea was to have an extended period. However, majority of the company competitors' oldest available financial data were from 2012. Therefore, 2013 was set as the beginning year, and the period decreased the sample size because it is crucial to have sufficient periods to evaluate necessary conditions.

4.2 Measures

4.2.1 Dependent variable

The dependent variable in this thesis is profitability. Profitability is measured by the return on assets (ROA). This ratio is widely used in empirical research to determine the relationship between WCM and profitability (Jose et al., 1996; Hofmann & Wetzel, 2019; Chang, 2018). Moreover, the component for ROA is available for all companies to be studied in this thesis. The detailed calculation for ROA can be found in chapter 2.4.

4.2.2 Independent variables

The previous research shows that ratios and cycle times are the most popular ways to determine working capital measures. In this thesis, the cash conversion cycle (CCC) calculates the working capital management. This method is one of the most used measurements of WCM (Deloof, 2003; Jose et al., 1996; Hofmann & Wetzel, 2019). Furthermore, it is applied to measure the capital management of an entire supply chain (Hofmann & Wetzel, 2019). The information is well available for the components of CCC. There are more accurate cycle measurements, for example, the weighted cash conversion cycle (WCCC). This measurement requires internal information, and thus

there is not enough information available to calculate it. The calculation for CCC is in 2.3.2.

4.2.3 Control variables

Additional variables are used in the regression model to control for other potential factors on profitability. The variables are size (SIZE), leverage, and opportunity growth. Similar control variables are used by, for example, Baños-Caballero et al. (2014) and Hofmann and Wetzel (2019).

The first control variable is the firm size (SIZE). This variable has been used for all studies because it influences the WCM and profitability. The larger companies have better access to financial markets and can require cheaper finance. Therefore, larger companies are resources to invest in working capital and boost profitability. At the same time, smaller firms are more dependent on trade credit. The natural logarithm of sales measures the firm size:

$$SIZE = ln(Sales) \quad (06)$$

The second control variable in this thesis is leverage (LEV). The smaller companies may use more debt to finance their operations because they might not have enough internal funding. Previous researchers have found a negative relationship between profitability and financial leverage (Baños-Caballero et al., 2014; Chang, 2018). The debt can increase the cost of financing due to the risk premiums. Moreover, internal funding is cheaper for companies and used before external financing. Leverage is measured by the ratio of total debt divided by total assets:

$$LEV = \frac{Total\ Debt}{Total\ Assets} \quad (07)$$

The growth opportunities for the companies are measured by sales growth (GROWTH). The opportunities can influence, for example, inventories. Companies can increase their sales by increasing their investment in inventories. Moreover, the high availability of items in inventories can help companies to increase market shares. In the companies, the investment in inventories has increased to the possible growth opportunities for product launches. The variable is calculated by this year's sales minus the previous year's sales divided by the previous year's sales (Deloof, 2003):

$$GROWTH = \frac{This\ year's\ sales - previous\ year's\ sales}{previous\ year's\ sales} \quad (08)$$

The variables related to cash availability are included in this study. Previous studies have used cash flow (CFLOW) and cash holdings (CHOLD) as proxies for cash availability (Afrifa, 2016). Available cash flow helps companies invest more on working capital. Moreover, the companies can receive other benefits, for example, discounts from suppliers. In addition, companies can provide better payment terms towards customers with available cash. This situation can boost sales and thus profitability. Cash flow is determined by the net income plus depreciation divided by sales:

$$CFLOW = \frac{Net\ Income + depreciation}{sales} \quad (09)$$

and cash holdings is calculated by cash and equivalent divided by net assets:

$$CHOLD = \frac{Cash\ \&\ Equivalent}{Net\ Assets} \quad (10)$$

4.3 Methodology

This section will present this thesis's panel data methodology and models. Furthermore, the correlation analyses and issues with multicollinearity will be outlined. The models

follow the previous research on the effect of working capital and profitability (Afrifa, 2016; Deloof, 2003; Baños-Caballero et al., 2014).

4.3.1 Panel data method

The panel data methodology will assign the most suitable regression for the cross-sectional time-series dataset. The method combines two dimensions; the cross-sectional units, i = 1, …, N, overtime periods, t = 1, …, T (Hsiao, 2007). On the other hand, panel data can include a more complicated hierarchical structure. Moreover, it has more degrees of freedom and sample variability than the cross-sectional method. The method helps simplify computation and statistical inference. The panel data method has become more popular due to data availability (Hsiao, 2007). Improved data quality is due to better data collection and availability on different platforms.

There are more advantages of panel data, for example, controlling the impact of omitted variables. The results from the analysis can be affected by ignoring the effects of some variables in the model that relate to the included explanatory variable. In other words, missing a variable can give different results. Hsiao (2007) states that panel data includes all the information on the individuals and the dynamics and therefore allows to control of the influence of unobserved variables. Furthermore, panel data can reduce the collinearity between current and time-adjustment patterns.

Unobserved heterogeneity can be controlled by choosing a suitable model because random or fixed variables can cause it. The Hausmann test can be performed if there is a need to decide on two modes.

4.3.2 Models

The thesis will follow Deloof (2003), Baños-Caballero et al. (2014), and Afrifa's (2016) models on the effect of working capital on company profitability. Previous research has assessed the relationship between working capital and profitability with linear and non-linear models. However, the non-linear model is only evaluated in the thesis because the aim is to evaluate whether there is an inverted U-shaped relationship between working capital and profitability.

The profitability will function as the dependent variable, measured by ROA. The primary independent variable for this study will be CCC, measured in days. The remaining variables will remain control variables, for example, size, leverage, and growth. The model includes the quadratic term for the primary independent variable, CCC. Including this variable in the model helps to investigate whether the relationship is concave. The mathematical form of this relationship is outlined by including a positive variable of CCC and a negative quadratic term of CCC^2. The first three hypotheses will be evaluated with regression model 1. The hypotheses are related to the relationship between profitability and working capital, size, and financial leverage. Regression model 1 has additional regression models of the components of the CCC.

Regression model 1:

$$ROA_{i,t} = \beta_0 + \beta_1 CCC_{i,t} + \beta_2 CCC^2{}_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 LEV_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 CFLOW_{i,t} + \beta_7 CHOLD_{i,t} + \varepsilon \quad (11)$$

Where ROA is a return on assets, CCC is the cash conversion cycle, SIZE is the company's size, LEV is leverage, GROWTH is growth opportunities, CFLOW is cash flow, and lastly CHOLD is cash holding. A subscript i presents a cross-sectional dimension; in this case, it is firm, while a subscript t is a time series dimension (Hsiao, 2007). The model also includes an error component, ε. There is expected to be an inverted U-shaped relationship between working capital and profitability when $\beta_1 > 0$, and $\beta_2 < 0$.

Regression model 1.2:

$$ROA_{i,t} = \beta_0 + \beta_1 DIO_{i,t} + \beta_2 CONTROLS_{i,t} + \varepsilon \quad (12)$$

Regression model 1.3:

$$ROA_{i,t} = \beta_0 + \beta_1 DSO_{i,t} + \beta_2 CONTROLS_{i,t} + \varepsilon \quad (13)$$

Regression model 1.4:

$$ROA_{i,t} = \beta_0 + \beta_1 DPO_{i,t} + \beta_2 CONTROLS_{i,t} + \varepsilon \quad (14)$$

Regression models 2 and 3 will assess hypothesis 4. The hypothesis outlines that cash flow availability positively impacts on working capital and profitability at higher levels of working capital and negatively at lower levels. The regression models will help to investigate whether cash availability has an impact on working capital.

Regression model 2:

$$ROA_{i,t} = \beta_0 + \beta_{1(}CCC_{i,t} \times CFLOW_{i,t}) + \beta_2(CCC^2{}_{i,t} \times CFLOW_{i,t}) + \beta_3 SIZE_{i,t} + \beta_4 LEV_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 CFLOW_{i,t} + \varepsilon \quad (15)$$

Regression model 3:

$$ROA_{i,t} = \beta_0 + \beta_{1(}CCC_{i,t} \times CHOLD_{i,t}) + \beta_2(CCC^2{}_{i,t} \times CHOLD_{i,t}) + \beta_3 SIZE_{i,t} + \beta_4 LEV_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 CHOLD_{i,t} + \varepsilon \quad (16)$$

Hausman test will determine whether a fixed effects model or random effect model is more suitable for this research. This helps to control the unobservable heterogeneity

and potential endogeneity problems. The significant level is determined at the 5% level. The random effect model will be used if the null hypothesis is accepted. The null hypothesis will be rejected if the p-value is less than 0.05. Therefore, the following null and alternative hypothesizes are developed for the Hausmann test:

H0: The *random effects are differed from the independent variables.*

Ha: The *random effects do not have a significant relationship between the independent variables.*

4.3.3 Correlation analyses

Correlation analysis investigating the relationship between two variables. For instance, between the independent and dependent variables or two independent variables. The correlation between independent variables is essential because this can lead to biased results. On the other hand, correlation helps to understand better the relationship between dependent and independent variables.

Correlation coefficients present the relationship between two variables numerically. It is also known as the Pearson Product Moment. The range is from -1.0 to 1.0 and illustrates the strength and direction of the relation. 1.0 shows a strong positive relationship, while the negative value shows a weak one. A correlation close to zero presents a lack of association between two variables.

If the relationship between two variables is highly correlated, it can indicate multicollinearity. The perfect linear relationship between two independent variables can be problematic. For instance, it becomes more challenging to determine the coefficient in the regression model accurately. (Studenmund, 2014, p. 261). Moreover, standard errors of estimation can increase. In the case of the risk of multicollinearity, one can evaluate it by variance inflation factor (VIF). The method helps discover an equation's

different multicollinearity (Studenmund, 2014, p. 273). The value outlines that the multicollinearity has increased. If VIF is higher than 5, it can indicate severe multicollinearity. If their VIF results show multicollinearity, there are different actions to reduce the issue. Studenmund (2014) proposes no actions, abandoning a redundant variable and expanding the sample size. Usually, the thumb rule for the limit for VIF value is 5, but the ranges are flexible. If the VIF value is 1, there is no multicollinearity.

The serial correlation is defined by the value of the error term depending systematically on other periods (Studenmund, 2014, p. 327). Serial correlation is also known as autocorrelation. The serial correlation violates the assumption that the observations of error terms are not correlated. The Durbin-Watson test is often used to assess the serial correlation. The value range is from 0 to 4. The value of 0 represents a highly positive serial correlation, while 2 shows no correlation. Regarding the negative serial correlation, the value for the Durbin-Watson is 4 (Studenmund, 2014, p. 348).

4.4 Descriptive statistics

Table 2. Descriptive statistics of whole sample (author's calculation).

Variable	Min	1st Q	Median	Mean	3rd Q	Max	St. D
ROA	-0.26485	0.01567	0.04300	0.04841	0.07517	0.4361	0.07
CCC	-214.59	89.89	159.14	194.14	233.28	1884.06	189.382
DIO	-445.88	71.15	133.44	154.05	192.56	1768.43	139.842
DSO	-0.298	58.102	89.751	130.423	160.900	14151.368	127.23
DPO	-1568.32	44.44	82.37	96.66	124.58	635.42	97.696
SIZE	7.654	10.679	11.824	17.641	13.675	398.184	36.673
LEV	-0.8092	-0.0248	0.1221	3.8333	0.2590	379.1372	24.065
GROWTH	-0.72154	-0.09452	0.06312	3.05800	0.25884	253.74255	17.963
CFLOW	-1.72600	0.03339	0.06503	0.39954	0.12307	11.21422	1.717
CHOLD	-0.43742	0.07466	0.17900	0.23704	0.32528	9.36875	0.368

Where ROA is return on assets, CCC is cash conversion cycle, DIO is days in inventory, DSO is days in receivables, DPO is days in payables, SIZE is company's size, LEV is leverage, GROWTH is growth opportunities, CFLOW is cash flow, and lastly CHOLD is cash holding.

Table 2. summarizes the data gathered for this thesis. Min illustrates the minimum, 1st Q is the first quartile, median, mean, third is the third quartile, max is maximum, and St. D stands for standard deviation. The mean ROA is only 4%, a less spread variable in this data set. The highest variation is between the CCC and its components. The mean for CCC is 194.14 days (the median is 159.14 days). The longest days, on average, are days in inventory; the mean value is 154, while the median is 133 days. On average, the companies use more debt than equity to finance their operations (the mean is 383%, while the median is only 12%). The growth opportunities on average are 305% (median is only 6%). The cash flow for the whole industry is 0.4, while the median is only 0.065. The mean cash holding ratio is 0.24 (median is 0.17).

The sample includes some outliers, and there are considerable differences between companies. Therefore, heteroscedasticity was evaluated by the Breusch-Pagan test. Significant heteroscedasticity was not found in the sample. Therefore, the outliers were not excluded from this sample. Reducing too many outliers can lead to biased results. The high values for CCC and its variables can be due to different supply chain issues created by COVID-19 and logistics problems. On the other hand, a long CCC can indicate the availability of cash flow or company's age (Baños-Caballero et al., 2010). There are also some variations in size, growth, and leverage.

Table 3. Descriptive statistics of the company and its competitors (author's calculation).

Variable	Min	1st Q	Median	Mean	3rd Q	Max	St. D
ROA	-0.086	0.028	0.061	0.056	0.094	0.169	0.055
CCC	58.50	83.44	126.88	124.72	160.13	203.26	39.495
DIO	43.28	89.57	120.71	119.31	155.74	199.67	40.887
DSO	34.41	43.96	54.89	57.89	66.56	95.59	17.083
DPO	23.08	38.79	50.86	52.48	63.74	100.48	21.082
SIZE	13.47	14.00	14.84	14.85	15.34	16.26	0.766
LEV	-0.190	-0.006	0.089	0.085	0.174	0.289	0.129
GROWTH	-0.355	-0.109	0.023	0.027	0.118	1.33	0.248
CFLOW	-0.052	0.033	0.05	0.054	0.069	0.193	0.061
CHOLD	0.022	0.127	0.187	0.255	0.309	0.722	0.170

Where ROA is return on assets, CCC is cash conversion cycle, DIO is days in inventory, DSO is days in receivables, DPO is days in payables, SIZE is company's size, LEV is leverage, GROWTH is growth opportunities, CFLOW is cash flow, and lastly CHOLD is cash holding.

Table 3. gives more insight into how the leaders behave in the industry. The values are more stable compared to the whole sample. On average, the return from assets is 5.6% (median is 6%). The mean CCC is 124.72 days (median 126.88 days). The longest days in this group are days in inventories, with a mean of 119.31 days (median is 120.71 days). On average, the company and its competitors use 8.5% of debt to finance their assets. Therefore, they use more internal finance to operate their processes. The mean growth opportunities are 2.7% (median is 2.3%). Cash flow on average is 0.54, and cash holding is 0.26.

Table 4. Correlation matrix of whole sample (author's calculation).

	ROA	CCC	DIO	DSO	DPO	SIZE	LEV	GROWTH	CFLOW	CHOLD
ROA	-									
CCC	-0.17***	-								
DIO	-0.12***	0.74***	-							
DSO	-0.19***	0.71***	0.41***	-						
DPO	-0.1**	0.09*	0.46***	0.45***	-					
SIZE	-0.06	0.08*	-0.17***	-0.17***	-0.16***	-				
LEV	-0.07	0.08*	-0.17***	-0.16***	-0.15***	0.86***	-			
GROWTH	-0.1*	0.02	-0.18***	-0.16***	-0.16***	0.78***	0.78***	-		
CFLOW	-0.03	-0.008	-0.21***	-0.21***	-0.2***	0.76***	0.77***	0.79***	-	
CHOLD	-0.008	-0.1**	-0.04	-0.04	0.03	-0.13***	-0.11***	-0.06	-0.07**	-

Where ROA is return on assets, CCC is cash conversion cycle, DIO is days in inventory, DSO is days in receivables, DPO is days in payables, SIZE is company's size, LEV is leverage, GROWTH is growth opportunities, CFLOW is cash flow, and lastly CHOLD is cash holding. '*', '**', and '***', indicates significance at the 0.10, 0.05, and 0.01 level respectively.

Table 4. presents the correlation coefficient matrix between the dependent variables (ROA) and independent variables, CCC, DIO, DSO, DPO, SIZE, LEV, GROWTH, CFLOW, and CHOLD. The correlation matrix aims to identify the correlation between all variables. The high correlation between variables can later affect the regression analysis results. All independent variables correlate negatively with ROA. Control variables have a significant negative correlation with components of CCC. The strongest correlation is between size and leverage (0.86). This may indicate that one independent variable could determine by another independent variable. Inventories are the strongest determinator (0.74) for the CCC in this study. Most variables have a significant relationship with each other.

Some correlation coefficients between the independent variables in this sample indicate the risk of multicollinearity. In the case of multicollinearity, it can lead to fewer statistical assumptions. In this thesis, the multicollinearity is also assessed by the VIF for the independent values. The sample's VIF values for independent values were between 6.49 and 1.0. The typical limit for multicollinearity is 5, but deciding the limit value is somehow flexible. Some variables do not have multicollinearity, which is indicated by the VIF value of 1.0. The highest value is not extreme and close to the typical limit of the

VIF value of 5.0. The limits are flexible; thus, no actions are needed in this sample to reduce multicollinearity.

Table 5. Correlation matrix of company and its competitors (author's calculation)

	ROA	CCC	DIO	DSO	DPO	SIZE	LEV	GROWTH	CFLOW	CHOLD
ROA	-									
CCC	0.27**	-								
DIO	0.35***	0.95***	-							
DSO	-0.17	-0.13	-0.14	-						
DPO	0.04	-0.14	0.05	0.78***	-					
SIZE	0.63***	0.03	0.124	0.16	0.32*	-				
LEV	0.02	-0.11	0.012	0.29*	0.46**	0.6***	-			
GROWTH	0.26*	0.26*	0.29**	0.08	0.11	0.03	0.06	-		
CFLOW	0.87***	0.46***	0.52***	0.006	0.143	0.49***	0.001	0.211	-	
CHOLD	-0.1	-0.5***	-0.44**	-0.19	-0.08	0.004	-0.1	-0.31**	-0.168	-

Where ROA is return on assets, CCC is cash conversion cycle, DIO is days in inventory, DSO is days in receivables, DPO is days in payables, SIZE is company's size, LEV is leverage, GROWTH is growth opportunities, CFLOW is cash flow, and lastly CHOLD is cash holding. '*', '**', and '***', indicates significance at the 0.10, 0.05, and 0.01 level respectively.

Table 5. presents the correlation between variables in the company and its competitors' sample. The results differ from the larger sample; for example, CCC and CFLOW positively correlate with ROA. The size has a positive correlation between CCC and its determinants. Moreover, it is positively correlated with ROA (0.63). The growth is correlated positively with ROA (0.26) and DIO (0.26). Cash flow has a positive correlation coefficient with ROA and CCC. This relation may indicate that availability of cash flow increases the investment in working capital (Baños-Caballero et al., 2014). Cash holding has a negative correlation with all variables except CFLOW. The highest correlation is between days in inventories and the CCC (0.95), and the relationship is a strong positive.

If the correlation is remarkably high, it can indicate multicollinearity. The VIF value range was from 1.78 to 25.4. As stated previously, there is no specific range for the VIF. Hence, determining the range is flexible. The VIF was for CCC, indicating high multicollinearity between days in inventories and the CCC. However, the industry is highly dependent on

inventories. For instance, mining companies like to have spare parts available at the site because it is crucial to keep mining ongoing. A slight pause in operations can cause significant losses for a company.

Moreover, the supply chain challenges have increased inventory levels. The aim to have more parts in inventories help to keep operations ongoing and profit coming in uncertain times. There are different actions to reduce the multicollinearity in this sample. Increasing the sample would be an excellent way to reduce the issue. However, the sample already includes the main competitors; the last year for available data for some companies is 2012. Hence, increasing the sample, in this case, is not possible. Another action is doing nothing, which will be chosen for this study.

5 Empirical findings

This chapter will foremost present the empirical results of this thesis. The first section will be an introduction to the regression analyses. The results of all regression models will be presented and analyzed. There will be three different regression finding tables. The first two results will focus on three first hypotheses. The last table will present the results for the hypothesis four. The chapter will be concluded by discussion section. This section will determine whether hypothesis is accepted or rejected.

5.1 Regression analyses

In this section, the result from regression analyses will be presented. Both fixed and random effect models were performed. However, the findings of the best model are only presented. In addition, the correlation coefficient matrix was analyzed in chapter 4.4. The matrix raised some multicollinearity issues. The multicollinearity values were stable for all samples, but there were some for multicollinearity in the smaller sample. In the first sample, there were minor multicollinearity issues.

Regression models for each sample were performed. The first regression model will present the result for the whole industry. The second result of regression 1 will show the findings for the company and its competitors. The results of regression models 2 and 3 will be presented last. This result will consider the whole industry.

The Hausman test was conducted to determine which regression model is more suitable to analyze the data for this study. The hypotheses for the Hausman test are stated in chapter 4.3.2. As stated, the null hypothesis is rejected if the p-value is less than 0.05. This means that the fixed effect regression model is used for this thesis. The null hypothesis is accepted if the p-value is more than 0.05. Hence, the random effect regression model will be chosen for the study.

The results of the Hausman test show that the p-value is 1.90e-19. The result is smaller than the p-value. Therefore, the null hypothesis is rejected for regression analysis for the industry sample. In other words, the fixed effect model is used to analyze the data in this study. Furthermore, the fixed effect model is used in all regression models and the random effect is rejected for all models.

5.1.1 Regression analysis of whole industry

Table 6 presents the findings for hypotheses 1-3 and the primary model for the industry. The results include alternative models that help to get an insight into the components of the CCC. As previously stated, the components are DIO, DSO, and DPO. The same alternative models are used in the smaller focus group, and the results for this sample can be found in Table 6. The regression models are in Chapter 4.3.2. (1) indicates model 1, while (1.2) in the model for DIO, (1.3) is DSO regression model, and lastly, (1.4) is DPO regression model.

Table 6 shows a convex relationship between profitability and working capital. The CCC, DIO, and DSO have significantly negative related to ROA. The coefficients for these variables are as follows; (-0.00023), (-0.000108), and (-0.000363). One additional day in inventories will decrease profitability by 0.01%. In addition, increasing DSO by one day will decline profitability by 0.036%. Therefore, long days in inventories and payments from the customer have a negative impact on profitability. Other significant relationships between ROA and independent variables are size, leverage, and cash flow. The size has a positive influence on profitability, and the most significant effect is in regression model 1.2. The leverage has a negative effect on ROA for all models. Also, this determinant has the most considerable impact on the DIO regression model (1.2). The growth has mostly a negative effect on profitability. It is somehow significant in the first model. In others, the relationship between growth and the dependent variable is not significant. CFLOW in all models shows a significant positive relationship with ROA.

CHOLD has an insignificant effect on profitability in all models. According to adjusted R-squared, the half variation of dependent variables can be explained by determinants.

Table 6. The results of regression 1, the whole industry (author's calculation).

Variable	(1)	(1.2)	(1.3)	(1.4)
CCC	-0.00023***			
	(-7.032)			
CCC^2	1.08e-07***			
	(5.133)			
DIO		-0.000108***		
		(-2.763)		
DSO			-0.000363***	
			(-7.016)	
DPO				1.54e-05
				(0.523)
SIZE	0.000768***	0.000829***	0.000648***	0.000661***
	(4.611)	(4.652)	(3.873)	(3.847)
LEV	-0.000452**	-0.001040***	-0.000573***	-0.000594***
	(-2.114)	(-3.587)	(-2.671)	(-2.697)
GROWTH	-0.000421*	0.000268	-0.000191	-0.000162
	(1.894)	(1.096)	(-0.861)	(-2.697)
CFLOW	0.12***	0.175***	0.151***	0.153***
	(9.02)	(11.20)	(10.673)	(11.02)
CHOLD	-0.00274	-0.000341	-0.0018	-0.000135
	(-0.502)	(-0.062)	(-0.327)	(-0.024)
Adjusted R-squared	0.516	0.509	0.509	0.481
Durbin-Watson statistic	1.288	1.297	1.219	1.203
F-statistic	8.971	8.728	8.752	7.921
Number of obs.	809	805	809	809

Note: The dependent variable for this table is ROA. ROA is return on assets, CCC is cash conversion cycle, DIO is days in inventory, DSO is days in receivables, DPO is days in payables, SIZE is company's size, LEV is leverage, GROWTH is growth opportunities, CFLOW is cash flow, and lastly CHOLD is cash holding. t-values are below the coefficients. '*', '**', and '***', indicates significance at the 0.10, 0.05, and 0.01 level respectively.

5.1.2 Regression analysis of the company and its competitors

Table 7 present the findings for hypotheses 1-3, but for smaller sample. This sample includes the company and its main competitors. The first model includes only CCC, while the other models have one of the components.

Table 7. The results of the regression model, the company, and its competitors (author's calculation).

Variable	(1)	(1.2)	(1.3)	(1.4)
CCC	-0.00115			
	(-1.424)			
CCC^2	3.72e-06			
	(1.246)			
DIO		6.83E-05		
		(0.103)		
DSO			-0.006338**	
			(-2.523)	
DPO				-0.000675
				(-0.334)
SIZE	0.00844	0.0036	-0.0167	0.00805
	(0.364)	(0.161)	(-0.849)	(0.373)
LEV	0.00127	0.0319	-0.00365	0.0208
	(0.0191)	(0.481)	(-0.0663)	(0.324)
GROWTH	0.0382*	0.0396*	0.0458**	0.041*
	(1.898)	(1.942)	(2.468)	(2.002)
CFLOW	0.735***	0.75***	0.817***	0.761108***
	(7.307)	(6.956)	(9.639)	(7.479)
CHOLD	0.0215	0.0362	-0.0161	0.0406
	(0.411)	(0.701)	(-0.356)	(0.802)
Adjusted R-squared	0.804	0.792	0.848	0.795
Durbin-Watson statistic	1.935	1.904	1.818	1.924
F-statistic	17.059	15.942	22.78	16.144
Number of obs.	48	48	48	48

Note: The dependent variable for this table is ROA. Where ROA is return on assets, CCC is cash conversion cycle, DIO is days in inventory, DSO is days in receivables, DPO is days in payables, SIZE is company's size, LEV is leverage, GROWTH is growth opportunities, CFLOW is cash flow, and lastly CHOLD is cash holding. t-values are below the coefficients. '*', '**', and '***', indicates significance at the 0.10, 0.05, and 0.01 level respectively.

The findings in Table 7 are like Table 6. Furthermore, the results show a convex relationship between ROA and CCC. However, the relationship is insignificant. Fewer determinants have a significant influence on the dependent variable, ROA. Only one component of CCC has a significant effect on the dependent variable. This determinant is DSO with a coefficient of (-0.006338). The growth and cash flow also have a significant relationship with ROA. The growth values in this sample have a more significant effect on ROA than in the results in Table 6.

Moreover, there is a similar result in cash-flow coefficients. When investigating the relationship between DPO and ROA, cash flow has the most considerable effect on profitability. The coefficient, in this case, is (0.0458). CHOLD also has an insignificant relationship with ROA. This finding is like the whole industry sample. The adjusted R-squared is better than in Table 6. Around 80% of the variation in ROA can be explained by the determinants.

5.1.3 Regression analysis of cash availability effect on working capital investment

Table 8 presents the cash flow effect of working capital investment on profitability. The sample for this table is the whole industry. The result shows a convex relationship of ROA with CCC×CFLOW and CCC×CHOLD. The coefficients for CCC×CFLOW and CCC^2×CFLOW are (-9.67e-05) and (-5.60e-09). The significant level was only for CCC×CFLOW, and it is 0.1. The coefficients are for CCC×CHOLD (-0.000493) and CCC^2×CHOLD (1.49e-07). The significant levels are 0.10 and 0.01. Again, size has a significant favorable influence on ROA. The highest coefficient (0.00152) is in model 2.

Table 8. The results of ROA, working capital, and cash availability (author's calculation).

Variable	(2)	(3)
CCC×CFLOW	-9.67e-05*	
	(-1.505)	
CCC^2×CFLOW	-5.60e-09	
	(-0.154)	
CCC×CHOLD		-0.000493***
		(-4.606)
CCC^2×CHOLD		1.49e-07*
		(1.478)
SIZE	0.00152***	0.000322*
	(3.599)	(1.774)
LEV	0.000333	-0.000785***
	(0.681)	(-3.388)
GROWTH	-0.000979*	-0.000278
	(-1.689)	(-1.158)
CFLOW	0.198***	
	(10.173)	
CHOLD		0.0252***
		(3.217)
Adjusted R-squared	0.495	0.42
Durbin-Watson statistic	1.181	1.24
F-statistic	8.420	6.469
observation	812	817

Note: The dependent variable for this table is ROA. Where ROA is return on assets, CCC is cash conversion cycle, DIO is days in inventory, DSO is days in receivables, DPO is days in payables, SIZE is company's size, LEV is leverage, GROWTH is growth opportunities, CFLOW is cash flow, and lastly CHOLD is cash holding. t-values are below the coefficients. '*', '**', and '***', indicates significance at the 0.10, 0.05, and 0.01 level respectively.

5.2 Discussion

H0: *There is no trade-off between working capital and profitability.*

The null is rejected because there is relationship between working capital and profitability in Table 6. However, in Table 7, which focus more on the leader companies in the industry, do not show a significant relationship between the working capital and profitability.

H1: *There is an optimal level between profitability and working capital management.*

Hypothesis 1 is rejected because there is no inverted concave relationship between working capital management and corporate profitability. Moreover, the results indicate an aggressive strategy to be more profitable for the companies operating in the manufacturing industry in the mining, quarrying, and construction segment.

Hypothesis 1 states that there is an optimal level between profitability and working capital management. This relation should be inverted U-shaped, where firms with higher (lower) working capital levels should decrease (increase) the working capital. The relationship is supported by, for example, Baños-Caballero et al. (2014) and Afrifa (2016).

The results from Tables 6 and 7 show a convex relationship between working capital management and profitability. The coefficient of CCC is negative ($\beta 1 < 0$), and the coefficient of CCC^2 is positive ($\beta 2 > 0$). In Table 5, the coefficient for CCC is (-0.00023), and CCC^2 is (1.08e-07) and significant at level 0.01. When checking the components of CCC, the DIO (-0.000108) and DSO (-0.000363) have a negative relation with ROA with a significant level of 0.01. The finding shows that there is not an optimal level of working capital. The findings are like Panda and Nanda's (2018) study on WCM and the profitability of Indian manufacturing firms. A convex relationship existed between working capital and corporate profitability in the chemical, construction, and customer goods sector.

The aggressive WCM strategy could increase profitability in this industry. In other words, the traditional school of thought can explain the relationship between working capital and profitability. This idea aims to shorter the length of the working capital cycle. Therefore, the firms in this industry should decrease the number of days in inventories and AR to a minimum (Deloof, 2003). This action could help companies to decrease, for instance, interest costs because a higher working capital level needs more investment. Also, warehouse renting costs would decrease, thus improving profitability. A negative

relationship between DSO and profitability could be influenced by customers' needs to evaluate products before buying them (Deloof, 2003). A negative association between DIO and financial performance could be impacted by a loss of sales, leading to lower profits and higher stocking levels (Deloof, 2003).

H2: *A company size has a positive influence on profitability.*

Young companies are more vulnerable to capital market imperfections (Almeida et al., 2004). Alarussi and Alhaderi (2018) argue that larger companies manage their assets more efficiently than smaller ones. Therefore, size plays an important role when investing in, for example, working capital management. Furthermore, cheaper funding helps to save costs and invest more funds in projects and inventories. In summary, hypothesis 2 is accepted for this master's thesis.

Hypothesis 2 proposes that there is a positive relationship between size and profitability. Larger firms have more possibilities to invest in working capital and may be more efficient in managing their assets.

The results from Table 6 show that the size has a significant positive relationship with ROA in both CCC and its components. The most significant positive impact on profitability is when DIO is regressed on ROA, and the coefficient is (0.000829). At the same time, the slightest influence is when DSO is regressed on ROA. The size coefficient, in this case, is (0.000648) with a significant level of 0.01. Similar results are presented by Alarussi and Alhaderi (2018). They found a positive correlation between size and profitability in Malaysian firms.

In this industry, size has a positive influence on profitability. The larger companies may have better financing possibilities than smaller companies. For instance, better borrowing capacity and can source cheaper finance. Moreover, large firms can use internal funding, which is cheaper than external. The smaller firms usually face higher informational asymmetry and agency costs.

H3: *The Financial leverage has a negative effect on profitability.*

According to the results from Table 6, the companies in this industry may prefer internal funding to external. This may be affected by the cost of debt. For instance, debt can be more expensive than equity due to agency costs. Moreover, firms may face higher financial risks when using leverage. The benefit of a tax shield is not better than the benefits from internal funding. Hypothesis three is accepted for this research.

Hypothesis three outlines that leverage has a negative influence on corporate profitability. Firms may use leverage as a tax shield, positively impacting profitability. Moreover, it is one of the components of a company's capital structure. However, using external debt can be more expensive than internal funding. Therefore, leverage can influence profitability negatively because it can be a more expensive funding source.

Table 6 results show a significant negative relationship between leverage and profitability. The enormous impact is when DIO is regressed on ROA. The coefficient in this model is (-0.001040). At the same time, a minor influence is when CCC is regressed on ROA, and the coefficient is (-0.000452). The coefficients are significant at 0.01 and 0.5, respectively. Table 6 shows mixed results, but most models show a positive relation between leverage and profitability.

Furthermore, the results are insignificant. Similar results are presented by Alarussi and Alhaderi (2018). Their results showed a significant negative association between company leverage and profitability.

H4: *Cash flow availability has a positive influence on working capital and profitability at higher levels of working capital.*

H5: *Cash flow availability has a positive influence on working capital and profitability and negatively at lower levels of working capital.*

The convex relationship of ROA between CCCC×HOLD on the relationship between CCC and profitability was also discovered by Afrifa (2016). However, the results are mixed between CFLOW and CHOLD, and the results for CFLOW were insignificant. Therefore, there is no clear answer for this effect.

The last hypothesis in this thesis outlines that cash flow availability positively affects working capital. The availability of cash flow is essential in working capital management because it needs investment to generate cash. In addition, low cash flow can decrease the investment in working capital management, leading to lower profitability. The companies should increase their investment in working capital to improve profitability at a higher level of cash flow.

The results from Table 8 show the results for cash flow availability on working capital management. This sample includes the whole sample in the specified industry. The finding shows a convex relationship of ROA between CCCC × HOLD and a concave between CCCC×FLOW on the relationship between CCC and profitability. The coefficient for the variables (-9.67e-05) and (-0.000493) are negative, respectively ($\beta 1 < 0$). The significant levels are 0.1 and 0.01, respectively. The coefficient for $CCC^2 \times$ CFLOW is negative but not significant. However, the $CCC^2 \times$CHOLD coefficient (1.49E-07) is positive ($\beta 2 > 0$) and significant at 0.1. Therefore, the results show some cash flow influence on CCC and corporate profitability.

6 Conclusion

The aim of this thesis was to investigate the optimal working capital level for the manufacturing industry in the mining, quarrying, and construction segment. This research aimed to determine a benchmark for the multinational company in this industry. Moreover, to understand the future strategy in working capital and optimizing the supply chain. For one, it can be essential to understand the industry's strategy and how the CCC and its components affect corporate profitability. In addition, to check the availability of cash effect to working capital. This helps to develop the right actions to improve working capital management.

The sample included 809 observations from manufacturing machinery for mining, quarrying, and construction (NACE Rev. 2 code 2892). The period for this master's thesis was nine years, from 2013 to 2021, and covered all global regions. The analyzed data was done by panel data analysis. Furthermore, the fixed effect model was chosen to analyze data. The dependent variable for this research was ROA, while the independent variables were CCC, SIZE, LEV, GROWTH, CFLOW, and CHOLD.

The following sections will present the main findings of this thesis and its practical implications. This also includes the answers to the research questions. Lastly, this chapter is concluded with the limitations of the study and ideas for future research.

The following research questions for this thesis were:

RQ1: *Do companies optimize their working capital to achieve superior financial performance?*

RQ2: *Which working capital component has a positive (negative) effect on profitability?*

The relationship between working capital management and corporate performance was convex. This rejects H1 because it outlined an inverted U-shaped relationship. Moreover,

the result indicates that the companies in this industry benefit from an aggressive WCM strategy. In other words, shortening the CCC will increase financial performance. The strategy is also known as a traditional school of thought. It is one of the most supported theories to explain the relationship between working capital and profitability. According to this school of thought, companies should minimize DIO and DSO.

The most significant components of CCC were DIO and DSO. The DSO has a more significant effect on ROA than DIO. Increasing DSO by one day will decline profitability by 0.036%. Improving the DIO companies should move the risks of goods as soon as possible to its customers. For instance, shipping them immediately when receiving a customer order or delivering items as Delivered-at-Place (DAP). Other actions to improve could be better inventory management, for instance, forecasting and moving items upstream in supply chain.

Moreover, scrapping unmarkable items before they become worthless. In other words, more careful planning and minimize the mistakes in customer orders. Collaboration with a customer could help optimize the payments and deliveries, improving DIO. Collaborative WCM has shown a positive cost-saving effect and increased performance (Hofmann & Wetzel, 2019). Moreover, the firms should follow a just-in-time production strategy because it can help to reduce inventory levels. Minimizing DSO can also be done by shortening the payment terms. This action helps to move the working capital cost to another stage, in this case, to the customer's working capital.

A short CCC helps companies maintain low financing and interest costs. Therefore, they have more cash to invest in other projects. In addition, a shorter CCC can indicate efficient cash conversion from assets to back to cash. There are benefits on the debit side because lower CCC shows a little need for external funding. However, shortening too much on CCC can lead to other issues. For instance, a short DIO can lead to the loss of potential sales due to a lack of stock availability. Moreover, a short DSO also negatively influences sales, such as a decrease in sales from customers requiring a credit.

There are limitations in this study. Firstly, the sample was limited because there was large number of companies missing accounting data. Furthermore, the time is short because it does not include the whole economic cycle. A shorter period was chosen because some main competitors had only data from 2012 onwards. Also, the sample did not include 2022, when the company faced a considerable increase in inventory levels due to all logistics issues and COVID-19. The data had some extreme values that could have affected to final data. In addition, there were some multicollinearity issues. The source for data could be more accurate because there were many missing values in the sample companies. This could be affected by the differences between accounting standards and practices.

For further research, the investigating working capital management in an inter-organizational supply chain setting. This could be done by analyzing the company and its leading suppliers and customers. Collaboration along the supply chain can improve working capital and increase profitability (Hofmann & Wetzel, 2019). Another interesting area of future research is investigating the differences between countries or geographical areas. Later, when more data are available from 2022, it would be interesting to investigate the influence of interest rates on working capital. Currently, companies are facing higher interest rates for loans and thus borrowing is more expensive. This means that there can be less investment in WCM if a firm is using more debt to keep its operating running. Moreover, examine whether the credit rating of a company affects the WCM. Credit rating presents the credit risk of a company and its ability to face financial obligations.

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