3350 – Thesis in Accounting and Financial Management
Stockholm School of Management

Profitability Effects of Working Capital Management: An Analysis of Swedish SMEs

Andrew Benecke[*]
Robin Fredriksson Lindmark[†]

June 7, 2017

Abstract

The purpose of this thesis is to examine how the profitability in Swedish small and medium sized enterprises (SMEs) is affected by working capital management (WCM). The cash conversion cycle and its three elements (days in inventory, days accounts receivable and days accounts payable), which are utilised as measures of WCM, all show negative relationships with SME profitability when analysed with fixed effects regressions. The negative relationships between WCM and profitability are found to be pronounced in economic downturns, confirming previous research on large firms. It is shown that industry affiliation is an important factor since the negative relationships are found not to be valid across all industries. Though the use of linear spline regressions, SMEs' current level of working capital is additionally found to influence the profitability effects of WCM. Furthermore, a dynamic panel generalised method of moments (GMM) estimator is utilised in order to allow current values of WCM to be influenced by past profitability. SMEs wishing to improve profitability are advised to focus on the management of days in inventory. Days in inventory is found to have the largest impact on profitability and it is the only significant component of the CCC when the dynamic nature of the profitability-WCM relationship is accounted for.

Supervisor: Florian Eugster, Assistant Professor Department of Accounting[‡]

Keywords:
Cash conversion cycle, Dynamic panel GMM estimator, Firm profitability, SMEs, Working capital management

[*]40854@student.hhs.se
[†]22432@student.hhs.se
[‡] We would like to thank our thesis supervisor Florian Eugster for his fruitful discussions and valuable insights. His supervision has been of great help in the making of this thesis.

Contents

List of figures

List of tables

1 Introduction

The small firm sector plays a vital role in stimulating technological innovation and creating employment (Peel & Wilson, 1996). SMEs represent over 65% of the total number of persons employed in Sweden and they contribute to more than half of the gross value added of the Swedish economy[1]. The importance of SMEs is also found across the European Union and is not only isolated to Sweden (Airaksinen, Luomaranta, Alajääskö, & Roodhuijzen, 2015). Despite the contribution of SMEs to employment and economic growth they often face difficulties in obtaining financing and are therefore particularly reliant on short term financing and trade credit (Wagenvoort, 2003; Peel & Wilson, 1996; Petersen & Rajan, 1997). Similarly, the majority of SMEs' assets are current in nature which, in combination with the short term nature of financing, highlights the essential nature of efficient working capital management in ensuring the continued survival, profitability and growth of SMEs (Peel & Wilson, 1996). Due to the importance of SMEs for the economy and SMEs' reliance on working capital it is important to understand the impact of working capital management on SMEs' profitability. Our research question is therefore how the profitability of Swedish SMEs is affected by working capital management (hereinafter WCM).

Considering that an overwhelming majority of SMEs utilise WCM practices it is of interest to determine how best SMEs can allocate their time and resources in improving WCM. It is of interest to not only understand the profitability effects of WCM at an aggregate level through the cash conversion cycle concept, but also how WCM relates to the cash conversion cycle's constituent elements (days in inventory, days accounts receivable and days accounts payable). Specifically, it is useful to understand if there is an optimal level at which managers should maintain the cash conversion cycle and its constituent elements. Although previous research has investigated the presence on non-linarites through quadratic equations, the use of a quadratic equation, albeit theoretically justified, presumes the shape of the relationship between WCM and profitability (Baños-Caballero, Garcia-Teruel, & Martinez-Solano, 2012; Lyngstadaas & Berg, 2016; Pais & Gama, 2015). For this reason we utilise a spline regression in order to more accurately model the profitability effects of WCM at different working capital levels. Prior research has found the WCM-profitability relationship in large firms to be influenced by economic downturns (Enqvist, Graham, & Nikkinen, 2014). Since SMEs are less

[1] Gross value added (GVA) at market prices is output at market prices minus intermediate consumption at purchaser prices.

liquid and have more volatile cash flows and profits, it is relevant to investigate how the WCM-profitability relationship in SMEs is affected in poor economic states (Peel & Wilson, 1996).

WCM and managers' ability to realise working capital improvements are particularly influenced by the industries within which firms are operating. The most powerful industries and firms within a supply chain are able to realise improvements at the cost of less focal industries and firms (Hoffman & Kotzab, 2010). Our study therefore investigates the effect of WCM on profitability with the sample being classified into ten industries. Should a firm's positioning relative to other firms as well as its historical performance determine the level of working capital, the question arises whether WCM is driven by past profitability. Previous research has recognised the presence of endogeneity specifically arising from unobserved heterogeneity and simultaneity. However, the methods used to control for these endogeneity sources have neglected the possibility of current values of WCM to be influenced by past profitability. In order to address these concerns we utilise a dynamic panel generalised method of moments (hereinafter GMM) estimator through which instruments are constructed from past values of the cash conversion cycle, its constituent elements and control variables to account for the aforementioned source of endogeneity.

Our findings provide guidance to managers wishing to improve profitability through WCM practices. Specifically managers wishing to improve profitability are advised to focus their time and resources on reducing days in inventory. This is a valuable insight since it is not uncommon that SMEs face weaker positions in their supply chains which may limit their ability to realise improvements in WCM and therefore the most effective allocation of attention is essential (Hoffman & Kotzab, 2010). Our findings additionally cast doubt on the profitability effects of WCM and are indicative of a dynamic relationship whereby WCM is influenced by past profitability.

Our thesis contributes to the literature through the inclusion of profitability measures, return on net operating assets (RNOA) and return on capital employed (ROCE), which provide a closer measure of firms' operating profitability in comparison to the traditional return on assets (ROA) measure. Moreover, to our knowledge this paper is the first of its kind to utilise spline regressions in modelling non-linearities in the relationship between profitability and WCM. Lastly, the paper contributes through the use of GMM estimators in controlling for the dynamic relationship between WCM and profitability.

Our thesis will proceed by first reviewing the literature underpinning the measurement of working capital and previous findings regarding the relationship between WCM and profitability. Next, the research design is outlined after which our results are presented. The paper ends with concluding remarks and suggestions on further research.

2 Previous literature

This section will start with an overview of previous literature on the subject of measuring working capital, which will be followed by previous research on how working capital and WCM is related to profitability. The two last parts of the section discuss the effects of poor economic states on the profitability-WCM relationship and endogeneity concerns.

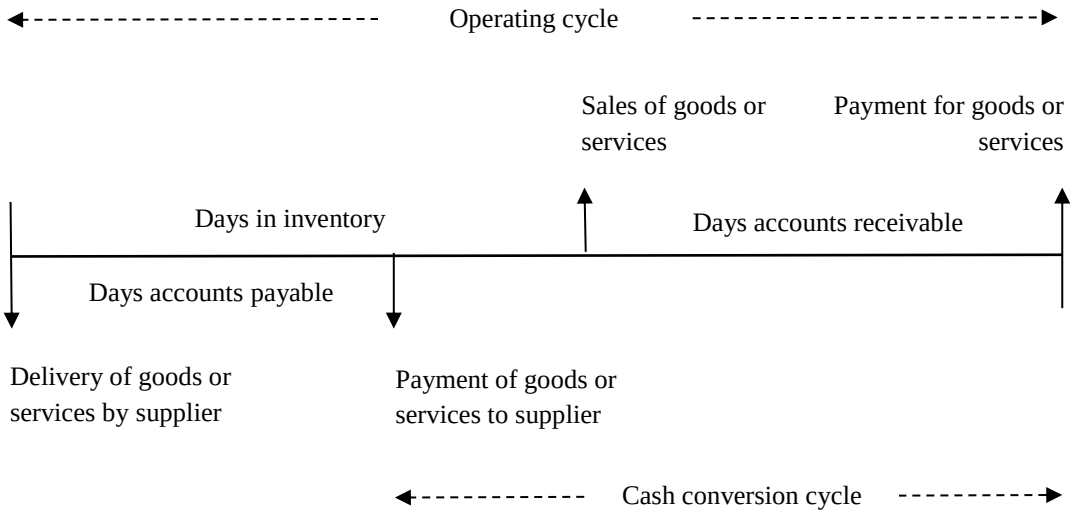
2.1 The measurement of working capital

The current ratio, defined as current assets to current liabilities, has been the traditional tool for financial analysts when examining firms' liquidity positions (Richards & Laughlin, 1980). Inter-firm and inter-period comparisons of the current ratio are however of questionable value due to differences in liquidity characteristics of current assets (Richards & Laughlin, 1980). Due to this weakness, the current ratio has been complemented with the quick ratio (or "acid test" ratio) which excludes less liquid current assets when evaluating liquidity. However, a drawback with static measures such as both the current ratio and the quick ratio is the fundamental assumption of current assets being convertible into cash at close to their carrying amounts. This assumption is problematic as firms may experience significant differences in the speed with which current assets can be converted into cash flows (Richards & Laughlin, 1980). Hence the usefulness of static liquidity measures is limited by the failure to provide information about cash flow attributes of the working capital's transformation process. Static liquidity measures therefore emphasise a liquidation rather than a going-concern approach (Richards & Laughlin, 1980).

The static balance sheet analysis of liquidity can be developed to a flow concept by including income statement information of a firm's operating activities. The cash conversion cycle (hereinafter the CCC), defined as the time in days that elapses between the first outflows associated with production and the final inflow of cash generated from sales, is a key tool for financial managers in the management of a firm's working capital (Gitman, 1974). The cumulative average days in accounts receivable and inventory can be seen as an approximation of the operating cycle's length (Richards & Laughlin, 1980). The cumulative average days in accounts receivable and inventory is reduced with the average payment period to reflect the

deferral of payments for costs incurred to support operating activities. By adding average days in inventory with average days accounts receivables and subtracting the average payment period, the CCC is obtained which is regarded as a comprehensive flow measure of liquidity, as seen in figure 1 (Richards & Laughlin, 1980).

Figure 1: The cash conversion cycle



The CCC reflects four basic operating activities: purchasing and/or production, payment, sales and collection. The CCC provides a reflection of the non-instantaneous and unsynchronized flows within the working capital accounts and thereby depicts the residual time over which additional financing must be secured (Richards & Laughlin, 1980). Using the CCC concept, a firm can minimise its operating cash requirement by paying its bills as late as possible, selling its inventory quickly, reducing time in the production cycle and speeding up the collection of accounts receivables (Gitman, 1974). A movement to a longer CCC will in general increase current assets. If these investments in current assets are funded by long-term financing, the current or quick ratio can increase and reflect a more liquid position for the firm, however a CCC analysis will explain the higher ratios as a result of a heavier reliance on less liquid forms of current asset investments (Richards & Laughlin, 1980). The CCC analysis therefore provides superior insights compared to static measures for the management of a firm's working capital position (Richards & Laughlin, 1980).

Since the CCC is focusing on the time funds are tied up in the cycle and neglecting the amount of funds committed, another measure can be constructed to take into account both the timing of cash flows and the amounts of funds used in each part of the cycle, the Weighted CCC (Gentry, Vaidyanathan, & Lee, 1990). The Weighted CCC is weights the three components of the CCC

with their respective amounts tied up by the final value of the product (Gentry, Vaidyanathan, & Lee, 1990). The CCC assumes that costs related to all steps in the operating cycle starts on the first day thereof while the weighted approach brings costs into the analysis as they are added at each step of the cycle and adjusts them for their relative contributions (Gentry, Vaidyanathan, & Lee, 1990). Compared to the unweighted approach, the Weighted CCC provides a more refined interpretation of the working capital commitment to the operating cycle (Gentry, Vaidyanathan, & Lee, 1990). However, breaking up and weighting the different components in the operating cycle require information which is typically not available to the general public and consequently the CCC is the concept most widely used in research as a comprehensive measure of WCM (Enqvist, Graham, & Nikkinen, 2014; Shin & Soenen, 1998).

2.2 Working capital, WCM and profitability

Studies analysing the profitability effects of WCM have broadly contrasted two strategies in the management of working capital (Martinez-Solano & Garica-Teruel, 2007). An aggressive approach can be followed where working capital is kept to a minimum through the reduction of inventory levels and more stringent credit extension and collection from customers. Alternatively working capital can be increased as a means of supporting sales through high inventory levels and liberal credit policies to customers. An aggressive WCM strategy results in a short CCC with, in general, less capital tied up on the balance sheet. Less capital tied up on the balance sheet is, all else equal, beneficial for profitability ratios through a smaller asset base, in other words firms decrease their opportunity cost of capital. The different WCM strategies might also affect the income measure in the profitability calculation. It is therefore not clear whether the numerator or denominator effect, the effect on income or the effect on the asset base, is the dominating force. Thus, in determining the optimal level of working capital a trade-off is implied where the risk and profitability effects of each strategy must be evaluated. It must also be kept in mind that optimising any one part of the CCC can have adverse effects on other parts of the cycle. Therefore an overall approach needs to be taken in the management of any firm's working capital (Hager, 1976).

Early research conducted on large US firms in the area of profitability effects from WCM support the notion of aggressive WCM enhancing profitability (Jose, Lancaster, & Stevens, 1996; Shin & Soenen, 1998). A short CCC is found to minimise the necessary holdings of relatively unproductive assets such as cash and marketable securities. Additionally a short CCC preserves a firm's debt capacity since less short term borrowing is needed to support liquidity (Jose, Lancaster, & Stevens, 1996). However, early research placed a focus on WCM only at a

comprehensive level (through the CCC), but understanding the benefits and risks of minimising or increasing the CCC entails breaking down the cycle into its separate elements (days accounts payable, days accounts receivable and days in inventory) and understanding the motives behind the management of each element.

Trade credit forms an integral part of the CCC with both days accounts receivable and payable related to trade credit extension and acceptance. The management of trade credit has implications on a firm's supply chain as an important tool in managing client and supplier relations (Hoffman & Kotzab, 2010). Trade credit serves to alleviate information asymmetries between buyers and sellers, a concern which is particularly relevant when considering the information opacity typically associated with SMEs (Ng, Smith, & Smith, 1999; Petersen & Rajan, 1997). The positioning of trade creditors relative to customers give them a unique insight into the operations of debtors and therefore an increased ability in monitoring the quality of credit extended (Wilner, 2000). Similarly, debtors gain the ability to monitor the quality of goods and services delivered before settlement is made to suppliers (Pais & Gama, 2015).

The management of trade credit by firms can, just as WCM in general, be categorised into two strategies. Following an aggressive strategy entails minimising trade receivables and maximising trade payables whilst a more liberal strategy implies extending longer days accounts receivable and paying suppliers more promptly (Hager, 1976). Through decreasing accounts receivable and increasing accounts payable a firm might be able to increase its profitability by reducing the amount of capital that needs to be invested in maintaining working capital, investments which are typically associated with lower returns when contrasted to long term investments (Lyngstadaas & Berg, 2016). However, following such a strategy takes a narrow view of a firms operations, threatening to marginalise the role of client and supplier relations in maintaining profitability. Strictly increasing accounts payable, risks stressing supplier relations which ultimately could impact the ability of firms in attaining future credit from suppliers and, depending on credit terms offered, increase cost of sales through the foregoing of discounts for early payment (Wang, 2002). Similarly, minimising trade receivables, which are often used as a means for incentivising sales, risks placing client relations under strain which could ultimately adversely impact sales and profitability (Seifert, Seifert, & Protopappa-Sieke, 2013).

The empirical evidence of profitability effects of days accounts payable and days accounts receivable broadly suggest that decreasing days accounts receivables as well as payables do both have positive profitability effects (Baños-Caballero, Garcia-Teruel, & Martinez-Solano, 2012; Deloof, 2003; Enqvist, Graham, & Nikkinen, 2014; Gill, Biger, & Mathur, 2010; Lyngstadaas & Berg, 2016; Pais & Gama, 2015). These findings corroborate the positive profitability benefits of following an aggressive WCM strategy in relation to accounts receivable yet contradict the theoretical benefits of aggressive working capital management with respect to accounts payable. Deloof (2003) hypothesises that the observed negative relationship between profitability and days accounts payable could stem from less profitable firms delaying payments to suppliers and more profitable firms being capable of utilising discounts granted for early payments. It has also been found that after controlling for simultaneity, the negative relationship between profitability and days accounts payable becomes insignificant, and the negative relationship between profitability and days accounts receivable is found to be positive which could be attributed to customers requiring longer periods to inspect the quality of goods delivered before payment if suppliers are of poor profitability (Martinez-Solano & Garica-Teruel, 2007; Pais & Gama, 2015).

The final element of the CCC relates to the management of inventory levels. As for trade receivables and trade payables, a trade-off needs to be made between the benefits and costs of holding higher or lower levels of inventory. The costs of holding inventory can be grouped into two categories. Out-of-pocket costs (such as storage, handling, insurance and obsolete inventory costs) directly decrease profitability through the incursion of expenses (Kim & Chung, 1990). In addition to the out-of-pocket costs, firms incur opportunity costs through forgoing returns if funds invested in inventory had been invested otherwise (Kim & Chung, 1990). On the other hand, maintaining low levels of inventory increase the risk of disrupting manufacturing processes as well as providing sub-optimal customer service which ultimately affect profitability negatively (Jose, Lancaster, & Stevens, 1996; Koumanakos, 2008). Therefore, the trade-off implied is a minimisation of the costs associated with inventory in order to maximise profitability whilst maintaining continuity in production and satisfying customer demands.

Previous research has generally found negative profitability effects of increased days in inventory (Enqvist, Graham, & Nikkinen, 2014; Lyngstadaas & Berg, 2016; Martinez-Solano & Garcia-Teruel, 2007; Pais & Gama, 2015). However, Deloof (2003) highlights that firms

with poor profitability might be experiencing lower sales levels and consequently a build-up of stock, increasing days in inventory. The negative relationship can therefore not be strictly attributed to the profitability effects of reducing inventory since it might rather be driven by profitability's effect on inventory.

As has been touched upon in the discussion of trade credit, the WCM of firms is influenced by their positioning within supply chains (Hawawini, Viallet, & Vora, 1986; Hoffman & Kotzab, 2010). Through the extension of trade credit to customers, acceptance of trade credit from suppliers as well as inventory management; a firm has the ability to effectively shift credit risk and capital costs to other parties in the supply chain (Hoffman & Kotzab, 2010). Strictly minimising working capital through a reduction of trade receivables, inventory and increase of payables risks taking a narrow and short term view of a firm's relations in a supply chain. Increasing settlement periods to suppliers who might have restricted access to financing and a higher cost of capital jeopardises the long term stability of a firm's supplier base and has the potential to increase cost of sales. Similarly, firms who limit credit extended to customers could place the financial stability of their clients under strain as well as lose out on potential sales (Hoffman & Kotzab, 2010). Therefore, undertaking aggressive WCM, although potentially promising short-term financial benefits, might impede the long-term profitability and stability of a firm.

From the supply chain perspective, should all firms undertake to reduce risks and costs through a reduction of the CCC, the question arises as to who bares the capital cost and credit risk that has been transferred (Hoffman & Kotzab, 2010). Larger and more powerful firms in supply chains are suggested to be capable of dictating their payment terms onto smaller less powerful firms who often face higher borrowing costs and have restrained access to financing (Hoffman & Kotzab, 2010; Petersen & Rajan, 1997). Since SMEs by definition are smaller firms who typically possess less power in the supply chain, it remains to doubt to what degree SMEs are capable of actively implementing working capital improvements.

From the above theoretical discussions and empirical findings, our first group of hypotheses relate to the question if profitability in Swedish SMEs is affected by firms' management of working capital measured through the CCC and its constituent elements. These hypotheses are detailed on the next page:

H1a: Firm profitability is affected by days in inventory.

H1b: Firm profitability is affected by days accounts receivable.

H1c: Firm profitability is affected by days accounts payable.

H1d: Firm profitability is affected by the length of the cash conversion cycle.

2.3 The profitability-WCM relationship during economic downturns

Economy-wide fluctuations are important determinants for the demand of firms' products and also important for financing decisions. The recent global financial crisis placed strain on revenues, profits and working capital requirements of firms, renewing the focus on WCM (Enqvist, Graham, & Nikkinen, 2014). Therefore, the simultaneous working capital and business cycle effects are a relevant extension of the traditional working capital-profitability literature since optimal levels of working capital might be influenced by economic conditions. Evidence for a pronounced negative profitability-WCM relationship during economic downturns has been found for large firms in prior research, however without any corresponding effects in prosperous times (Enqvist, Graham, & Nikkinen, 2014). Inventory management and management of accounts receivables are components of the CCC which show a pronounced impact on profitability in economic downturns. The results are evidence for economic conditions being important influences on the working capital and profitability relationship (Enqvist, Graham, & Nikkinen, 2014).

SMEs are less liquid and have more volatile cash flows and profits compared to their larger counterparties (Peel & Wilson, 1996). Our second set of hypotheses is therefore aimed at investigating whether the effect of economic downturns on the simultaneous working capital profitability relationship is valid also for SMEs and are specified as:

H2a: The relationship between firm profitability and days in inventory is affected by economic downturns.

H2b: The relationship between firm profitability and days accounts receivable is affected by economic downturns.

H2c: The relationship between firm profitability and days account payable is affected by economic downturns.

H2d: The relationship between firm profitability and the length of the CCC is affected by economic downturns.

2.4 Non-linearities in the profitability-WCM relationship

As has been discussed, minimising working capital could increase risks and costs in running firm operations. Conversely investing in working capital could negatively affect profitability if the cost of the investment exceeds the benefits of maintaining a higher level of working capital. The relationship between WCM and profitability has therefore been hypothesised to be non-linear rather than linear and squared terms of the CCC and its components have been added to the traditional regression analysis (Baños-Caballero, Garcia-Teruel, & Martinez-Solano, 2012; Lyngstadaas & Berg, 2016; Pais & Gama, 2015). Baños-Caballero, Garcia-Teruel & Martinez-Solano (2012) were the first to relax the assumption of a linear relationship between WCM and profitability finding evidence for the presence of a maximum in the relationship between profitability and the CCC. Hence increasing the CCC increases profitability at low levels and decreases profitability at higher levels of the CCC. Subsequent studies have however found the coefficients of the squared WCM variables to be positive, indicating the presence of a minimum (Pais & Gama, 2015; Lyngstadaas & Berg, 2016). The minimum is found at large values of working capital variables, implying that an increase in those variables tend to decrease profitability at low levels of working capital. Hence, such non-linear relationships approximate a negative linear relationship since decreasing working capital increases profitability except for firms with the highest levels of working capital.

Our third group of hypotheses are therefore aimed at investigating whether the relationship between firm profitability and WCM varies depending on the level of working capital through the following hypotheses:

H3a: The relationship between firm profitability and days in inventory varies depending on the level of days in inventory.

H3b: The relationship between firm profitability and days account receivable varies depending on the level of days account receivable.

H3c: The relationship between firm profitability and days account payable varies depending on the level of days account payable.

H3d: The relationship between firm profitability and the length of the CCC varies depending on the length of the CCC.

2.5 Endogeneity concerns

Corporate finance research attempting to explain causes and effects from financial decisions is commonly plagued with endogeneity problems (Wintoki, Linck, & Netter, 2012). If not dealt with properly, endogeneity can have serious implications for the usefulness of research. The lack of natural experiments and exogenous factors make endogeneity troublesome for reliable interpretation from estimates (Wintoki, Linck, & Netter, 2012). The relationship between WCM and profitability is no exception. Deloof (2003) was one of the first researchers who acknowledged the importance of endogeneity concerns in the profitability-WCM relationships. He forwarded that the observed negative relationships might be driven by profitability's effect on WCM rather than WCM's effect on profitability.

Unobserved heterogeneity and simultaneity are the two sources of endogeneity commonly discussed by researchers (Wintoki, Linck, & Netter, 2012). The method most frequently employed in previous research when controlling for reversed causality has been to utilise the first lags of DINV, DAR, DAP and the CCC as instruments for WCM in fixed effects regressions (Lyngstadaas & Berg, 2016; Martinez-Solano & Garcia-Teruel, 2007; Pais & Gama, 2015). However, this method neglects a third source of endogeneity, namely the possibility that current values of the WCM variables might be functions of past profitability. Therefore the reliability of conclusions drawn is potentially compromised (Wintoki, Linck, & Netter, 2012).

3 Methodology

3.1 Sample description

This study makes use of an unbalanced panel data set covering Swedish SMEs over the period 1999-2015. The sample was acquired from the Serrano Database, which contains financial and general company data obtained from the Swedish Companies Registration Office. The sample has been limited to firms which meet the latest definition of SMEs set by the European Commission in the EU recommendation 2003/361, which is in line with previous European research (Baños-Caballero, Garcia-Teruel, & Martinez-Solano, 2010; Baños-Caballero, Garcia-Teruel, & Martinez-Solano, 2012; Pais & Gama, 2015). In the determination whether a firm

falls within the SME definition an assessment must be made of a firm's ownership situation in order to establish if a firm should be assessed on a standalone basis or from a broader group perspective. To avoid misclassification, only independent companies have been included in the sample to ensure that our classification of SMEs is only made on entities which are not under the control of other entities or form part of larger groups. Firms were classified as SMEs if they met the EU definition for 50% or more of the firm years for which data was available. Based on the EU recommendation, firms with less than 250 employees and revenue of equal or less than € 50 million or total assets equal or less than € 43 million were classified as SMEs. An additional requirement has been set through the introduction of a lower limit in defining SMEs. In accordance with the EU recommendation, micro firms with less than 10 employees and revenue equal or less than € 2 million or total assets equal or less than € 2 million were excluded from the sample if they were below the SME limit for more than 50% of the firm years for which data was available. The application of the lower limit ensures that, consistent with the EU definition, only small and medium sized enterprises are included in the sample.

Following practice in prior research the sample excludes firms in the financial and real estate sector. Furthermore, firm years with a reporting period of less or more than twelve months have been excluded from the sample. In addition, observations with missing data or values of zero for net sales, cost of sales, number of employees, and total assets were excluded. Firms with missing values for inventory, accounts receivable, accounts payable, days accounts payable, days accounts receivable, days in inventory and return on assets were further excluded from the sample. Moreover, firm years with nonsensible values were dropped by excluding firms with negative values for accounts receivable, accounts payable, inventory, capital employed, the current asset ratio, the current liability ratio, the debt ratio and total liabilities. In addition, firms with ratios higher than one for the leverage ratio, the current asset ratio or the current liability ratio were excluded. Firm years in which total assets did not equate the sum of total equity and liabilities were also dropped. Lastly, after applying the above filters, firms were only included for which consecutive yearly data was available for the period over which respective firms reported their financial results in order to exclude those firms which might have had interruptions in their operations and returned as firms managed materially different[1]. A detailed description of the filter process can be found in appendix A1.

[1] As a robustness check the regressions in section 4 have been estimated with firms with gaps in their time series being maintained in the sample. The results and interpretations do not differ from results obtained by excluding firms with gaps in their time series from the sample.

Ensuring that the effect of outliers do not drive the results, the variables return on assets, days accounts receivable, days accounts payable, days in inventory and sales growth have been winsorised by year at the 1st and 99th percentile[1]. After applying the above filters 21 132 SMEs remained in the sample with 143 258 firm year observations.

3.2 Variable motivation and description

3.2.1 Dependent variables

The dependent variable in our study, profitability, has been measured as return on assets (ROA) and is defined as earnings before interest expenses and taxes over the average of opening and closing balances of total assets (Penman, 2013). ROA is the profitability measure presented throughout the results section in an effort to enhance comparability with prior research which has, to a large extent, utilised ROA. The average of total assets has been used in order to give a fairer reflection of the assets employed during the year to generate income which creates greater consistency between the numerator and denominator in the ratio. The income measure, income before interest expenses and taxes, ensures that the measure of income is attributable to all providers of capital, which further enhances consistency between the income measure and the asset base.

An alternative measure of profitability, return on capital employed (ROCE) is utilised as a robustness check of the results. The measure focusses on measuring profitability relative to capital which has not arisen from operating activities but rather from debt and equity holders with an expectation of return for contributing capital. This is especially relevant considering that a large part of SMEs' liabilities are related to working capital (Martinez-Solano & Garica-Teruel, 2007; Wagenvoort, 2003). Therefore non-interest bearing liabilities (trade accounts payable and other current liabilities) are deducted from total assets. The results from using ROCE as the dependent variable are reported in the appendix as robustness checks.

A concern in the calculation of ROA and ROCE is that firms with a high proportion of financial assets will report income figures which are influenced by income generated from investing activities (Deloof, 2003). In order to ensure that a closer measure of operating profitability is attained, profitability is measured through return on net operating assets (RNOA), which is

[1] Winsorising the variables is found to only impact the significance of the results presented in section 4, however it does not alter the direction of the relationships investigated.

defined as income before interest and tax over the average of opening and closing balance of net operating assets. Net operating assets has been calculated as capital employed less financial fixed assets and short term investments. The results from using RNOA as the dependent variable are also reported in appendix as robustness checks of the results.

3.2.2 Independent variables

3.2.2.1 Primary independent variables

The CCC is the concept most widely used in previous research as a comprehensive measure of WCM due to its superior insight compared to static measures and the difficulties in obtaining data required to apply the weighted CCC (Deloof, 2003; Enqvist, Graham, & Nikkinen, 2014; Jose, Lancaster, & Stevens, 1996; Lyngstadaas & Berg, 2016; Martinez-Solano & Garcia-Teruel, 2007; Pais & Gama, 2015; Yazdanfar & Öhman, 2014). Hence employing the CCC concept enhances comparability to prior research. Accordingly the CCC and its constituent elements; days accounts receivable (DAR), days accounts payable (DAP) and days in inventory (DINV) will form the basis of the measurement of WCM. Breaking up the CCC and analysing the three components individually (and not just on at an aggregate level through the CCC) allows for the analysis of the different parts of WCM and their relative importance. The formulas for the calculations are as follows:

$$DINV = \frac{Inventory_{CB}}{Purchases} \times 365$$

$$DAR = \frac{Accounts\ receivables_{CB}}{Sales} \times 365$$

$$DAP = \frac{Accounts\ payables_{CB}}{Purchases} \times 365$$

$$CCC = DINV + DAR - DAP$$

where $Purchases = Inventory_{CB} - Inventory_{OB} + Cost\ of\ goods\ sold$

3.2.2.2 Control variables

Control variables included in the study are firm size (Size), sales growth (SalesG), the leverage (DOA), the current asset ratio (CAR), the current liability ratio (CLR), and the real economic growth in the Swedish economy within each respective year (GDPG).

Previous analyses of the profitability of SMEs have found a positive relationship between firm size and profitability with larger firms being capable of capitalising on economies of scale (Baños-Caballero, Garcia-Teruel, & Martinez-Solano, 2010; Martinez-Solano & Garica-Teruel, 2007; Yazdanfar & Öhman, 2014; Pais & Gama, 2015). Moreover, smaller firms are associated with higher information asymmetries in comparison to larger firms. Information asymmetries impede small firms' ability to attain external financing for investments in more profitable long term projects (Lyngstadaas & Berg, 2016; Berger & Udell, 1998). In line with previous research, we have controlled for firm size through the natural logarithm of total assets (Lyngstadaas & Berg, 2016; Martinez-Solano & Garica-Teruel, 2007; Pais & Gama, 2015). Similarly, the growth of firms is positively related to firm profitability and influences WCM within firms (Pais & Gama, 2015; Deloof, 2003; Martinez-Solano & Garica-Teruel, 2007). Firms with higher sales growth are capable of generating additional income which can be invested in profitable projects (Asimakopoulos, Samitas, & Papadogonas, 2009).

Leverage has been broadly found to negatively affect the profitability of firms although some differences exist depending on the measure of profitability used (Baños-Caballero, Garcia-Teruel, & Martinez-Solano, 2012; Lyngstadaas & Berg, 2016; Pais & Gama, 2015). The relationship is explained as the result of firms with increased leverage having to commit more resources to finance the cost of debt and so doing decreasing profitability (Goddard, Tavakoli, & Wilson, 2005). Moreover, firms with higher debt could face higher financing constraints which impede firms' ability to undertake profitable investments and therefore profitability might suffer (Vlieghe & Benito, 2000). In order to control for the effect of leverage, the ratio of total debt over total assets (DOA) is included as a control variable, defined as *(short and long term interest bearing liabilities / total assets)*

The leverage ratio, previously discussed, controls for the presence of interest bearing debt in firms' capital structures but it does not account for the composition of debt (Lyngstadaas & Berg, 2016). Considering that SMEs face constraints in gaining access to external long term financing, a more extensive use of current liabilities can be expected. Therefore the current liability ratio is included to control for the impact of the composition of liabilities on profitability. Specifically, current liabilities could serve as a cheap source of financing as no explicit interest cost is incurred, however taking the implicit interest cost into account, firms with a more extensive use of current liabilities could increase their cost of sales and thereby

decrease profitability (Petersen & Rajan, 1997; Yazdanfar & Öhman, 2014). Moreover, increases in current liabilities might be due to firms increasing the goods bought as a result of increased sales or expectations thereof. Alternatively, firms with increases in current liabilities might be suffering from constrained ability to settle obligations as a result of poor financial performance (Lyngstadaas & Berg, 2016). Previous research has found evidence for a positive relationship between profitability and the current liability ratio (Lyngstadaas & Berg, 2016; Pais & Gama, 2015). Therefore the current liability ratio (CLR) is utilised and defined as *(current liabilities / total liabilities).*

On a similar note, a large part of SMEs' assets are invested within current assets, which can be expected to offer lower returns in comparison to long term investments and therefore negatively impact profitability (Asimakopoulos, Samitas, & Papadogonas, 2009; Baños-Caballero, Garcia-Teruel, & Martinez-Solano, 2012). However, holding a higher proportion of current assets also allows a firm greater flexibility in running its operations which serves as a safety margin which can support sales growth and profitability (Deloof, 2003; Eljelly, 2004; Pais & Gama, 2015) Should a firm hold a too high proportion of their assets in liquid assets firms might however forgo investments in profitable long term projects (Goddard, Tavakoli, & Wilson, 2005). Empirically, research has found the presence of a positive relationship between the current asset ratio and profitability for SMEs (Lyngstadaas & Berg, 2016; Pais & Gama, 2015). Hence the current asset ratio (CAR) has been included and defined as *(current assets / total assets).*

Lastly, the impact of economy-wide fluctuations has a material impact on firm's performance and operating, investing as well as financing decisions (Enqvist, Graham, & Nikkinen, 2014). Therefore the effect of economy-wide fluctuations has been controlled for through the inclusion of the yearly Swedish real GDP growth rate, based upon IMF data, as a control variable. The effect of economic downturns might be particularly relevant for SMEs who utilise trade credit as an alternative source of external financing when credit extension from financial institutions is limited (Petersen & Rajan, 1997). During periods such as the 2008 financial crisis, when financial institutions are unable or unwilling to extend credit, firms might be especially reliant upon trade credit from suppliers with better credit standings (Bodie, Kane, & Marcus, 2010; Hoffman & Kotzab, 2010; Wagenvoort, 2003). Economic downturns are also found to affect inventory levels, with unanticipated declines in sales levels resulting in increased inventory levels (Lyngstadaas & Berg, 2016). To account for the effect of poor economic states on the

relationship between profitability and WCM we have identified the years with lowest real economic growth over the period covering 1999-2015. The period has been separated into quartiles based upon real GDP growth and years within the lowest quartile were classified as poor economic states.

3.3 Empirical strategy

3.3.1 Univariate analysis

The first step undertaken within the univariate analysis is a correlation analysis to examine how the measures of WCM are correlated with profitability and is presented in table 2. The second step in the univariate analysis is to determine the existence of differences in WCM between the most and least profitable firms. Therefore, differences in the mean and median values of independent variables are compared across profitability quartiles. Quartiles based on ROA have been formed annually, leading to an overlap in profitability quartiles due to the variation in ROA across years. The mean and median levels of the WCM measures are compared between the first and fourth quartile to determine whether there is a significant difference in WCM levels between the most and least profitable firms which is tested with the t-test and Mann-Whitney U-test. Results are reported in table 3.

3.3.2 Multivariate analysis

3.3.2.1 Firm fixed effects model

The first step in the multivariate analysis is aimed at identifying linear relationships between profitability and WCM. The CCC as well its constituent elements are included as independent variables in four different regressions with ROA as the dependent variable. Controlling for the time invariant characteristics of firms, the regressions are estimated with use of fixed effects to control for unobserved heterogeneity and robust standard errors are applied in order obtain heteroscedasticity consistent standard errors. The regressions are specified as follows and results are reported in table 4:

$$(1)\ ROA_{i,t} = \beta_0 + \beta_1 DINV_{i,t} + \beta_2 SalesG_{i,t} + \beta_3 Size_{i,t} + \beta_4 DOA_{i,t} + \beta_5 CAR_{i,t} + \beta_6 CLR_{i,t} + \beta_7 GDPG_t + \gamma_i + \varepsilon_{i,t}$$

$$(2)\ ROA_{i,t} = \beta_0 + \beta_1 DAR_{i,t} + \beta_2 SalesG_{i,t} + \beta_3 Size_{i,t} + \beta_4 DOA_{i,t} + \beta_5 CAR_{i,t} + \beta_6 CLR_{i,t} + \beta_7 GDPG_t + \gamma_i + \varepsilon_{i,t}$$

$$(3)\ ROA_{i,t} = \beta_0 + \beta_1 DAP_{i,t} + \beta_2 SalesG_{i,t} + \beta_3 Size_{i,t} + \beta_4 DOA_{i,t} + \beta_5 CAR_{i,t} + \beta_6 CLR_{i,t} + \beta_7 GDPG_t + \gamma_i + \varepsilon_{i,t}$$

$$(4)\ ROA_{i,t} = \beta_0 + \beta_1 CCC_{i,t} + \beta_2 SalesG_{i,t} + \beta_3 Size_{i,t} + \beta_4 DOA_{i,t} + \beta_5 CAR_{i,t} + \beta_6 CLR_{i,t} + \beta_7 GDPG_t + \gamma_i + \varepsilon_{i,t}$$

Where:

DINV: Days in inventory, DAR: Days accounts recievable, DAP: Days accounts payable
CCC: The cash conversion cycle, SalesG: Annual sales growth, Size: Ln(Total assets)
DOA: Total debt over total assets, CAR: Current assets over total assets
CLR: Current liabilites over total liabilites, GDPG: Real GDP growth rate

3.3.2.2 Firm fixed effects model controlling for poor economic states

In order to capture the simultaneous profitability effects of WCM and economic downturns found in previous research for large firms, four additional fixed effects regressions are estimated where the four years with the lowest real GDP growth (2008, 2009, 2012 and 2013) are assigned a dummy variable which is combined with the CCC and its three components. This interaction term captures the changed relationship between WCM and profitability in times of poor economic states compared to normal years (which are also including years with prosperous economic growth). The regression equations for this analysis are as follows with results reported in table 5:

$$(5)-(8)\ ROA_{i,t} = \beta_0 + \beta_1 X_{i,t} + \beta_2 SalesG_{i,t} + \beta_3 Size_{i,t} + \beta_4 DOA_{i,t} + \beta_5 CAR_{i,t} + \beta_6 CLR_{i,t} + \beta_7 D1 + \beta_8 D1 * X_{i,t} + \gamma_i + \varepsilon_{i,t}$$

Where:

$X_{i,t} = DINV_{i,t}, DAR_{i,t}, DAP_{i,t}\ and\ CCC_{i,t}$ respectively in regression $(5)-(8)$
and $D1 = 1$ if Year $= 2008, 2009, 2012$ or 2013, else 0

3.3.2.3 Industry fixed effects model and industry specific firm fixed effects models

The four fixed effects regressions with robust standard errors (1)-(4) are also estimated with the inclusion of industry dummy variables to control for industry effects in the profitability relationship with WCM with results reported in table 6. Industry classification has been based upon the Serrano Database's classification of industries derived from the fifth digit of the firms' SNI codes. To examine if the relationship between profitability and WCM differs across industries and whether economic downturns affect the relationship differently, the four fixed

effects regressions (5)-(8) are estimated separately for the industries and the results reported in table 7.

3.3.2.4 Spline estimation

As previous research has found non-linear relationships between profitability and WCM, a spline regression is used to examine whether the relationship is different depending on the length of the CCC and its constituent elements. Specifically, a continuous function is formed by connecting linear segments which have been estimated over four intervals of the CCC and its components. The intervals have been formed by respectively grouping the CCC and its constituent elements into four quartiles with three intersections between quartiles. Forming four quartiles allows us to observe and interpret the WCM-profitability relationship for firms which maintain either high or low levels of working capital, being the first and fourth quartiles, as well as for firms which maintain working capital just above or below the median. The use of a spline regression allows for modelling the profitability effects of WCM at different levels of working capital without presuming the shape of the function across all observations. The spline regressions are applied with fixed effects and robust standard errors. Results are reported in table 8 and regressions are specified as follows:

$$(9)-(12)\ ROA_{i,t} = \beta_0 + f(X) + \beta_2 SalesG_{i,t} + \beta_3 Size_{i,t} + \beta_4 DOA_{i,t} + \beta_5 CAR_{i,t} + \beta_6 CLR_{i,t} + \beta_7 GDPG_t + \gamma_i + \varepsilon_{i,t}$$

$$\frac{dROA}{dX_{i,t}} = \begin{cases} a_1 = if\ X_{i,t} < quartile\ 1 \\ a_2 = if\ quartile\ 1 \leq X_{i,t} < quartile\ 2 \\ a_3 = if\ quartile\ 2 \leq X_{i,t} < quartile\ 3 \\ a_4 = if\ X_{i,t} \geq quartile\ 3 \end{cases}$$

Where:

$$X_{i,t} = DINV_{i,t}, DAR_{i,t}, DAP_{i,t}\ and\ CCC_{i,t}\ \text{respectively in regression}\ (9)-(12)$$

3.3.2.5 Dynamic models

As a first step in the dynamic analysis of the relationship between WCM and profitability, the first lag of ROA is included in the four fixed effects regressions (1)-(4). Including the first lag of ROA gives an indication of the impact of past profitability on firms' current performance. The results of these regressions are presented in table 9.

Attempts to explain causes and effects of financial decisions often have severe endogeneity concerns (Wintoki, Linck, & Netter, 2012). The fixed effects estimations used within regression

(1)-(8) alleviate the bias arising from unobserved heterogeneity. Fixed effects models however assume that current observations of the independent variable (CCC and its three components) are independent of historical values of the dependent variable (profitability), potentially resulting in biased and inconsistent estimates (Wintoki, Linck, & Netter, 2012). Moreover, as previously mentioned, results could further be driven by profitability in a relevant period influencing WCM in the same period.

In dealing with the above endogeneity concerns the use of a dynamic panel GMM estimator is propagated by Wintoki, Linck and Netter (2012) who analyse the relationship between corporate governance and profitability. The dynamic GMM approach allows for WCM in a respective period to be influenced by past profitability. To control for reversed causality internal instruments are created by a combination of historical firm variables. Hence, past values of WCM, control variables and profitability are used as instruments for current WCM which eliminates the need for external instruments (Wintoki, Linck, & Netter, 2012). The dynamic panel GMM estimators utilised in this study is specified in equation (13)-(16) with Z_{it} representing the control variables specified within equation (1)-(4) with exception of real GDP growth which has been excluded due to the inclusion of year dummy variables. The results to the dynamic panel GMM estimators are presented in table 10.

$$(13)-(16)\ \begin{bmatrix} ROA_{it} \\ \Delta ROA_{it} \end{bmatrix} = \alpha + \kappa_1 \begin{bmatrix} ROA_{it-1} \\ \Delta ROA_{it-1} \end{bmatrix} + \beta \begin{bmatrix} X_{it-1} \\ \Delta X_{it-1} \end{bmatrix} + \gamma \begin{bmatrix} \mathrm{Z}_{it} \\ \Delta \mathrm{Z}_{it} \end{bmatrix} + \varepsilon_{it}$$

Where:

$$X_{i,t} = DINV_{i,t}, DAR_{i,t}, DAP_{i,t} \text{ and } CCC_{i,t} \text{ respectively in regression } (13)-(16)$$

As seen from equations (13)-(16), the system GMM uses an equation in levels and one in differences. The lagged variables within the level equation are used as instruments within the differenced equation. Similarly, the lagged differences are used as instruments for the levels equations (Wintoki, Linck, & Netter, 2012).

In applying the dynamic GMM model, the Stata command *xtabond2* is used. According to the checklist by Roodman (2009), year dummies are included and the only variables considered to be strictly exogenous are the year dummies. In specifying the model, the options twostep, robust, orthogonal and collapse are applied. The option twostep is utilised since the linear two-step GMM estimators tend to be more efficient compared to the one-step variants (Roodman, 2009). However, twostep standard errors tend to be downward biased and therefore the option

robust is also applied (Roodman, 2009). The option orthogonal subtracts the average of all future available observations of a variable instead of first-differencing (Wintoki, Linck, & Netter, 2012). It also replaces lagged instruments with their deviations from past means. The collapse option is applied since it reduces the number of instruments and the number of moment conditions by making *xtabond2* create one instrument for every variable and lag distance instead of creating one for every time period, variable, and lag distance (Wintoki, Linck, & Netter, 2012). Applying the collapse option makes the tests for a correct model specification more powerful (Wintoki, Linck, & Netter, 2012)[1].

The reliability of the GMM estimates is tested with the Hansen J test for instrument validity and the Arellano and Bond (1991) tests for serially uncorrelated error terms. The Hansen J test tests if the instruments as a group are exogenous, with a p-value of 0.1 or higher indicating that the lagged values are exogenous to the current values. The Arellano and Bond (1991) test is applied to differenced residuals and tests for autocorrelation with the null hypothesis of no autocorrelation. The system GMM estimates are constructed in a way that makes the AR(1) test to usually be rejected (Wintoki, Linck, & Netter, 2012). The AR(2) test is important to detect serial correlation in the equation in levels. A low AR(2) p-value implies a possible specification error and omitted variable bias. Different model specifications regarding the number of lags have been tested in order to ensure that the model is specified as correctly as possible with specific reference to the Hansen J test and the AR(2) measure. Using one lag of the dependent variable ROA and a lag of three years for the internal instruments has been determined to best meet the above requirements.

[1] For further information regarding the estimation of the GMM estimator and the command *xtabond2* please see Roodman (2009).

4 Results

4.1 Summary statistics

Table 1: Summary statistics

The table summarizes the dependent variable, ROA (return on assets), and the primary independent variables in our study; DINV (days in inventory), DAR (days accounts receivables), DAP (days accounts payables) and CCC (cash conversion cycle) over the period 1999-2015. Summary statistics are included for control variables Size (natural logarithm of total assets), SalesG (sales growth in percent between two years), DOA (total debt as a percentage of total assets), CAR (current assets as a percentage of total assets) and CLR (current liabilities as a percentage of total liabilities). A total of 21 132 firms have been included in the summary statistics with a total of 143 258 observations. The summary statistics provided in the table are after winsorising ROA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	ROA	DINV	DAR	DAP	CCC	Size	SalesG	DOA	CAR	CLR
Mean	11.23	35.97	37.48	43.43	30.02	8.89	16.57	15.10	68.37	77.88
Median	9.23	11.62	37.14	35.31	19.99	8.88	7.08	4.56	74.70	86.87
SD	14.48	54.83	26.63	48.25	69.69	1.04	44.61	19.67	25.99	24.33
Minimum	-43.15	0.00	0.00	0.00	-793.90	1.61	-66.82	0.00	0.00	0.00
Maximum	74.14	370.52	133.16	793.90	442.05	15.99	350.45	99.88	100.00	100.00
1st quartile	3.38	0.00	16.30	22.30	-2.12	8.19	-1.97	0.00	47.87	58.87
3rd quartile	17.78	51.82	52.84	51.51	56.00	9.55	21.07	26.71	91.82	100.00

The companies in our sample have an average ROA of 11.23% with a corresponding median of 9.23%. Inventory is held on average for 36 days, accounts receivables for 37 days, accounts payables for 43 days and the average length of the CCC is 30 days. The corresponding median values are 12 days, 37 days, 35 days and 20 days respectively. Of the three CCC components, DINV has the highest standard deviation and DAR the lowest. The average total assets for firms in the sample is SEK 7.3 million and on average firms display an annual sales growth of 17%, with medians of SEK 7.2 and 7%. The average balance sheet consists of 15% interest bearing debt with 68% of total assets being current in nature. Similarly current liabilities represent 78% of total liabilities. As has been found by previous research in other European countries, the high level of current assets and current liabilities can be seen as indicative of SMEs' reliance on short term assets and liabilities (Lyngstadaas & Berg, 2016; Martinez-Solano & Garica-Teruel, 2007). Interest bearing debt represents only 15% of the balance sheet total suggesting that Swedish SMEs appear to have constrained access to debt financing providing support findings from other European countries (Wagenvoort, 2003).

In figure 2, the development of the CCC and its three components indicate that over time, SMEs have reduced their DAR, DAP and particularly their DINV. Consequently the CCC has also decreased over the period. Analyses of the development of the first and third quartile shows that the dispersion of the CCC, DINV and DAP has decreased, while it has remained relatively constant for DAR. The median ROA for SMEs has experienced some cyclicality over our

sample period but appears to be relatively stable around 10%. However, the dispersion in profitability has increased over time, particularly in the latter part of the sample period.

Figure 2: Time development of variables

Time development of ROA (return on assets), DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts payable) and the CCC (cash conversion cycle) is displayed below after winsorising DINV, DAR, DAP and ROA at the 1st and 99th percentile. The development of variables has been graphed over time according to each variable's respective yearly mean, median, first quartile and third quartile.

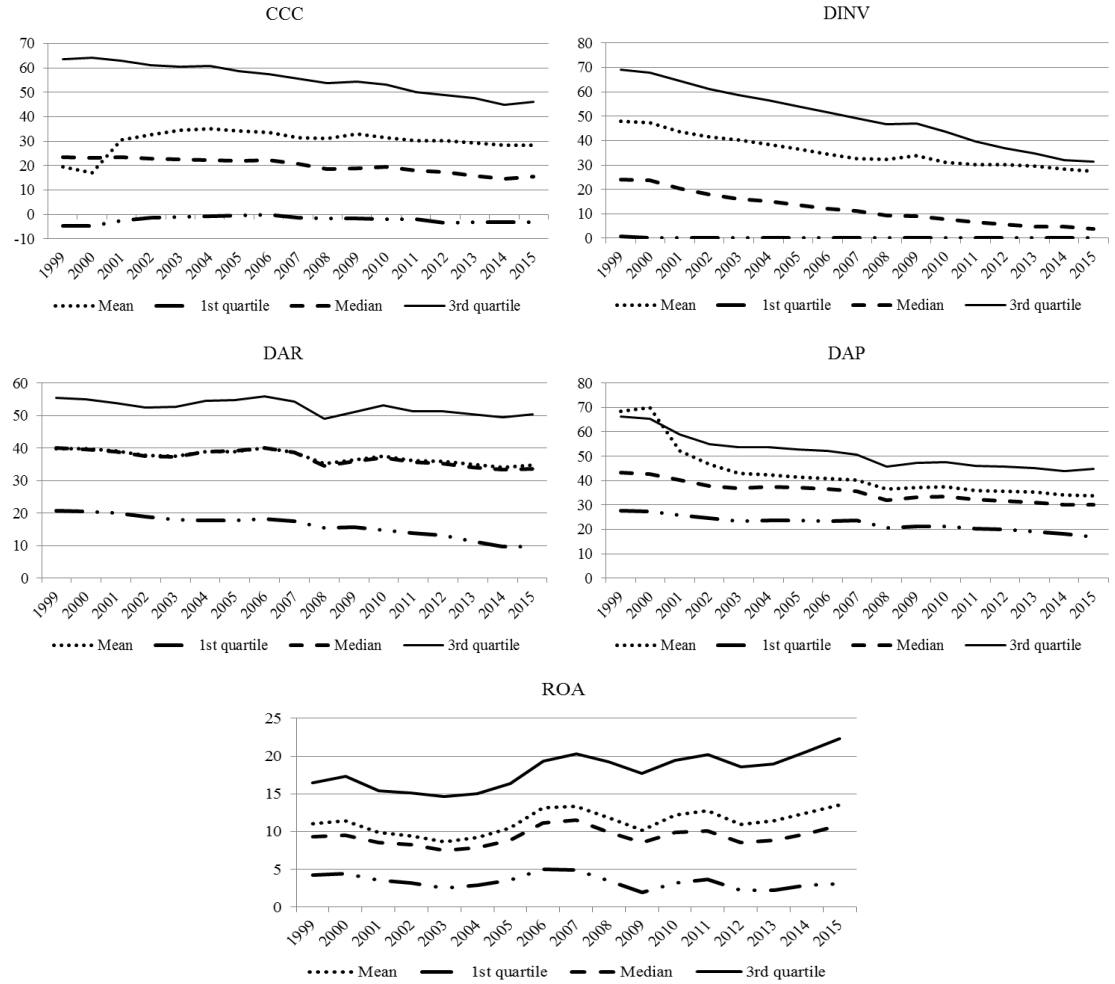
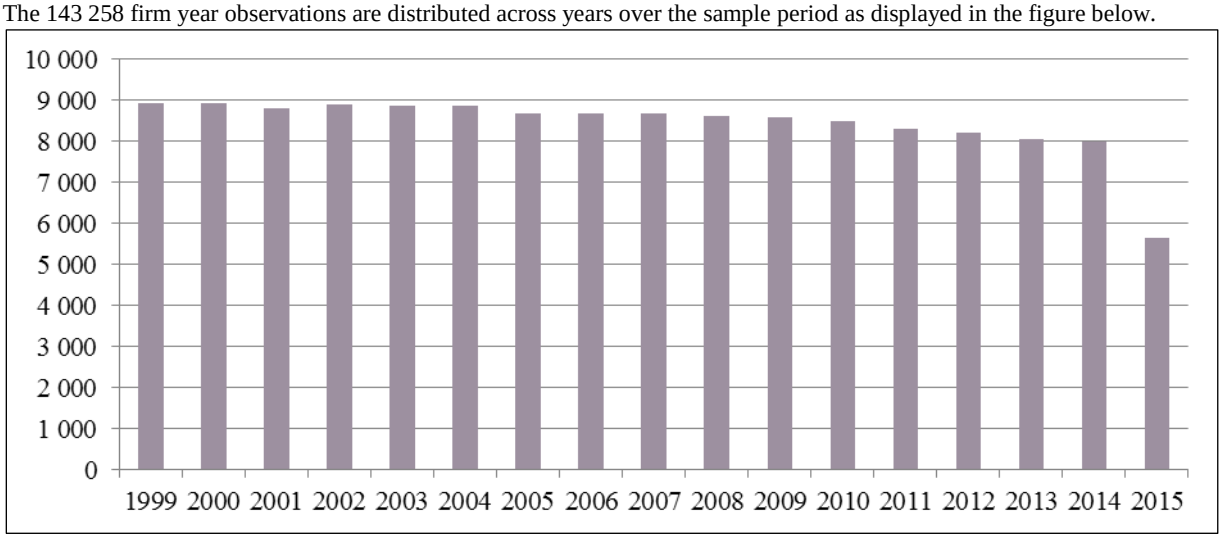


Figure 3: Time development of number of observations in sample

The 143 258 firm year observations are distributed across years over the sample period as displayed in the figure below.



The number of observations in the sample has remained relatively constant, with a yearly average of 8 427 firm year observations over the sample period. A slight but steady decrease over time can be observed from close to 9 000 firm year observations at the beginning of the period to around 8 000 at the end thereof. The decrease in the firm year observations in 2015 is attributable to the application of the definition of SMEs which require firms to meet the criterion in more than half of the period for which financial data is available and therefore most newly started firms in 2015 are excluded.

4.2 Univariate analysis

4.2.1 Pearson correlation matrix

Table 2: Pearson correlation coefficients

The table presents the Pearson correlation coefficients between variables included in the regression models. Coefficients are marked with a ** if they are statistically significant at the 1% level and a * if they are statistically significant at the 5% level. The results presented in the table are after winsorising ROA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	ROA	DINV	DAR	DAP	CCC	Size	SalesG	DOA	CAR	CLR	GDPG
ROA	1.00										
DINV	-0.12**	1.00									
DAR	-0.00	0.03**	1.00								
DAP	-0.07**	0.14**	0.22**	1.00							
CCC	-0.05**	0.70**	0.25**	-0.50**	1.00						
Size	0.01**	0.26**	0.17**	0.11**	0.19**	1.00					
SalesG	-0,00	-0,00	0.00	0.01*	-0.01*	0.00	1.00				
DOA	-0.25**	0.12**	-0.03**	0.06**	0.04**	0.18**	-0.00	1.00			
CAR	0.20**	0.12**	0.18**	-0.05**	0.20**	-0.21**	0.00	-0.57**	1.00		
CLR	0.24**	-0.17**	0.06**	-0.04**	-0.08**	-0.24**	0.00	-0.78**	0.64**	1.00	
GDPG	0.03**	0.03**	0.03**	0.08**	-0.02**	-0.03**	0.00	0.01**	-0.01*	-0.02**	1.00

In table 2 the Pearson correlation coefficients are reported for the variables in the study from which an initial indication can be derived of the profitability effects of WCM. A negative and significant relationship is found to exist between ROA and DINV, DAP and the CCC. DAR is also found to have a negative relationship with profitability but is not of statistical significance. The results suggest that decreases in DINV, DAP and CCC are associated with increases in profitability. The findings are consistent with previous research with the exception that no significant relationship is found for DAR (Deloof, 2003; Lyngstadaas & Berg, 2016; Martinez-Solano & Garica-Teruel, 2007; Pais & Gama, 2015). The usefulness of the correlation coefficients in the interpretation of the profitability-WCM relationship is however limited. The correlation coefficients are correlated with one another and do not control for the influence of other variables on profitability.

4.2.2 ROA quartile analysis

Table 3 presents the mean and median values of the CCC and its constituent elements based upon ROA quartiles which have been formed annually in panel A and B respectively. The annual formation leads to an overlap in the ranges of ROA across adjacent quartiles. The comparisons in table 3 are made in order to observe working capital differences between firms with high profitability contrasted to firms with low profitability.

Table 3: Mean quartiles and median quartiles

The quartiles of ROA are calculated annually. For each quartile a lower limit was considered, the lowest value across all years, and an upper limit, the largest value across all years, creating overlaps between ranges of ROA in quartiles. Sample firms are grouped according to their value of ROA, and a study conducted of the mean and median value of variables for each quartile in panel A and B respectively. For the mean quartile analysis a two sided t-test was applied to determine if the mean values of the fourth quartile are significantly different from that of the first. For median quartiles the z-value for the Mann-Whitney U-test is reported with the null hypothesis that the first and fourth quartiles are from populations with the same distribution. P-values for the t-test and the Mann-Whitney U-test are reported in parenthesis and significance at the 1% level is indicated with a ** and at the 5% level with a *. The results presented in the table are after winsorising ROA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

Panel A: Mean quartiles					
	1st quartile of ROA	2nd quartile of ROA	3rd quartile of ROA	4th quartile of ROA	t-value
Range of ROA	-43.15-5.02	1.96-11.52	7.54-22.27	14.61-74.14	
ROA	-4.26	6.30	13.16	29.72	-440.00 (0.00)**
DINV	40.25	43.57	36.59	23.46	43.08 (0.00) **
DAR	36.56	38.16	38.05	37.16	-2.97 (0.00) **
DAP	47.06	46.09	42.49	38.07	24.83 (0.00) **
CCC	29.75	35.64	32.15	22.55	14.09 (0.00) **
Size	8.73	9.05	9.00	8.77	-5.50 (0.00) **
SalesG	8.58	11.64	15.50	30.57	-57.77 (0.00) **
DOA	18.71	21.62	14.09	5.96	98.66 (0.00) **
CAR	65.57	62.45	67.76	77.69	-66.65 (0.00) **
CLR	74.34	70.27	78.01	88.91	-89.42 (0.00) **
Panel B: Median quartiles					
	1st quartile of ROA	2nd quartile of ROA	3rd quartile of ROA	4th quartile of ROA	z-value
Range of ROA	-43.15-5.02	1.96-11.52	7.54-22.27	14.61-74.14	
ROA	-0.88	6.26	12.85	26.15	-231.78 (0.00) **
DINV	12.91	17.51	14.21	4.14	39.40 (0.00) **
DAR	35.14	37.87	38.31	37.08	-4.90 (0.00) **
DAP	36.98	37.73	35.25	31.62	33.55 (0.00) **
CCC	17.78	23.55	22.88	16.58	9.14 (0.00) **
Size	8.71	9.04	8.99	8.76	-7.02 (0.00) **
SalesG	0.63	5.45	8.33	15.18	-101.32 (0.00) **
DOA	10.63	15.87	4.59	0.00	93.49 (0.00) **
CAR	71.08	65.37	72.77	84.87	-58.76 (0.00) **
CLR	79.30	71.88	86.39	100.00	-87.13 (0.00) **
Number of firms					21 132
Number of observations					143 258

DINV, DAP and the CCC are lower for the most profitable firms in the fourth quartile compared to firms in the first quartile with lower profitability. The relationship holds across mean and median values. In table 3 panel A, the t-values indicate a significant difference in the mean values between the fourth and first quartiles. Similarly, in panel B the z-values for the Mann – Whitney U-test confirm that the observations in the first and fourth quartiles do not follow the same distribution. However, DINV, DAP and the CCC are not found to consistently decrease across quartiles as profitability increases. In contrast, DAR is found to increase with profitability, irrespective of whether it is measured through mean or median values. The difference is found to be statistically significant for both mean and medians.

4.3 Multivariate analysis

4.3.1 Firm fixed effects model

Table 4: Firm fixed effects regression with robust standard errors

ROA (return on assets) is regressed on the primary independent variables; DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts payable) and the CCC (cash conversion cycle) respectively in regression (1), (2), (3) and (4). The Hausman test is applied to determine if a fixed effects model is preferred over random effects. Fixed effects models are preferred in model (1), (2), (3) and (4). Robust standard errors are applied in all models presented. T-values are reported within parenthesis and significance at the 1% level is indicated with a ** and at the 5% level with a *. The standardised coefficient indicates the change in ROA for one standard deviation change in DINV, DAR, DAP and the CCC. The results presented in the table are after winsorising ROA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(1)	(2)	(3)	(4)
	ROA	ROA	ROA	ROA
DINV	-0.032 (-17.00)**			
DAR		-0.030 (-9.69)**		
DAP			-0.006 (-6.62)**	
CCC				-0.008 (-9.01)**
Size	3.919 (31.63)**	3.953 (31.54)**	3.827 (30.71)**	3.916 (31.40)**
SalesG	0.073 (45.89)**	0.074 (46.73)**	0.074 (46.49)**	0.073 (46.00)**
DOA	-0.158 (-28.13)**	-0.161 (-28.53)**	-0.162 (-28.73)**	-0.161 (-28.67)**
CAR	0.147 (25.99)**	0.144 (25.28)**	0.138 (24.46)**	0.143 (25.20)**
CLR	0.003 (0.60)	0.007 (1.39)	0.008 (1.76)	0.005 (1.08)
GDPG	0.218 (18.75)**	0.226 (19.37)**	0.223 (19.09)**	0.213 (18.24)**
Constant	-32.050 (-25.43)**	-32.518 (-25.65)**	-31.906 (-25.10)**	-32.789 (-25.84)**
Number of observations	143 258	143 258	143 258	143 258
Number of firms	21 132	21 132	21 132	21 132
R-squared	0.132	0.129	0.128	0.128
P-value Hausman test	0.000	0.000	0.000	0.000
Standardised coefficient	-0.122	-0.055	-0.020	-0.038

Four separate regressions are estimated in table 4, with ROA being regressed upon the CCC and each of its constituent elements. The Hausman test is applied to determine if a fixed effects or random effects model is preferred. Since the p-values in table 4 are close to zero the null hypothesis can be rejected. Consequently all regressions in table 4 are estimated with fixed

effects, a method which is commonly utilised in previous research to control for unobserved heterogeneity (Deloof, 2003; Lyngstadaas & Berg, 2016; Martinez-Solano & Garica-Teruel, 2007; Pais & Gama, 2015).

After introducing a multivariate analysis and controlling for unobserved heterogeneity, the findings in table 4 are in general in line with those suggested by the Pearson correlation matrix as well as the mean and median comparisons across quartiles of profitability. The coefficients of DINV, DAR, DAP and the CCC are found to be negative and significant at the 1% level[1]. The negative DAR-profitability relationship however diverges from the findings of both the correlation matrix and quartile analysis. The fixed effects regression provides a more refined estimate of the profitability–WCM relationship through controlling for unobserved heterogeneity as well as variables correlated with both profitability and WCM.

The negative relationships between ROA and DINV, DAR and the CCC suggest that risks and costs of low working capital levels are exceeded by the positive profitability effects of an aggressive WCM strategy. However, following an aggressive WCM strategy with respect to DAP (increasing days accounts payable) is found to be negatively associated with profitability. The negative relationship between DINV, DAR, DAP, the CCC and profitability confirm findings in prior research (Deloof, 2003; Lyngstadaas & Berg, 2016; Martinez-Solano & Garica-Teruel, 2007; Pais & Gama, 2015). The profitability effects of the CCC components have not been previously studied within Sweden, however the negative relationship observed for the CCC is similarly found by Yazdanfar and Öhman (2014) when analysing solely the CCC's effect on profitability in Swedish SMEs. Therefore the positive profitability effects of an aggressive WCM strategy as found by Yazdanfar and Öhman (2014) can be explained as driven by the positive profitability effects of decreasing DAR and DINV but not from increasing DAP. Deloof (2003) attributes the observed negative relationship between DAP and profitability to firms with lower profitability delaying payments to suppliers and more profitable firms being capable of utilising discounts granted for early payments.

The relative importance of the three CCC components can be analysed through the estimation of their standardised coefficients. The standardised coefficients express by how many standard deviations ROA would change should one standard deviation change in DINV,DAR, DAP or

[1] The main findings in table 4 remain the same when ROCE and RNOA are used as measures of profitability, as can be seen in appendix A3 and A4. DAP is however found to lose its significance when the accounts payables are deducted from the asset base which can be interpreted as evidence strengthening the case for aggressive WCM.

the CCC occur. DINV, displaying the greatest negative standardised coefficient, is found to have the greatest economic significance out of the three CCC components with DAP displaying the least economic significance. Decreasing DAR and DAP with half of their standard deviations is associated with an increased ROA of 0.40 and 0.14 percentage points respectively. Decreasing DINV with half of its standard deviation is associated with a much higher increase in ROA of 0.88 percentage points.

4.3.2 Firm fixed effects model controlling for poor economic states

Table 5: Firm fixed effects regression with a dummy variable for poor economic states

ROA (return on assets) regressed on primary independent variables; DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts receivable) and the CCC (cash conversion cycle) respectively in regression (5), (6), (7) and (7). A dummy variable (D1) has been included for poor economic states as well as interaction terms. Poor economic states have been identified as the four periods over 1999-2015 with the lowest real economic growth (2008, 2009, 2012 and 2013). Robust standard errors are applied in all models presented. T-values are reported within parenthesis and significance at the 1% level is indicated with a ** and at the 5% level with a *. The results presented in the table are after winsorising ROA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(5) ROA	(6) ROA	(7) ROA	(8) ROA
DINV	-0.030 (-15.86)**			
DAR		-0.028 (-8.98)**		
DAP			-0.005 (-5.13)**	
CCC				-0.007 (-8.25)**
D1	-1.246 (-12.36)**	-1.254 (-8.45)**	-0.410 (-2.69)**	-1.258 (-12.71)**
DINV*D1	-0.009 (-7.05)**			
DAR* D1		-0.010 (-3.16)**		
DAP* D1			-0.033 (-9.75)**	
CCC* D1				-0.009 (-6.87)**
Size	4.049 (32.49)**	4.094 (32.45)**	3.999 (31.84)**	4.045 (32.24)**
SalesG	0.072 (45.76)**	0.074 (46.57)**	0.074 (46.43)**	0.073 (45.82)**
DOA	-0.158 (-28.25)**	-0.161 (-28.57)**	-0.161 (-28.65)**	-0.162 (-28.79)**
CAR	0.148 (26.23)**	0.146 (25.54)**	0.139 (24.72)**	0.144 (25.51)**
CLR	0.004 (0.86)	0.008 (1.65)	0.010 (2.14)*	0.006 (1.28)
Constant	-32.557 (-25.79)**	-33.100 (-26.03)**	-32.830 (-25.73)**	-33.257 (-26.18)**
Number of observations	143 258	143 258	143 258	143 258
Number of firmss	21 132	21 132	21 132	21 132
R-squared	0.1325	0.1293	0.1292	0.1291

The negative coefficients for the CCC and its constituent elements are maintained when replacing GDP growth with a dummy variable thereby controlling for poor economic states. The dummy variable for poor economic states (D1) is, as expected, significant and negative in all four regressions. This reflects an average decrease in SME profitability during periods of low real economic growth (2008, 2009, 2012 and 2013). Of interest though is the profitability-WCM relationship during periods of poor economic growth which is studied through the use of the interaction terms DINV*D1, DAR*D1, DAP*D1 and CCC*D1. All interaction terms are significant and negative which is indicative of the increased importance of efficient WCM

during periods of economic downturns[1]. Firms with longer DINV, DAR, DAP and CCC on average experience greater negative profitability effects during periods of economic downturns. Enqvist, Graham, and Nikkinen (2014) broadly find similar evidence when analysing the profitability-WCM relationship for large Finnish corporates during economic downturns. However in their study, economic downturns are not found to significantly affect the DAP relationship with profitability.

Firms can face declining demand for their services and products during periods of negative or low economic growth. This results in increased levels of inventory if inadequate inventory management has been undertaken and the associated out-of-pocket and opportunity costs might consequently increase (Kim & Chung, 1990). Moreover, should demand be lower and inventory be held for longer periods SMEs could be faced with disposing of inventory at lower prices further decreasing profitability. These costs might be particularly strenuous for SMEs who during periods of economic distress face constrained access to financing.

Our findings in relation to DAR support those of Enqvist, Graham and Nikkinen (2014) who find the negative relationship to be pronounced during periods of economic downturns. Considering that trade credit could serve as an alternative source of financing should institutional financing be constrained, the negative coefficient observed on the interaction term could be due to firms extending trade credit to financially weaker firms who are more reliant upon trade credit during periods of low real growth (Petersen & Rajan, 1997). This might be especially applicable considering that firms could use their credit terms as a means of incentivising their sales in periods of low demand (Enqvist, Graham, & Nikkinen, 2014). Due to the extension of trade credit to weaker firms it could then be expected that greater monitoring costs and losses are incurred in debt collection, hence the profitability of SMEs with longer DAR is punished more severely during times of low real economic growth compared to normal times.

Similar to the DAR-profitability relationship, the negative DAP-profitability relationship is found to be pronounced during economic downturns. SMEs could be expected to themselves

[1] The main findings in table 5 remain the same when ROCE and RNOA are used as measures of profitability, as can be seen in appendix A5 and A6. DAP is not found to be significant, however the interaction term for DAP is found to be negative and significant which strengthens the claim for the negative relationship between profitability and WCM.

make greater use of trade credit during economic downturns as they are faced with constrained liquidity, especially if clients are demanding longer settlement terms. Delaying payments to suppliers might however accompanied with increased costs; SMEs might forgo trade discounts for early payment and could bare additional costs and penalties for overdue payments which would decrease profitability.

4.3.3 Industry fixed effects model

Table 6: Industry fixed effects regression

ROA (return on assets) is regressed on primary independent variables; DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts payable) and the CCC (cash conversion cycle) respectively in regression (1), (2), (3) and (4). Dummy variables have been included for industries based upon the classification in the Serrano database. Observations have been clustered by firm ID in order to only treat observations with different firm IDs as truly independent. Robust standard errors are applied in all models presented. T-values are reported within parenthesis and significance at the 1% level is indicated with a ** and at the 5% level with a *. The results presented in the table are after winsorising ROA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(1) ROA	(2) ROA	(3) ROA	(4) ROA
DINV	-0.031 (-24.91)**			
DAR		-0.034 (-11.48)**		
DAP			-0.024 (-21.36)**	
CCC				-0.008 (-8.17)**
Size	1.743 (24.20)**	1.555 (22.05)**	1.527 (22.22)**	1.492 (21.14)**
SalesG	0.062 (35.63)**	0.065 (37.33)**	0.066 (37.50)**	0.064 (36.20)**
DOA	-0.103 (-23.89)**	-0.105 (-24.32)**	-0.105 (-24.38)**	-0.108 (-24.90)**
CAR	0.060 (17.04)**	0.043 (12.96)**	0.033 (10.45)**	0.043 (12.51)**
CLR	0.037 (8.74)**	0.054 (13.03)**	0.058 (13.99)**	0.050 (11.82)**
GDPG	0.137 (10.46)**	0.132 (10.03)**	0.155 (11.76)**	0.116 (8.83)**
Constant	-12.075 (-10.10)**	-10.270 (-9.07)**	-9.770 (-8.75)**	-10.325 (-8.97)**
Number of observations	143 258	143 258	143 258	143 258
Number of firms	21 132	21 132	21 132	21 132
R-squared	0.135	0.128	0.131	0.126

Comparable to regressions (1)-(4) presented in table 4 (Firm fixed effect model with robust standard errors) the coefficients of DINV, DAR, DAP and the CCC presented in table 6 remain negative and significant after controlling for industry effects through the use of dummy variables. More interestingly though is the existence of industry differences in the WCM-profitability relationship. Previous research when analysing the WCM-profitability relationship acknowledges that although there tends to be an overall negative relationship between the length of the CCC and profitability, industry affiliation is an important factor influencing the WCM strategy of firms (Hawawini, Viallet, & Vora, 1986; Jose, Lancaster, & Stevens, 1996; Shin & Soenen, 1998). Therefore, in table 7 the same estimations as in table 5 are estimated, however for 10 separate industries.

As can be observed in table 7 the profitability effects of WCM varies across industries. Overall, negative and significant relationships between profitability and DINV, DAR, DAP and the CCC

are observed for the majority of observations in the sample. The CCC component which is negative and significant for most of the industries and firm year observations is DINV. As can be seen in the table, 79% of all observations are found in four industries (industrial goods, construction industry, shopping goods and corporate services) and in these four industries the negative relationship between WCM and profitability can be generally confirmed. Two exceptions in those industries when compared to the sample as a whole can however be found. For shopping goods DAR and the CCC show no significance and for corporate services DAP is not significant. Considering that the three largest sub-industries within corporate services are freight transport by road, business and management consultancy and general cleaning of buildings, a possible explanation for the insignificant DAP could be that the operations of many firms in corporate services can be characterised by a low reliance on accounts payable. Similarly the insignificant DAR in the shopping goods industry could be explained by the high representation of firms within the sub-industries restaurants, taxi operations and sale of cars, sub-industries which can be expected to have a low reliance on accounts receivable. Therefore, from these observations it can be inferred that industry characteristics influence the degree to which WCM impacts profitability and hence the profitability effects of DINV, DAR, DAP and the CCC cannot automatically be generalised across industries. For industries with a low amount of firm year observations, such as telecom and media or energy and environment, the general lack of significance in the profitability-WCM relationships could be attributed to the small samples. Mean and median values of the WCM measures for the different industries can be found in appendix A7.

In contrast to our findings Yazdanfar and Öhman (2014) conclude that the overall negative relationship between profitability and the CCC is valid across all the industries in their study although acknowledging that the importance of the relationship varies. Our findings however suggest that the WCM-profitability relationship might not only vary across industries, the validity of the relationship itself appears to be dependent on industry affiliation.

As was seen in table 5, the WCM-profitability relationship was found to be pronounced in economic downturns. This general finding can also be observed in table 7 when industries are analysed separately. For many industries not showing any significant relationship between WCM and profitability in normal years, a significant relationship is however found in economic downturns. Looking at DINV, the industries energy and environment, health and education as well as telecom and media all lack significance between DINV and profitability in normal years,

Table 7: Industry specific firm fixed effects regressions with dummy variables for poor economic states

ROA (return on assets) is regressed on primary independent variables; (DINV) days in inventory, (DAR) days accounts receivable, DAP (days accounts payable) and the CCC (cash conversion cycle) respectively in regression (5), (6), (8) and (8). Separate regressions are performed for each industry with inclusion of dummy and interaction terms for poor economic states (2008, 2009, 2012 and 2013). Industries are based on the classification in the Serrano Database. Robust standard errors are applied in all models presented. T-values are reported within parenthesis and significance at the 1% level is indicated with a ** and at the 5% level with a *. The results presented in the table are after winsorising ROA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	Number of observations	(5)		(6)		(7)		(8)	
		DINV	DINV*D1	DAR	DAR*D1	DAP	DAP*D1	CCC	CCC*D1
Energy & Environment	1 239	0.006	-0.050**	-0.039*	0.059	0.004	0.083*	-0.005	-0.048**
Materials	3 063	-0.007	0.003	-0.031	0.019	-0.010	-0.013	0.002	0.004
Industrial goods	22 014	-0.032**	-0.004	-0.042**	0.027**	-0.015**	-0.006	-0.023**	-0.003
Construction industry	27 737	-0.027**	-0.010**	-0.030**	0.009	-0.008**	-0.030**	-0.008**	-0.005
Shopping goods	30 443	-0.037**	-0.010**	-0.019	-0.024**	-0.011**	-0.045**	-0.005	-0.010**
Convenience goods	8 232	-0.041**	0.005	-0.019	-0.024**	-0.011**	-0.045**	-0.001	0.005
Health & Education	9 888	-0.023	-0.049**	-0.022	-0.055**	-0.044**	-0.027**	0.016*	-0.021*
IT & Electronics	4 186	-0.022	0.000	-0.046**	-0.027	-0.015	-0.019	-0.007	-0.006
Telecom & Media	1 088	0.016	-0.035**	-0.013	-0.020	-0.003	-0.019	0.007	-0.027
Corporate services	32 857	-0.025**	0.002	-0.020**	0.004	0.002	-0.029**	-0.005**	0.008
Other	2 511	-0.023*	0.005	-0.024	0.026	-0.009	0.016	-0.015*	0.005

a relationship which becomes significant in poor economic states. Insignificant relationships becoming significant during poor economic states is observed for all components of the CCC and the CCC itself. This suggests that the negative relationship between WCM and profitability becomes valid for a larger share of firms and industries during economic downturns, reinforcing that the WCM-profitability relationship is pronounced during economic downturns, as was found in table 5**.**

4.3.4 Spline estimation

Table 8: Regression of ROA on WCM measures utilising spline regressions

ROA (return on assets) is regressed on the primary independent variables; DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts payable) and the CCC (cash conversion cycle) in regression (9), (10), (11) and (12) through the use of spline regressions. A continuous function is formed by connecting linear segments which have been estimated over four intervals (a_1, a_2, a_3 and a_4) of the CCC and its constituent elements. Three knots have been placed at the 1st, 2nd and 3rd quartile of DINV, DAR, DAP and the CCC. Fixed effects and robust standard errors have been utilised with robust t-statistics reported within parenthesis and significance at the 1% level indicated with a ** and at the 5% level with a *. The results presented in the table are after winsorising ROA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(9)	(10)	(11)	(12)
Dependent variable	ROA	ROA	ROA	ROA
Independent variable	DINV	DAR	DAP	CCC
a_1	-	-0.128 (-5.63)**	-0.107 (-6.97)**	-0.001 (-0.81)
a_2	-0.179 (-7.07)**	-0.013 (-1.18)	-0.029 (-2.50)**	0.016 (2.14)*
a_3	-0.070 (-9.75)**	-0.015 (-1.62)	-0.090 (-11.65)**	-0.018 (-3.32)**
a_4	-0.020 (-9.30)**	-0.031 (-6.63)**	0.003 (3.53)**	-0.032 (-14.60)**
Size	3.948 (31.99)**	3.970 (31.61)**	3.979 (31.75)**	3.946 (31.68)**
SalesG	0.073 (46.16)**	0.074 (46.75)**	0.075 (47.29)**	0.073 (45.78)**
DOA	-0.156 (-27.87)**	-0.161 (-28.54)**	-0.158 (-28.19)**	-0.160 (-28.46)**
CAR	0.147 (26.17)**	0.144 (25.21)**	0.136 (24.33)**	0.147 (25.75)**
CLR	0.003 (0.61)	0.007 (1.40)	0.012 (2.59)**	0.003 (0.53)
GDPG	0.223 (19.14)**	0.225 (19.27)**	0.233 (19.95)**	0.214 (18.34)**
Constant	-31.050 (-24.58)**	-31.636 (-24.62)**	-30.981 (-24.29)**	-32.974 (-25.99)**
Number of observations	143 258	143 258	143 258	143 258
Number of firms	21 132	21 132	21 132	21 132
R-squared	0.133	0.129	0.131	0.130

The regression models in table 8 investigate how the relationship between profitability and WCM differs depending on the level of working capital in SMEs. The results indicate that at low levels of the CCC, within the first quartile of our sample, there is no significant impact on profitability as the CCC is changed. Firms within the second quartile however experience on average an increase in their profitability as their CCC is increased as can be seen by the positive and significant coefficient. However, the relationship is reversed for firms with a CCC in the third and fourth quartile who experience a negative relationship. Therefore, the results are indicative of an optimal level of working capital whereby firms with a CCC just below the median can increase profitability through a lengthening of the CCC, however beyond an optimal level firms experience declining profitability with an increase in the CCC. This finding is in

line with Baños-Caballero, Garcia-Teruel and Martinez-Solano (2012) who find an optimal level of the CCC with deviations from the optimum associated with decreased profitability. However the presence of a minimum has also been found in prior research (Lyngstadaas & Berg, 2016; Pais & Gama, 2015). The interpretation of such a convex function reflects those drawn from linear models whereby profitability decreases as the CCC increases towards the minimum which is found at large values of the CCC.

Looking at the specific elements of the CCC, DINV in the first quartile has no coefficient reported due to the first quartile of DINV being zero days of inventory. Beyond the first quartile of DINV, firms who increase their DINV can expect to negatively impact their profitability. This relationship is observed across the second, third and fourth quartiles of DINV. The results provide support that firms seeking to improve profitability through inventory management should generally strive for decreasing DINV since the results suggest that the risks and costs of low inventory levels are outweighed by the cost benefits of maintaining low inventory levels.

The DAR similarly appears to have an overall negative effect on profitability. Firms who fall within the two most extreme quartiles, the first and fourth, can expect to experience a significant negative impact on profitability should DAR be increased. Firms closer to the median DAR in the sample, within the second and third quartile, do not experience a significant impact on profitability should DAR be altered. Therefore, the results provide support that SMEs with either high or low DAR can improve profitability through decreasing DAR. However should a SME have DAR which is placed around the median within our sample, minor changes in DAR appears to have no significant impact on profitability.

Lastly, the DAP-profitability relationship appears to have a minimum at large values of DAP. Within the first, second and third quartile firms can expect to experience a decrease in profitability as DAP is increased. However for firms with the longest DAP in our sample, those within the fourth quartile, a positive effect on profitability is experienced as DAP is increased. The presence of a minimum for large values of DAP is in line with the findings of Lyngstadaas and Berg (2016) and Pais and Gama (2015). These findings could be explained by taking a supply chain view of WCM as supposed to a single firm perspective (Hoffman & Kotzab, 2010). Should more powerful and profitable firms within a supply chain be capable of dictating repayments periods at the expense of suppliers it could be expected that higher DAP would be associated with increased profitability. Supporting this hypothesis, it can be observed that firms within the fourth quartile of DAP have larger total asset values when compared to firms within

the first three quartiles, with the size difference being significant when tested both with a student t-test as well as the Mann-Whitney U-test.

The results in table 8 taken as a whole can be interpreted as evidence for the relationship between WCM and profitability to be non-linear[1]. Confirming a non-linear relationship provides depth to the understanding of profitability effects of WCM since it highlights that all SMEs cannot expect the same effects from managing their working capital. The current level of working capital is, just as industry affiliation, an important factor when SMEs evaluate the profitability effects from changing their WCM strategies.

4.3.5 Dynamic models

Table 9: Dynamic firm fixed effects model with robust standard errors

ROA (return on assets) is regressed on the primary independent variables; DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts payable) and the CCC (cash conversion cycle) respectively in regression (1), (2), (3) and (4). ROA(t-1) is included as a control variable. Robust standard errors are applied in all models presented. T-values are reported within parenthesis and significance at the 1% level is indicated with a ** and at the 5% level with a *. The results presented in the table are after winsorising ROA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(1)	(2)	(3)	(4)
	ROA	ROA	ROA	ROA
ROA(t-1)	0.189 (34.73)**	0.192 (35.19)**	0.192 (35.23)**	0.192 (35.16)**
DINV	-0.027 (-14.02)**			
DAR		-0.030 (-9.65)**		
DAP			-0.008 (-7.99)**	
CCC				-0.007 (-7.29)**
Size	3.571 (28.53)**	3.601 (28.41)**	3.465 (27.54)**	3.545 (28.17)**
SalesG	0.101 (41.80)**	0.102 (42.57)**	0.102 (42.45)**	0.101 (41.99)**
DOA	-0.138 (-24.52)**	-0.140 (-24.76)**	-0.141 (-24.93)**	-0.141 (-24.91)**
CAR	0.142 (25.42)**	0.141 (25.05)**	0.134 (24.19)**	0.138 (24.77)**
CLR	-0.005 (-1.16)	-0.002 (-0.54)	-0.001 (-0.16)	-0.004 (-0.81)
GDPG	0.181 (15.40)**	0.190 (16.08)**	0.186 (15.80)**	0.179 (15.19)**
Constant	-30.859 (-24.54)**	-31.154 (-24.63)**	-30.398 (-24.01)**	-31.278 (-24.74)**
Number of observations	122 126	122 126	122 126	122 126
Number of firms	18 148	18 148	18 148	18 148
R-squared	0.170	0.178	0.177	0.177

Past profitability has an important influence on present profitability since abnormally high or low profitability has been found to be persistent albeit diminishing over time due to competitive forces (Goddard, Tavakoli, & Wilson, 2005; Koller, Goedhart, & Wessels, 2015). In the four models in table 9 the coefficients for the first lag of ROA are highly significant and vary between 0.189 and 0.192. Compared to table 4 where the results from the fixed effects

[1] The results presented in table 8 are in general confirmed when ROCE and RNOA are utilised as dependent variables. Please see appendix A8 and A9. Estimating the non-linear relationships through the use of quadratic equations in fixed effects regressions (as has been done in prior research) confirms our findings of a maximum for the CCC and a minimum for DAP. Please see appendix A10.

regressions without the first lag of ROA are presented, the R-squared increases from levels between 0.128 and 0.132 to between 0.170 and 0.178. This provides support for the importance of controlling for past profitability.

Looking at the CCC and its three elements, the results in table 9 show that the same relationships presented in table 4 are valid also when the first lag of ROA is included in the fixed effects regressions; DINV, DAR, DAP and the CCC all have negative and significant coefficients. However including one lag of ROA in the fixed effects regressions do not fully account for the dynamic relationship between WCM and profitability. To account for the dynamic relationship the dynamic panel GMM estimator is applied below.

Table 10: Regression of ROA on WCM measures using a dynamic panel GMM estimator

ROA (return on assets) regressed on primary independent variables; DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts payable) and the CCC (cash conversion cycle) respectively in regression (13), (14), (15) and (16) using a dynamic panel GMM estimator. Year dummies (not reported separately) are classified as exogenous variables. All other variables are classified as endogenous. The estimation is conducted using the *xtabond2* command in Stata with the options twostep, robust, orthogonal and collapse. Each regression has been estimated with lag(3 3). The model is specified according to the checklist presented in Roodman (2009). AR(1) is a test for first-order serial correlation in the first-differenced residuals under the null hypothesis of no serial correlation. The AR(2) is a similar test but for the second-order serial correlation in the first-differenced residuals. Hansen J test is a test for exogeneity of instruments as a group. Z-values are reported within parenthesis and significance at the 1% level is indicated with ** and at the 5% level with *. The results presented in the table are after winsorising ROA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(13) ROA	(14) ROA	(15) ROA	(16) ROA
ROA(t-1)	0.406 (11.41)**	0.431 (12.50)**	0.426 (12.10)**	0.939 (10.19)**
DINV	-0.027 (-3.84)**			
DAR		0.040 (0.93)		
DAP			-0.029 (-0.35)	
CCC				-0.042 (-2.35)*
Size	0.463 (1.04)	0.053 (0.10)	0.444 (0.90)	0.705 (1.48)
SalesG	0.200 (3.76)**	0.234 (4.01)**	0.235 (4.41)**	0.176 (3.62)**
DOA	0.007 (0.26)	0.016 (0.53)	0.020 (0.68)	-0.001 (-0.02)
CAR	0.047 (2.67)**	0.040 (1.98)*	0.049 (2.60)**	0.054 (3.05)**
CLR	0.043 (1.77)	0.053 (2.10)*	0.052 (1.91)	0.034 (1.40)
Constant	-5.404 (-1.14)	-6.707 (-1.29)	-6.442 (-1.33)	-7.785 (-1.69)
Number of observations	122 126	122 126	122 126	122 126
Number of firms	18 148	18 148	18 148	18 148
Number of instruments	28	28	28	28
Wald $\chi 2$	2 415.40	2 161.25	2 223.03	2 445.20
Hansen J test: $\chi 2$ (DF)	5	5	5	5
$\chi 2$	7.35	9.47	9.20	7.47
p-value	0.20	0.09	0.10	0.19
AR(1) test (p)	0.00	0.00	0.00	0.00
AR(2) test (p)	0.44	0.29	0.47	0.39
Lag specification	3 3	3 3	3 3	3 3

Endogeneity concerns in the relationship between WCM and profitability have been frequently discussed in previous research with a focus on simultaneity and unobserved heterogeneity. Utilising fixed effects regressions is a method aimed at controlling for unobserved heterogeneity, and simultaneity has been controlled for by using the first lags of DINV, DAR, DAP and the CCC as instruments in fixed effects regressions (Lyngstadaas & Berg, 2016; Martinez-Solano & Garica-Teruel, 2007; Pais & Gama, 2015). The conclusions after controlling for these two sources of endogeneity have in general been that the negative relationship between WCM and profitability observed is unaltered. However, the possibility that current values of the WCM variables might be a function of past profitability has not been discussed nor been controlled for in previous studies.

In table 10, the regression models for DINV, DAR, DAP and the CCC are presented when applying a dynamic panel GMM estimator. As discussed in methodology, utilising one lag of the ROA and a lag of three years for internal instruments is found to most accurately specify the model according to the AR(2) measure and the Hansen J test. After controlling for the dynamic relationship, DINV is found to have a negative and significant impact on profitability as well as the CCC, albeit the latter displays significance only at the 5% level. In contrast to the linear fixed effects model and the dynamic fixed effects model, both DAR and DAP lose significance which highlights the importance of controlling for past profitability effects on WCM. Our results therefore suggest that inventory management is the only CCC component which affects profitability and consequently could be attributed with driving the significance of the aggregate measure of WCM, the CCC. These findings provide credence to the endogeneity discussions of Deloof (2003) who raise concerns that less profitable firms might delay payments to suppliers or attempt to incentivise sales through extended credit periods to customers. Alternatively, customers of less profitable firms might require more time to assess the quality of goods received (Deloof, 2003).

From a supply chain perspective smaller companies typically possess less power within a supply chain and are consequently less capable of altering credit terms with more powerful counterparties (Hoffman & Kotzab, 2010). Similarly, the inventory levels of SMEs could be driven by inventory policies enforced by more powerful parties in supply chains (Hoffman & Kotzab, 2010). Therefore considering that altering WCM in SMEs can be a cumbersome process, managers wishing to allocate their time and resources efficiently should consider focussing their efforts on reducing inventory levels.

It should be mentioned that the p-values of the Hansen J test are found to be 0.09 and 0.10 for the dynamic panel GMM estimator for DAR and DAP respectively. A p-value above 0.10 is preferred as an indication that instruments are strictly exogenous as a group, nonetheless the model specification in table 10 was chosen to maximise the p-value of the Hansen J test across the four models together with the AR(2) test for second-order serial correlation.

5 Conclusions

The substantial contributions of SMEs in the Swedish economy together with their heavy reliance on working capital highlight the importance of effective and efficient working capital management (WCM) in ensuring their continued contribution. Previous research investigating the relationship between WCM and SME profitability has in general provided support for the presence of a negative relationship.

By studying Swedish SMEs, our results confirm prior research in that there is a significant negative relationship between days in inventory (DINV), days accounts receivable (DAR), days accounts payable (DAP), the cash conversion cycle (CCC) and profitability when the relationships are estimated with fixed effects models. A strictly aggressive WCM strategy entails decreasing DINV and DAR while increasing DAP, resulting in a shorter CCC. However, the negative relationship between DAP and profitability means that although a short CCC is associated with higher profitability, SMEs cannot decrease it by increasing DAP and expect positive profitability effects from such a strategy. Hence, a strictly aggressive WCM strategy is not suggested. Considering that WCM is influenced by supply chain relationships and that SMEs often face weaker positions therein, it is of interest to understand how SMEs can best allocate their time and resources in the management of working capital. Of the three CCC components, DINV displays the largest effect on profitability. It is therefore suggested that SMEs wanting to increase their profitability should place a special emphasis on managing inventory.

Economy-wide fluctuations are important determinants for the operations and financing of firms. Previous research has found the WCM-profitability relationship to be pronounced for large firms in economic downturns. Our results confirm that SMEs experience the same pronounced negative relationship between WCM and profitability during such times. DINV, DAR, DAP and the CCC all show an increased negative and significant relationships with profitability in the years with the lowest real GDP growth. Industry affiliation is also found to be an important determinant which SMEs should consider when changing their WCM

strategies. For most firms in our sample, a negative relationship between WCM and profitability is found when analysing the relationship by industry affiliation. However, the negative relationship is not valid for all SMEs. Some industries, such as the materials industry, lack significance in the relationship. The profitability-WCM relationship within industries is found to be altered further during years with the low real GDP growth. We find the WCM-profitability relationship to be significant in more industries during poor economic states compared to the number of industries during periods of more prosperous economic growth. This further strengthens the case for economic downturns as an important influencing factor in the relationship between WCM and profitability.

Similar to industry affiliation and poor economic states, SMEs' current level of working capital influences the degree to which working capital changes affect profitability. Minimising working capital has the potential to increase risks and costs in running firm operations. On the other hand investing in working capital could negatively affect profitability if the cost of the investment exceeds the benefits of maintaining higher levels of working capital. Our results from spline regressions confirm the presence of non-linear relationships and allow for a more refined interpretation of what profitability effects SMEs can expect when undertaking working capital improvements.

Previous research has often focused on endogeneity problems related to unobserved heterogeneity and simultaneity. However, as argued by Wintoki, Linck, and Netter (2012), a third source of endogeneity often ignored by researchers is the possibility that current values of the WCM variables might be a function of past profitability. We therefore apply a dynamic panel GMM estimator which takes this third source of endogeneity into account. While previous research has found the relationship between WCM and profitability to be significant after controlling for endogeneity, our results suggest that the third source of endogeneity is of importance as DAR and DAP lose their significance when the dynamic panel GMM estimator is applied. These findings cast doubt on the profitability effects of WCM as DINV is the only CCC component found to have a significant effect on profitability.

In conclusion, our results indicate that a change in DINV is of higher importance for SME profitability than changes in DAR and DAP. Taking the dynamic nature of the relationship between WCM and profitability into account, the suggested focus on optimising inventory levels is strengthened by DINV appearing to be the only CCC component affecting profitability. Hence, we suggest that SMEs attempting to improve profitability through WCM best allocate

their efforts on optimising levels of inventory. However, SMEs wanting to improve profitability should take industry affiliation and current levels of working capital into consideration when forming expectations regarding profitability effects of WCM.

The results of our study indicate that past profitability influences current WCM, with two out of the three CCC components losing their significant effect on profitability after the introduction of a dynamic model. We therefore propose that taking a dynamic approach to the question of how profitability is affected by WCM is of importance. Previous research has largely followed similar methodologies in controlling for unobserved heterogeneity and simultaneity. We therefore suggest that future research of the profitability effects of WCM place an emphasis on accounting for the dynamic nature of this relationship.

The validity tests and results from the Stata command *xtabond2* are found to be sensitive to the specification of the dynamic panel GMM model. Considering that the p-values of the Hansen J test for instrument exogeneity in regression (14) and (15) are relatively low, more research is needed to confirm that the results obtained are a true reflection of the underlying economic process and not driven by the model specification.

As a final remark, improvements in the management of inventory appear to offer the most effective means for SMEs to improve profitability in the management of working capital. Considering that focal companies in supply chains are capable of enforcing working capital policies onto smaller counterparties, the application of our findings is limited by the ability of SMEs to realise improvements themselves. It would therefore be of practical value to establish what degree of influence SMEs exert over their own inventory management.

References

Airaksinen, A., Luomaranta, H., Alajääskö, P., & Roodhuijzen, A. (2015). *Statistics on small and medium-sized enterprises.* Luxemburg: Eurostat.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, Vol. 58 No. 2, pp. 277-297.

Asimakopoulos, I., Samitas, A., & Papadogonas, T. (2009). Firm-specific and economy wide determinants of firm profitability: Greek evidence using panel data. *Managerial Finance*, Vol. 35 Issue 11, pp. 930 - 939.

Baños-Caballero, S., Garcia-Teruel, P. J., & Martinez-Solano, P. (2010). Working capital management in SMEs. *Accounting and Finance*, Vol. 50 No. 3, pp. 511-527.

Baños-Caballero, S., Garcia-Teruel, P. J., & Martinez-Solano, P. (2012). How does working capital management affect profitability of Spanish SMEs? *Small Business Economics*, Vol. 39 No. 2, pp. 517-529.

Berger, A. N., & Udell, G. F. (1998). The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking & Finance*, Vol. 22 Issue 6-8, pp. 623-673.

Bodie, Z., Kane, A., & Marcus, A. J. (2010). *Investments and Portfolio Management.* New York: Mc Graw Hill.

Deloof, M. (2003). Does working capital management affect profitability of Belgian firms? *Journal of Business Finance & Accounting*, Vol. 30 No. 3-4, pp. 573-587.

Eljelly, A. M. (2004). Liquidity - profitability tradeoff: An empirical investigation in an emerging market. *International Journal of Commerce and Management*, Vol. 14 Issue 2, pp. 48-61.

Enqvist, J., Graham, M., & Nikkinen, J. (2014). The impact of working capital management on firm profitability in different business cycles: Evidence from Finland. *Research in International Business and Finance*, Vol. 32, pp. 36-49.

Gentry, J. A., Vaidyanathan, R., & Lee, H. W. (1990). A weighted cash conversion cycle. *Financial Management*, Vol. 9 No. 1, pp. 90-99.

Gill, A., Biger, N., & Mathur, N. (2010). The relationship between working capital management and profitability: Evidene from the United States. *Business and Economics Journal*, Vol. 10 No. 1, pp. 1-9.

Gitman, L. J. (1974). Estimating corporate liquidity requirements: A simplified approach. *The Financial Review*, Vol. 9 No. 1, pp. 79-88.

Goddard, J., Tavakoli, M., & Wilson, J. O. (2005). Determinants of profitability in European manufacturing and services: evidence from a dynamic panel model. *Applied Financial Economics*, Vol. 15 No. 18, pp. 1269-1282.

Hager, H. (1976). Cash management and the cash cycle. *Management Accounting*, Vol. 57 Issue 9, pp. 19-21.

Hawawini, G., Viallet, C., & Vora, A. (1986). Industry influence on corporate working capital decisions. *Sloan Management Review*, Vol. 27 No. 4, pp. 15-24.

Hoffman, E., & Kotzab, H. (2010). A supply chain-orientated approach of working capital. *Journal of business logistics*, Vol. 31, No. 2 pp. 305-330.

Jose, M. L., Lancaster, C., & Stevens, J. L. (1996). Corporate returns and cash conversion cycles. *Journal of Economics and Finance*, Vol. 20 No. 1, pp. 33-46.

Kim, Y. H., & Chung, K. H. (1990). An integrated evaluation of investment in inventory and credit: A cash flow approach. *Journal of Business Finance and Accounting*, Vol. 17 No. 3, pp. 381-390.

Koller, T., Goedhart, M., & Wessels, D. (2015). *Valuation: Measuring and Managing the Value of Companies.* New Jersey: John Wiley & Sons, Inc.

Koumanakos, D. P. (2008). The effect of inventory management on firm performance. *International Journal of Productivity and Performance Management*, Vol. 57 Issue 5, pp. 355-369.

Lyngstadaas, H., & Berg, T. (2016). Working capital management: Evidence from Norway. *International Journal of Managerial Finance*, Vol. 12 No. 3, pp. 295-313.

Martinez-Solano, P., & Garica-Teruel, P. J. (2007). Effects of working capital management on SME profitability. *International Journal of Managerial Finance*, Vol. 3 Issue 2, pp. 164-177.

Ng, C. K., Smith, J. K., & Smith, R. L. (1999). Evidence on the determinants of credit terms used in interfirm trade. *The Journal of Finance*, Vol. LIV No. 3, pp. 1109-1129.

Pais, M. A., & Gama, P. M. (2015). Working capital management and SMEs profitability: Portuguese evidence. *International Journal of Managerial Finance*, Vol. 11 No. 3, pp. 341-358.

Peel, M. J., & Wilson, N. (1996). Working capital and financial management practices in the small firm sector. *International Small Business Journal*, Vol. 14 Issue 2, pp. 52-68.

Penman, S. H. (2013). *Financial Statement Analysis and Security Valuation.* New York, NY, USA: McGraw-Hill Education.

Petersen, M. A., & Rajan, R. G. (1997). Trade credit: Theories and evidence. *Review of Financial Studies*, Vol. 10 Issue 3, pp. 661-692.

Richards, V. D., & Laughlin, E. J. (1980). A cash conversion cycle approach to liquidity analysis. *Financial Management*, Vol. 9 No. 1, pp. 32-38.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The Stata Journal*, Vol. 9 No. 1, pp. 86-136.

Seifert, D., Seifert, R. W., & Protopappa-Sieke, M. (2013). A review of trade credit literature: Opportunities for research in operations. *European Journal of Operational Research*, Vol. 231 Issue 2, pp. 245-256.

Shin, H.-H., & Soenen, L. (1998). Efficiency of working capital and corporate profitability. *Financial Practice and Education*, Vol. 8 Issue 2, pp. 37-45.

Wagenvoort, R. (2003). Are finance constraints hindering the growth of SMEs in Europe? *EIB Papers*, Vol. 8 Issue 2, pp. 23-50.

Wang, Y.-W. (2002). Liquidity management, operating performance, and corporate value: Evidence from Japan and Taiwan. *Journal of Multinational Financial Management*, Vol. 12 Issue 2, pp. 159-169.

Wilner, B. S. (2000). The exploitation of relationships in financial distress: the case of trade credit. *Journal of Finance*, Vol. 55 No.1, pp. 153-178.

Wintoki, M. B., Linck, J. S., & Netter, M. J. (2012). Endogeneity and the dynamics of internal corporate governance. *Journal of Financial Economics*, Vol. 105 Issue 3, pp. 581-606.

Vlieghe, G., & Benito, A. (2000). Stylised facts on UK corporate financial health: evidence from micro-data. *Financial Stability Review* , Issue 8, pp. 83-96.

Yazdanfar, D., & Öhman, P. (2014). The impact of cash coversion cycle on firm profitability. *International Journal of Managerial Finance*, Vol. 10 No. 4, pp. 442-452.

Appendix

Table A1: Sample selection

	Number of firm year observations
Original sample	10 028 214
Keep only limited liability firms[1]	(2 914 666)
Keep only independent entities	(1 978 640)
Keep only observations where the financial reporting period is 12 months	(1 511 479)
Drop firms in the finance and real estate industry	(319 133)
Drop 0 or missing values for net sales, total assets and number of employees	(882 701)
Drop missing values and negative values for inventory, account receivables and account payables	(3 948)
Drop if total asset ≠ total equity and liabilities	(1 036)
Drop missing values for DINV, DAR, DAP and ROA	(384 580)
Drop 0 values for cost of sales	(1 013)
Drop negative values for debt, total liabilities	(1 272)
Drop if debt / total assets > 100%	(12 322)
Drop if CAR and CLR > 100% or < 0%	(2 595)
Drop if non-interest bearing liabilities > total assets	(43 095)
Drop if the firm is not a SME for more than 50% of the time	(231)
Drop if the firm is a Micro firm for more than 50% of the time	(1 810 518)
Drop if there is a year gap in observations	(17 727)
Final sample	**143 258**
Number of unique firms in the sample	*21 132*

Table A2: Summary statistics

The table summarizes the dependent variables, ROCE (return on capital employed) and RNOA (return on net operating assets) over the period 1999-2015. The summary statistics provided in the table are after winsorising ROCE and RNOA at the 1% and 99% level.

	ROCE	RNOA
Mean	23.59	25.28
Median	16.73	16.78
SD	36.34	50.15
Minimum	-136.51	-229.21
Maximum	175.05	282.24
1st quartile	6.00	5.17
3rd quartile	36.31	39.38

[1] This step does not have any influence on the final sample as only limited liability firms remain in the sample even without the exclusion.

Table A3: Firm fixed effects regression of ROCE with robust standard errors

Return on capital employed (ROCE) regressed on main independent variables; days inventory (INV), days accounts receivable (ACR), days accounts receivable (ACP) and the cash conversion cycle (CCC) respectively in regression (1), (2), (3) and (4). Robust standard errors were applied in all models presented. T-values are reported within parenthesis and significance at the 1% level is indicated with ** and at the 5% level with *. The results presented in the table are after winsorising ROCE, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(1)	(2)	(3)	(4)
	ROCE	ROCE	ROCE	ROCE
DINV	-0.045 (-10.74)**			
DAR		-0.032 (-4.23)**		
DAP			-0.002 (-1.04)	
CCC				-0.016 (-7.42)**
Size	6.510 (22.67)**	6.521 (22.48)**	6.400 (22.19)**	6.546 (22.69)**
SalesG	0.197 (47.37)**	0.198 (47.87)**	0.198 (47.68)**	0.197 (47.41)**
DOA	-0.350 (27.13)**	-0.355 (-27.43)**	-0.356 (-27.58)**	-0.355 (-27.46)**
CAR	0.318 (24.80)**	0.312 (24.21)**	0.306 (24.00)**	0.315 (24.51)**
CLR	0.078 (7.67)**	0.084 (8.22)**	0.085 (8.35)**	0.080 (7.84)**
GDPG	0.467 (15.50)**	0.476 (15.74)**	0.468 (15.49)**	0.457 (15.15)**
Constant	-59.567 (-20.73)**	-60.140 (-20.86)**	-59.755 (-20.68)**	-60.886 (-21.11)**
Number of observations	143 253	143 253	143 253	143 253
Number of firms	21 131	21 131	21 131	21 131
R-squared	0.122	0.121	0.120	0.121

Table A4: Firm fixed effects regression of RNOA with robust standard errors

Return on net operating assets (RNOA) regressed on main independent variables; days inventory (INV), days accounts receivable (ACR), days accounts receivable (ACP) and the cash conversion cycle (CCC) respectively in regression (1), (2), (3) and (4). Robust standard errors were applied in all models presented. T-values are reported within parenthesis and significance at the 1% level is indicated with ** and at the 5% level with *. The results presented in the table are after winsorising RNOA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(1)	(2)	(3)	(4)
	RNOA	RNOA	RNOA	RNOA
DINV	-0.051 (-8.37)**			
DAR		-0.050 (-4.75)**		
DAP			0.000 (0.13)	
CCC				-0.022 (-7.03)**
Size	9.060 (22.96)**	9.123 (22.93)**	8.943 (22.62)**	9.138 (23.06)**
SalesG	0.212 (38.87)**	0.214 (39.33)**	0.213 (39.13)**	0.212 (38.88)**
DOA	-0.389 (-23.07)**	-0.393 (-23.33)**	-0.396 (-23.52)**	-0.393 (-23.34)**
CAR	0.294 (14.24)**	0.291 (14.03)**	0.281 (13.67)**	0.293 (14.13)**
CLR	0.109 (7.56)**	0.115 (7.99)**	0.116 (8.09)**	0.110 (7.60)**
GDPG	0.521 (11.30)**	0.534 (11.58)**	0.520 (11.25)**	0.507 (10.98)**
Constant	-80.872 (-20.46)**	-81.635 (-20.61)**	-81.263 (-20.46)**	-82.635 (-20.83)**
Number of observations	143 237	143 237	143 237	143 237
Number of firms	21 131	21 131	21 131	21 131
R-squared:	0.070	0.069	0.069	0.069

Table A5: Firm fixed effects regression of ROCE with a dummy variable for poor economic states

Return on capital employed (ROCE) regressed on main independent variables; days inventory (DINV), days accounts receivable (DAR), days accounts receivable (DAP) and the cash conversion cycle (CCC) respectively in regression (5), (6), (7) and (8). A dummy variable has been included for poor economic states as well as interaction variables. Poor economic states have been identified as four periods over period 1999-2015 with lowest real economic growth (2008, 2009, 2012 and 2013). Robust standard errors were applied in all models presented. T-values are reported within parenthesis and significance at the 1% level is indicated with ** and at the 5% level with *. The results presented in the table are after winsorising ROCE, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(5)	(6)	(7)	(8)
	ROCE	ROCE	ROCE	ROCE
DINV	-0.043 (-10.18)**			
DAR		-0.027 (-3.59)**		
DAP			0.000 (0.14)	
CCC				-0.015 (-7.14)**
D1	-3.275 (-12.70)**	-2.677 (-7.09)**	-1.593 (-4.06)**	-3.276 (-12.66)**
DINV*D1	-0.010 (-3.28)**			
DAR*D1		-0.027 (-3.33)**		
DAP*D1			-0.056 (-5.92)**	
CCC*D1				-0.008 (-2.85)**
Size	6.832 (23.58)**	6.869 (23.46)**	6.793 (23.32)**	6.867 (23.59)**
SalesG	0.196 (47.24)**	0.197 (47.70)**	0.197 (47.59)**	0.196 (47.25)**
DOA	-0.350 (-27.19)**	-0.355 (-27.45)**	-0.355 (-27.51)**	-0.355 (-27.51)**
CAR	0.320 (25.05)**	0.315 (24.49)**	0.308 (24.27)**	0.318 (24.79)**
CLR	0.081 (7.97)**	0.087 (8.51)**	0.089 (8.74)**	0.083 (8.10)**
Constant	-60.941 (-21.16)**	-61.823 (-21.35)**	-61.895 (-21.32)**	-62.232 (-21.53)**
Number of observations	143 253	143 253	143 253	143 253
Number of firms	21 131	21 131	21 131	21 131
R-squared	0.123	0.122	0.122	0.122

Table A6: Firm fixed effects regression of RNOA with a dummy variable for poor economic states

Return on net operating assets (RNOA) regressed on main independent variables; days inventory (DINV), days accounts receivable (DAR), days accounts receivable (DAP) and the cash conversion cycle (CCC) respectively in regression (5), (6), (7) and (8). A dummy variable has been included for poor economic states as well as interaction variables. Poor economic states have been identified as four periods over period 1999-2015 with lowest real economic growth (2008, 2009, 2012 and 2013). Robust standard errors were applied in all models presented. T-values are reported within parenthesis and significance at the 1% level is indicated with ** and at the 5% level with *. The results presented in the table are after winsorising RNOA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(5)	(6)	(7)	(8)
	RNOA	RNOA	RNOA	RNOA
DINV	-0.049 (-7.82)**			
DAR		-0.043 (-3.99)**		
DAP			0.003 (0.95)	
CCC				-0.021 (-6.70)**
D1	-3.470 (-8.86)**	-2.558 (-4.22)**	-1.912 (-3.28)**	-3.348 (-8.34)**
DINV*D1	-0.010 (-2.43)*			
DAR*D1		-0.038 (-3.04)**		
DAP*D1			-0.052 (-3.84)**	
CCC*D1				-0.012 (-2.78)**
Size	9.385 (23.60)**	9.481 (23.64)**	9.334 (23.37)**	9.461 (23.70)**
SalesG	0.211 (38.78)**	0.213 (39.21)**	0.212 (39.07)**	0.211 (38.76)**
DOA	-0.389 (-23.60)**	-0.393 (-23.34)**	-0.395 (-23.45)**	-0.394 (-23.37)**
CAR	0.297 (14.39)**	0.294 (14.20)**	0.284 (13.83)**	0.297 (14.31)**
CLR	0.112 (7.77)**	0.118 (8.20)**	0.120 (8.37)**	0.112 (7.78)**
Constant	-82.114 (-20.71)**	-83.323(-20.94)**	-83.225 (-20.81)**	-83.864 (-21.07)**
Number of observations	143 237	143 237	143 237	143 237
Number of firms	21 131	21 131	21 131	21 131
R-squared	0.070	0.070	0.069	0.070

Table A7: Median and mean values of the WCM measures for different industries

The table shows the median and mean values of DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts payable) and the CCC (cash conversion cycle) for the different industries included in the sample.

Industry	Number of observations	DINV		DAR		DAP		CCC	
		Median	Mean	Median	Mean	Median	Mean	Median	Mean
Energy & Environment	1 239	6.81	36.47	32.71	37.70	37.28	51.82	21.23	22.35
Materials	3 063	21.85	45.32	40.51	40.43	39.92	45.72	27.30	40.03
Industrial goods	22 014	64.85	78.24	46.25	48.64	42.05	47.81	69.20	79.07
Construction industry	27 737	10.56	29.58	47.17	49.52	41.16	49.67	23.16	29.43
Shopping goods	30 443	20.96	47.59	11.24	20.11	28.99	35.99	15.35	31.37
Convenience goods	8 232	18.84	28.14	12.52	17.58	21.93	26.53	10.09	19.20
Health & Education	9 888	0.00	7.20	10.89	20.84	24.36	30.72	-5.73	-2.68
IT & Electronics	4 186	0.00	21.63	54.55	58.66	40.82	49.12	24.18	31.17
Telecom & Media	1 088	0.00	24.14	44.21	46.18	34.90	46.87	15.62	23.45
Corporate services	32 857	0.00	11.69	41.37	43.44	35.51	48.57	10.24	6.55
Other	2 511	44.60	68.89	21.85	27.52	36.85	46.37	32.95	50.04
Total	143 258	11.62	35.97	37.14	37.48	35.31	43.43	19.99	30.02

Table A8: Regression of ROCE on WCM measures utilising spline regressions

ROCE (return on capital employed) is regressed on the primary independent variables; DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts payable) and the CCC (cash conversion cycle) in regression (9), (10), (11) and (12) through the use of spline regressions. A continuous function is formed by connecting linear segments which have been estimated over four intervals (a_1, a_2, a_3 and a_4) of the CCC and its constituent elements. Three knots have been placed at the 1st, 2nd and 3rd quartile of DINV, DAR, DAP and the CCC. Fixed effects and robust standard errors have been utilised with robust t-statistics reported within parenthesis and significance at the 1% level indicated with a ** and at the 5% level with a *. The results presented in the table are after winsorising ROCE, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(9)	(10)	(11)	(12)
Dependent variable	ROCE	ROCE	ROCE	ROCE
Independent variable	DINV	DAR	DAP	CCC
a_1	-	-0.186 (-3.46)**	-0.093 (-2.63)**	-0.005 (-2.20)*
a_2	-0.313 (-5.05)**	-0.011 (-0.41)	-0.023 (-0.82)	0.009 (0.49)
a_3	-0.142 (-8.38)**	0.004 (0.18)	-0.118 (-6.11)**	-0.046 (-3.49)**
a_4	-0.017 (-3.60)**	-0.037 (-3.14)**	0.009 (4.16)**	-0.041 (-8.72)**
Size	6.569 (22.93)**	6.548 (22.57)**	6.555 (22.59)**	6.593 (22.87)**
SalesG	0.197 (47.58)**	0.199 (47.86)**	0.199 (47.96)**	0.196 (47.24)**
DOA	-0.346 (-26.89)**	-0.355 (-27.43)**	-0.352 (-27.26)**	-0.353 (-27.29)**
CAR	0.319 (24.98)**	0.312 (24.16)**	0.304 (23.94)**	0.322 (24.78)**
CLR	0.078 (7.67)**	0.084 (8.23)**	0.090 (8.76)**	0.076 (7.43)**
GDPG	0.476 (15.82)**	0.473 (15.67)**	0.480 (15.85)**	0.459 (15.22)**
Constant	-57.515 (-19.93)**	-58.723 (-20.01)**	-58.943 (-20.23)**	-60.995 (-21.11)**
Number of observations	143 253	143 253	143 253	143 253
Number of firms	21 131	21 131	21 131	21 131
R-squared	0.123	0.121	0.121	0.121

Table A9: Regression of RNOA on WCM measures utilising spline regressions

RNOA (return on net operating assets) is regressed on the primary independent variables; DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts payable) and the CCC (cash conversion cycle) in regression (9), (10), (11) and (12) through the use of spline regressions. A continuous function is formed by connecting linear segments which have been estimated over four intervals (a_1, a_2, a_3 and a_4) of the CCC and its constituent elements. Three knots have been placed at the 1st, 2nd and 3rd quartile of DINV, DAR, DAP and the CCC. Fixed effects and robust standard errors have been utilised with robust t-statistics reported within parenthesis and significance at the 1% level indicated with a ** and at the 5% level with a *. The results presented in the table are after winsorising RNOA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(9)	(10)	(11)	(12)
Dependent variable	RNOA	RNOA	RNOA	RNOA
Independent variable	DINV	DAR	DAP	CCC
a_1	-	-0.156 (-1.89)	-0.091 (-1.71)	-0.009 (-2.61)**
a_2	-0.390 (-4.42)**	-0.050 (-1.30)	0.001 (0.02)	0.016 (0.58)
a_3	-0.162 (-6.85)**	0.019 (0.58)	-0.151 (-5.40)**	-0.063 (-3.37)**
a_4	-0.018 (-2.69)**	-0.067 (-4.35)**	0.013 (4.23)**	-0.053 (-7.45)**
Size	9.132 (23.15)**	9.136 (22.98)**	9.098 (22.84)**	9.195 (23.20)**
SalesG	0.213 (39.02)**	0.214 (39.30)**	0.215 (39.32)**	0.211 (38.70)**
DOA	-0.384 (-22.82)**	-0.393 (-23.33)**	-0.391 (-23.26)**	-0.391 (-23.17)**
CAR	0.295 (14.32)**	0.290 (14.00)**	0.279 (13.59)**	0.301 (14.39)**
CLR	0.109 (7.55)**	0.115 (7.99)**	0.121 (8.41)**	0.105 (7.25)**
GDPG	0.532 (11.55)**	0.531 (11.51)**	0.533 (11.51)**	0.510 (11.04)**
Constant	-78.371 (-19.72)**	-80.582 (-19.79)**	-80.477 (-20.04)**	-82.822 (-20.81)**
Number of observations	143 237	143 237	143 237	143 237
Number of firms	21 131	21 131	21 131	21 131
R-squared	0.071	0.069	0.069	0.070

Table A10: Firm fixed effects model with quadratic WCM measures and robust standard errors

ROA (return on assets) is regressed on the primary independent variables; DINV (days in inventory), DAR (days accounts receivable), DAP (days accounts payable), the CCC (cash conversion cycle) and their squared terms respectively in regression (1), (2), (3) and (4). Robust standard errors are applied in all models presented. T-values are reported within parenthesis and significance at the 1% level is indicated with a ** and at the 5% level with a *. The results presented in the table are after winsorising RNOA, DINV, DAR, DAP and SalesG at the 1% and 99% level.

	(1)	(2)	(3)	(4)
	ROA	ROA	ROA	ROA
DINV	-0.073 (-17.17)**			
DAR		-0.033 (-3.74)**		
DAP			-0.027 (-12.77)**	
CCC				-0.013 (-11.97)**
$DINV^2$	0.000 (11.55)**			
DAR^2		0.000 (0.36)		
DAP^2			0.000 (12.20)**	
CCC^2				-0.000 (-10.71)**
Size	3.958 (32.03)**	3.955 (31.50)**	3.855 (30.94)**	3.948 (31.67)**
SalesG	0.073 (45.98)**	0.074 (46.70)**	0.074 (46.86)**	0.073 (46.00)**
DOA	-0.156 (-27.85)**	-0.161 (-28.54)**	-0.161 (-28.54)**	-0.161 (-28.55)**
CAR	0.149 (26.42)**	0.144 (25.27)**	0.137 (24.30)**	0.147 (25.76)**
CLR	0.002 (0.48)	0.007 (1.39)	0.010 (2.18)*	0.003 (0.57)
GDPG	0.220 (18.92)**	0.226 (19.38)**	0.227 (19.47)**	0.214 (18.35)**
Constant	-31.727 (-25.25)**	-32.486 (-25.55)**	-31.550 (-24.85)**	-32.886 (-25.96)**
Number of observations	143 258	143 258	143 258	143 258
Number of firms	21 132	21 132	21 132	21 132
R-squared	0.133	0.129	0.129	0.129