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MASTER THESIS

Working capital management`s effect on profitability

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Declaration of Authorship

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Abstract

The financial state of the most companies was significantly challenged by the last decade. Thus, financial managers must be aware of all factors that can contribute to the firm`s profitability in order to fight unstable economical environment. Working capital management`s effect on profitability has been raised recently and its importance is already known. This thesis aims to dig deeper into the relationship between working capital management and firm`s profitability across different sectors and different time periods. The subject for the empirical analysis are 908 UK manufacturing and 315 construction firms during the period of 2006-2013. The results indicate about the strong negative relationship between working capital, measured as cash conversion cycle (CCC) and gross operating profitability. Thus, it is an indicator that working capital and its characteristics must be included in the firm`s financial planning.

JEL Classification: G01, G30, G32

Keywords: working capital; profitability; manufacturing; construction; CCC

Contents

LIST OF TABLES.....	6
LIST OF FIGURES.....	7
1 INTRODUCTION	8
2 WORKING CAPITAL	10
2.1 DEFINITION OF WORKING CAPITAL	10
2.2 MANAGEMENT OF WORKING CAPITAL	14
2.3 FACTORS INFLUENCING WORKING CAPITAL	17
3 PROFITABILITY	22
3.1 MEASUREMENT OF PROFITABILITY	22
3.2 THE DETERMINANTS OF PROFITABILITY	23
4 MANUFACTURING INDUSTRY`S OUTLOOK.....	25
4.1 WORKING CAPITAL TRENDS	27
5 CONSTRUCTION INDUSTRY`S OUTLOOK.....	29
5.1 WORKING CAPITAL TRENDS	30
6 PREVIOUS RESEARCH.....	32
6.1 HYPOTHESES.....	36
7 METHODOLOGY	38
7.1 DESCRIPTIVE STATISTICS	41
7.2 PEARSON CORRELATION ANALYSIS.....	47
7.2.1 <i>Manufacturing sector</i>	48
7.2.2 <i>Construction sector</i>	52
7.2.3 <i>Conclusion of Pearson correlation analysis</i>	55
7.3 REGRESSION ANALYSIS.....	56
7.3.1 <i>Manufacturing sector</i>	57
7.3.2 <i>Construction sector</i>	60
7.3.3 <i>Conclusion of OLS regression analysis</i>	62
8 CONCLUSION	64
8.1 LIMITATIONS OF THE RESEARCH	65
9 BIBLIOGRAPHY.....	66

List of tables

Table 1. Internal working capital determinants	19
Table 2. External working capital determinants	21
Table 3. Subsectors of manufacturing industry	38
Table 4. Descriptives of the manufacturing companies, whole period 2006-2013	42
Table 5. Descriptives of the construction companies, whole period 2006-2013.....	42
Table 6. Descriptives of the manufacturing companies 2006-2007	44
Table 7. Descriptives of the construction companies 2006-2007.....	44
Table 8. Descriptives of the manufacturing companies 2008-2011	45
Table 9. Descriptives of the construction companies 2008-2011.....	45
Table 10. Descriptives of the manufacturing companies 2012-2013	46
Table 11. Descriptives of the construction companies 2012-2013.....	47
Table 12. Pearson correlation manufacturing sector 2006-2013	49
Table 13. Pearson correlation manufacturing sector 2006-2007	50
Table 14. Pearson correlation manufacturing sector 2008-2011	50
Table 15. Pearson correlation manufacturing sector 2012-2013	51
Table 16. Pearson correlation construction sector 2006-2013	52
Table 17. Pearson correlation construction sector 2006-2007	53
Table 18. Pearson correlation construction sector 2008-2011	54
Table 19. Pearson correlation construction sector 2012-2013	55
Table 20. Relationship of the firm`s profitability with CCC and its components, manufacturing sector.....	59
Table 21. Relationship of the firm`s profitability with CCC and its components, construction sector.....	61

List of figures

Figure 1. Working capital needs over time.....	10
Figure 2. Operating production cycle	13
Figure 3. Operating cycle versus cash cycle.....	14
Figure 4 Trade-off between illiquidity and liquidity costs	15
Figure 5. Manufacturing as a % of UK total: output, jobs, R&D and exports	25
Figure 6. Change in manufacturing sectors` employment 1971-2016.....	26
Figure 7. Output of high-tech manufacturers vs overall output , 1951-2016	26
Figure 8. Global vs Europe`s manufacturing sector working capital trend, 2009-2013	27
Figure 9. UK Construction sector`s profitability and productivity 2008-2016	29
Figure 10. UK construction sector`s contribution to the economy	30
Figure 11. Cash conversion cycle`s timeline.....	33
Figure 12. UK real GDP annual growth, manufacturing and construction sector growth %, 2002-2013.....	39

1 Introduction

Working capital management is the core part of the financial management. A large number of business failures have been attributed to inability of financial managers to plan and control properly the current assets and current liabilities of their respective organizations (Smith, 1973). Early research used accounting information to model or focus on specific activities such as cash management, accounts receivable management, inventory management, short-term borrowing, and cash budgeting (Gentry, 1988). However, the perspective has changed over time as the various elements of working capital are interrelated and can be seen as a part of short-term cycle Atrill (2010). Thus, the working-capital decisions are taken on a daily basis. Due to its routine nature and, compared to the long-term planning - small scope, its importance can be overlooked. Regarding the normal operations of a firm, working capital management attracts less attention than capital budget and capital structure in financial management (Chiou and Cheng, 2006). However, the efficient working capital management is an influential tool that can significantly contribute to the financial well-being of the enterprise.

In addition, working capital reflects short-term financing strategies. Thus, as recently the costs of obtaining money from capital markets have increased due to the financial turmoil, financial managers should focus on maintaining the most optimal level of working capital. Such level has to be adjusted not only according the industry of operation but to the prevailing economic conditions as well. Operating investments are critically affected by the firm's activity level; however, there are other potentially significant influences from the company, the industry, and the region in which the firm operates (Etiennot, Preve and Allende, 2012). According to Lamberson (1995) business needs for working capital increase during expanding economic activity and decrease during contracting economic activity. PWC analysis (2014) suggests, the working capital management is especially important to manufacturing and construction industries due to the capital-intensive nature and sensitivity to the economic swings, therefore these industries were chosen as the subject of further analysis

In this research, the relationship between profitability and working capital management as well as its change during the business cycle is analyzed. Using the sample of 908 UK manufacturing and 315 construction companies, the focus is on the relationship between working capital management and corporate profitability and the effect of economic downturn on the size of working capital. Thus, the main question to be answered is:

Is there an association between working capital and profitability and is the association stronger during a crisis?

To answer the research question, my work firstly analyses the working capital concept. Starting with the first part - definition of working capital, its categories and the main components. Following, is the analysis of the different management strategies that are found across firms with the explanation of the main factors that cause such differences. As profitability term is also included into the research question, the chapter 3 is dedicated to the research of the most used profitability measures and its determinants. Furthermore, resulting from the analysis of the previous research related to this work`s main question, the hypothesis are raised and explained. As the main subject of the analysis are the firms that belong to highly capital intensive sectors in the UK, the main characteristics of each sector are presented in chapters 4 and 5.

An empirical part consists of the analysis of each industry in question during different stages of economic state. The results show that there is a significant relationship between working capital and profitability as well as inventory, account payables and receivables. The factors that can cause their significant relationships are explained and the results are compared with the previous researches.

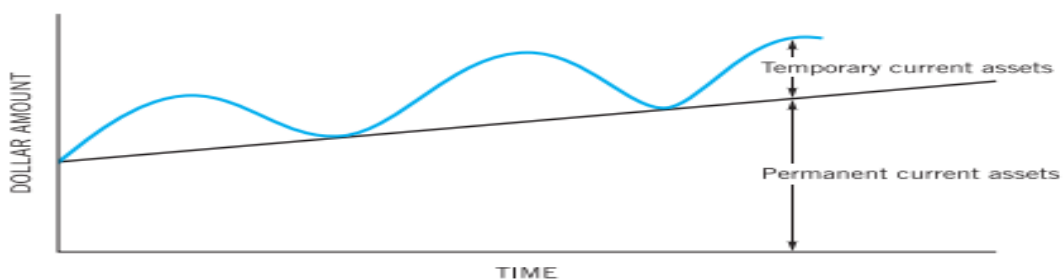
2 Working capital

2.1 Definition of working capital

An efficient working capital level is paramount requirement for every firm. Depending on the industry of operation, it can require significant funds of investment to keep the firm competitive in the market. In most cases, the financial managers must manage working capital so current assets meet current liabilities to avoid financial distress of the firm. The lack of understanding about the impact of working capital requirements on profitability, the lack of clarity about its determinants, and the lack of management's ability to plan and control its components may lead to insolvency and bankruptcy (Gill, 2011).

In the financial literature, *gross working capital* and *net working capital* are the accounting expressions used to measure working capital. *Net working capital* equals the difference between current assets and operating liabilities, whereas *gross working capital* refers to the value of current assets. The assets/liabilities that are expected to be sold/settled within one fiscal year fall under current assets/liabilities category. Also, Nunn and Kenneth (1981) further underscores two types of working capital, based on time perspective: temporary and permanent. Figure 1 illustrates firm's changing need for working capital requirements over time. Temporary working capital portion is highly dependent on the business scale of the daily activities and seasonalities. Thus, the constant adjusting and short-term planning is required for the decisions related to temporary part of working capital. The setting of order quantities or credit terms to customers can be named as the examples of such short-term planning. Contrarily, the permanent part of working capital is steady over the years and is described as the minimum amount of current assets needed to sustain business functioning irrespective of the level of operations. The permanent working capital in some industries represents a major portion of asset structure and requires long-term planning approach.

Figure 1. Working capital needs over time



Source: Horne and Wachowicz (2000), „Fundamentals of Financial Management“

Nonetheless, to be able to choose the most efficient strategy of working capital management, the understanding of its core elements is a necessity. It involves many different aspects of corporate operational management: management of receivables, management and use of trade credit, management of inventory (Kieschnick, LaPlante and Moussawi, 2006). The following listed components are found as the core parts of working capital and their management is an inseparable part from the day-to-day business activities.

- trade receivables – arise from the company`s decision to sell their goods on credit. Hence, it can be regarded as the source of short-term financing for the buyer and investment for the seller. As a source of current funds, it plays a very important role in the financing of many business corporations, especially those that do not have ready access to other types of credit (Guthmann & Dougall, 1946). In maximizing their own profits, firms with easy access to money markets are motivated to sell monetary resource of firms that have productive investment opportunities but are restricted in their ability to obtain funds (Schwartz, 1974). Thus, providing trade credit makes firms act as the financial intermediaries as their customers can acquire goods without turning to the third party for the external financing, bringing benefits to both parties involved.

Besides, the financial motive to provide trade credit, operational incentive can explain the behaviour of the firms with less predictable demand in their decision to provide customers with the goods before the payment. Thus, the offer of trade credit might be perceived as the managing tool of the fluctuations in the product demand as loosening (tightening) the credit terms leads to an increase (decrease) in sales. While this method of response is not costless, it can be implemented quickly and confines the disturbance to the financial sector of the firm, thereby insulating operations from the shocks produced by variations in demand (Emery, 1984). Additionally, the companies might seek to provide their customers with the flexible trade receivables policies as in return it can boost the sales. Receivables can be perceived as given extra time to customers to evaluate the product quality (Smith 1973). The flip side of granting trade credit is that money locked up in working capital (Deloof, 2003). Also, the costs, such as credit administration, bad debts costs, can reduce the company`s willingness to extend the account receivable collection time for its customers.

- trade payables – the result of the above analyzed trade credit provided by the supplier and is recognized on the buyer`s balance sheet as the current liability. Delaying payables to suppliers allows a firm to assess the quality of the products bought, and can be inexpensive and flexible source of financing for the firm (Deloof 2003). Hence, for many firms such

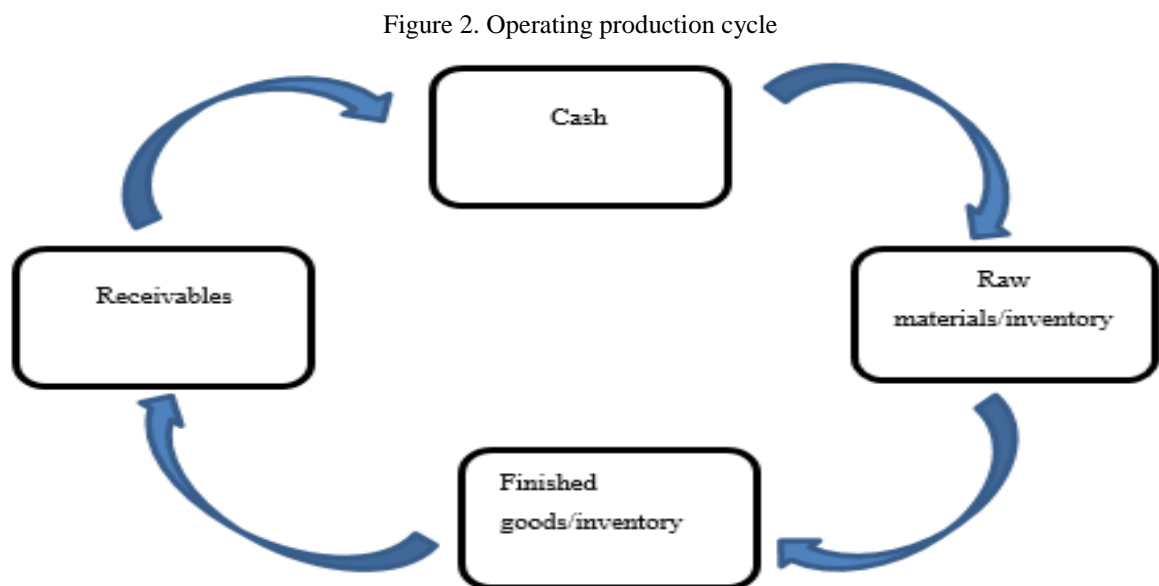
short-term debt is preferred as it is cheaper to obtain when compared to the overall interest paid on the long-term debt. Also, for the firms with numerous amount of transactions, it is reasonable to postpone payments until a certain date, so the transaction costs are minimized as the invoices are paid at once. It gives time to plan for the payment of unexpected purchases, enables to forecast future cash outlays with greater certainty, and simplifies the cash management (Schwartz 1974). However, in case the suppliers encourage its customers to pay the invoice as it occurs, by providing with the additional discounts, longer delays in accounts payables might become costly.

- inventories – the type of current asset, held primarily to satisfy the company`s demand. The main control tools of inventory are forecasting, production planning, economic run quantities. The company can decide to increase the level of inventory on hand due to the expected future price increase from supplier or expected future supply shortage. On the other hand, inventory has its own costs such as financing, obsolescence, storage as well as the opportunity costs. In addition to that, there are three types of inventory distinguished: finished goods, raw materials and works in progress. According to Atrill (2010), Just-in-time inventories management became a popular alternative among businesses that prefer to eliminate the need to hold inventories. The management system is based on timely delivery of inventories on exact time when it is needed for the production. Such system can be considered as the novelty compared to the former ones, where it was standard to stock-up inventory upon the forecasts of demand and it became widely used since 2000. However, the stock-up of inventory might be used as the prevention against future uncertainties.
- Cash and short-term investments/securities is an essential part of the firm`s current assets. Currency bills or cash deposits represent cash part and bank deposits consist of demand and time deposits. Demand deposits are on checking account, ready for the immediate use; whereas time deposits require time for payment processing from the saving accounts. According Brealey, Myers and Allen (2001), there are four main types of money uses: payments of account payables, labour/administrative expenses, capital expenditures and taxes, interests, dividends payments. Therefore, the firm must plan its cashflow so it has enough of cash to cover such primary expenses on a daily basis. Commercial paper issued by other companies and local government securities is the short-term debt that makes up marketable securities.

It can be clearly seen that behind the management of the core elements of working capital, many various incentives and possible benefits are found. Firms can reduce their financing cost and/or

increase the funds available for expansions projects by minimizing the amount tied up in current assets (Nazir and Afza, 2009). However, there are also costs involved resulting from each working capital element. Brealey, Myers and Allen (2001) categorize such costs into carrying and shortage costs. Interest income that could be earned on the cash received earlier from customers or opportunity costs together with storage costs resulting from higher level of inventory represent carrying costs. On the other hand, in case firm runs out of cash/inventory a need to borrow or stop the production will result in occurred shortage costs.

Below, figure 2 depicts the operating cycle of the company. A firm's operating cycle is the length of time from the commitment of cash for purchases until the collection of receivables resulting from the sale of goods or services (Horne and Wachowicz, 2000). It can be also looked at as working capital cycle. Firstly, the firm needs to use cash to purchase raw materials or goods from its suppliers and it might result in receiving trade credit. Secondly, time to convert raw materials into finished goods or to sell inventory is needed. Once inventories are sold not necessarily cash is received immediately, hence account receivables replace inventory until money is received from customers. Thus, as the starting and ending point, cash is distinguished. It is worthy to note that credit received from suppliers reduce working capital cycle; whereas credit provided to customers extends it.

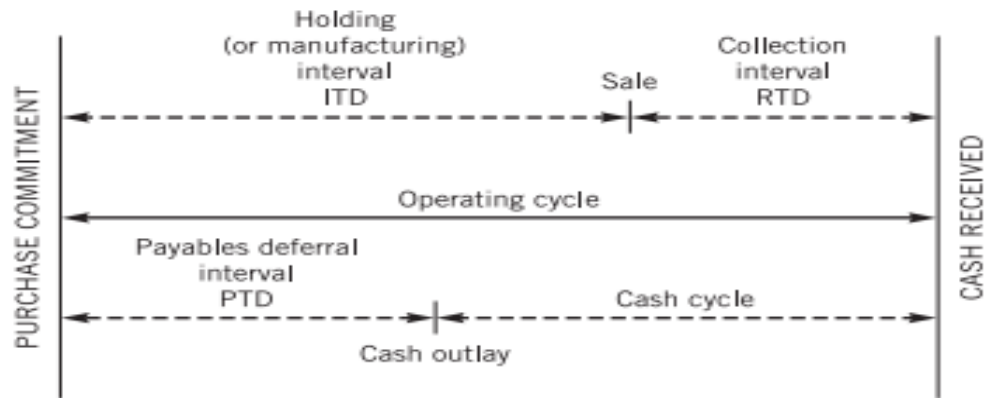


Source: made by author

Besides, while operating production cycle can be expressed as Inventory turnover days + Receivable turnover days, there is other important cycle related to the cash movement. Cash operating cycle aims to measure only time when cash leaves company's accounts to pay

supplier until the time when money is actually received from customers. Mathematically it is expressed as Operating cycle – Payable Turnover period. Figure 3 illustrates the timeline of both cycles.

Figure 3. Operating cycle versus cash cycle



Source: Horne and Wachowicz, 2010

The main objective of working capital management is to maintain the optimal balance between each of the working capital components (Gill, 2011). Additionally, it is essential to keep in mind that there is a strong interdependency among the separate components and thus, seek for the holistic approach when searching for the optimal level of working capital. Consequently, carefully managing the main components of working capital allows the business to generate funds internally instead of using external funding.

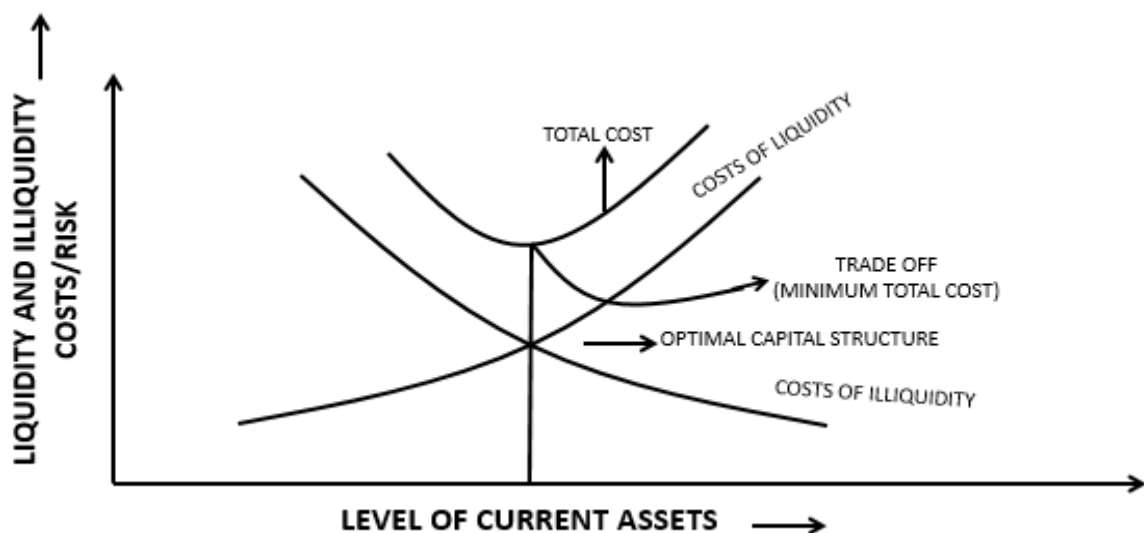
2.2 Management of working capital

The proportion of working capital components held is used to measure a company's liquidity position. Liquidity is a precondition to ensure that firms are able to meet their short-term obligations and its continued flow can be guaranteed from a profitable venture (Padachi, 2005). Efficient liquidity management involves planning and controlling current assets and current liabilities in such a manner that eliminates the risk of the inability to meet their short-term obligations, on one hand, and avoids excessive investment in these assets, on the other (Eljelly, 2004). The positive working capital indicates that the business can meet its daily operation needs and obligations, however, it does not represent the most efficient working capital level. When working capital's requirements are not properly managed and are allocated more than required, it renders the management inefficient and reduces the benefits of short-term investments (Nazir and Afza, 2009). Consequently, ensuring liquidity and at the same time

avoiding of leaving idle current asstes, brings the financial managers to the dilemma of contradictory goals of working capital management: liquidity and profitability.

Hence, the planning of optimal current asset`s level involves a trade-off between company`s liquidity and illiquidity costs. The illustration of such effect is shown in figure 4. A higher level of current assets equals the lower costs of liquidity, such as when company faces unexpected expenses, the excess of liquid assets can solve it without a need to turn to the external borrowers. Consequently, the lower lever of current assets results into higher costs of illiquidity as there is threat to the firm`s solvency. It is important to note, that it does relate to all current types of assets at all levels of liquidity, not only to cash. For instance – inventory, too low level of inventory (lack of liquidity) causes a halt of the firm`s operations with a result of lost sales (costs of illiquidity).

Figure 4 Trade-off between illiquidity and liquidity costs



Source: made by author based on Horne and Wachowicz, 2004

Therefore, the main challenge is to find the optimum level between risk and efficiency; to prevent the interruption of the operational activities and reduced efficiency. In financial literature, the trade-off between risk and return is dominant aspect when analyzing working capital management (Pass and Pike, 1984). Weinraub and Visscher (1998) state that the risk and return trade-offs are inherent in alternative working capital policies and that more aggressive approach in one area can be balanced by a more conservative approach in the other. Consequently, the main strategies of working capital management can be categorized according

to the level of risk-return trade-off and it includes only two financing sources available, short term and long term sources (Pandey, 2015).

When it comes to choosing the financing type, it is needed to evaluate whether the firm is ready to pay back its short-term debts once the maturity date is reached and whether the lender would be willing to roll-over it. Additionally, there is an uncertainty about the direction of the short-term interest rates that has a direct impact on company's profitability. A firm forced to refinance its short-term debt in a period of rising interest rates may pay an overall interest cost on short-term debt that is higher than it would have been originally on long-term debt (Horne and Wachowicz, 2004). Hence, the firm's readiness to cover debt once maturity is due and uncertainty level of interest rates on market must be taken into account when looking for the more profitable financing type for working capital. Based on the chosen financing sources, the working capital management strategies are categorized into following:

- An aggressive strategy – the company decides to finance its demand using only short-term liabilities and usually current assets are expressed as the small part of the total assets. The primary sources of liquidity - trade credit, short-term bank loans, available cash and cash equivalents and faster generation of account receivables are the main sources of funding. As this approach eliminates a negative effect on firm's profitability caused by the excessive levels of current assets, the strategy might bring higher returns. However, lower level of current assets can cause stock-outs and interrupt the smooth operation of the business (Horne and Wachowicz, 2004; Weinraub and Visscher, 1998). Especially, such approach might threaten the financial health of the fast-growing companies. The firms with rapid sales growth might face risk of overtrading. When large amounts of inventories are acquired on credit to meet the growing sales demand, it extends the working capital cycle and reduce the available amount of cash. Hence, the aggressive strategy is considered riskier and the management must actively track working capital to collect receivables on time, so the short-term liabilities are covered and there is adequate amount of funds available to maintain the level of trading.
- A conservative strategy – opposite to the aggressive strategy, long-term liabilities and shareholder's equity is chosen to satisfy company's demand. The lowest returns and risk are the main features of such strategy. The greater the investment in current assets, the lower the risk, and also the lower profitability obtained (Nazir and Afza, 2009). Such strategy represents a safe choice and is the most suitable for business operating in an unstable environment where it is not possible to rely on fast sales. Nonetheless, the main

drawback of the strategy is higher interest rate as it is commonly expected that long-term debt is more costly than short-term in the long run.

- A moderate or hedging strategy – the combination of long-term and short-term funds. The long-term financing is used to meet permanent working capital part; whereas short-term financing is attributed to temporary working capital requirement. Therefore, the key of this strategy is to match the expected life of asset with the period of source of finance by which asset is financed (Pandey, 2015). The rationale for this strategy is that if long-term debt is used to finance short-term needs, the firm will be paying interest for the use of funds during times when these funds are not needed (Horne and Wachowicz, 2004). Consequently, such approach is used in more certain business environments, when the changes in temporary working capital can be predicted with higher accuracy.
- Zero working capital strategy – one of the latest approaches becoming widely popular among modern corporate firms with fast ways of customer service. The main feature is to keep the current assets equal to current liabilities. Also, the firms usually have no inventory as demand is satisfied immediately upon its request.

As finding the optimal balance between risk and efficiency is the overall goal for the company, it is important to note that responsibility of the working capital management is often spread over many departments. For instance, sales department has different approach to inventory management than production. Thus, to avoid the situation when several managers may pursue different goals, the thorough analysis on the effects of every division's actions on working capital as well as the setting of the clear goals what has to be achieved is needed. According to Crowe Horwath report (2016), working capital management requires ongoing awareness and consistent, standardized practices throughout an organization which can happen only if senior leaders identify working capital management as a core objective.

2.3 Factors influencing working capital

Theoretically, working capital concepts may be simple and straightforward, but in practice, it has become one of most important issues in the organization (Gill, 2011). As there are different working capital management strategies, there are numerous factors influencing the choices of the strategy for each firm besides finding the least costly option and the manager's risk tolerance level. Determining the important factors, would help managers to decide the optimal level of investment in current assets as well as the appropriate sources to finance them (Manoori and Muhammad, 2012). The strategy also depends on the particular sector the firm is operating in as - industries do follow significantly different aggressive/conservative working capital policies

and they remain stable relative to each other over extended periods (Weinraub and Visscher 1998). Identifying the underlying factors is important for every financial manager when searching for the right strategy as it helps to minimize risk and maximize the benefits resulting from the optimal working capital strategy (Nazir and Afza 2009).

In general, the factors influencing working capital can be categorized as internal, arising from specific business characteristics or the external, macroeconomic ones. Nunn and Kenneth (1981) investigate the causes of different working capital levels across product-line business in various industries during the period 1970-1978. The research shows that for US companies working capital level mostly depends on productions-related variables, sales-related variables, accounting related variables, competitive position and industry factors. However, the research's focus is directed to the permanent type of working capital only. Nazir and Afza (2009) shows a significant impact of the internal factors such as operating cycle, leverage, ROA on working capital requirements. Leverage can be described as the ratio of short-term liabilities or as the ratio of long-term liabilities to total assets and in most literature, it is found as negatively associated to working capital. Kieschenik, LaPlante and Moussavi (2006) proves the firm's size, sales growth, the proportion of outside directors on its board, the current compensation of its CEO and CEO's share ownership has significant influence on working capital as well.

Furthermore, Chiou and Cheng (2006) besides the investigation of the internal determinants, included the external factors to determine those that have the biggest impact on working capital. For this purpose, the sample of Taiwanese firms was constructed, using 35 quarters' data, starting with 1996 and ending at the third quarter of 2004. The authors use net liquid balance (NLB) and working capital requirements (WCR) as the indicators for working capital management and business indicator as a measure of the external factors. They state that relatively high net volume of working capital requirements may occur in economic recession. Also, their main findings indicate that the debt ratio and operating cash flow maintain the negative relationship with the working capital management. Below in the table 1, based on the financial literature analysis, the main determinants of working capital and their examples are listed.

Table 1. Internal working capital determinants

Internal factors	<i>Examples</i>
Sales	The company might stock-up its inventory or expand trade credit upon the sales growth forecast. Also, the firm with bigger sales can use its higher market share as an advantage in negotiation with suppliers the trade credit terms.
Size	The large firms might have bigger bargaining power when negotiating with suppliers or in coordination of the supply management chain compared to the smaller peers. Also, larger investments might be needed in working capital due its larger sales levels. Alternatively, the size might be a determinant of the company`s accessibility to the external financing as smaller firms scarcely have the access to the long-term capital market funding other than the acquisition of a mortgage on a building. (Horne and Wachowicz, 2004). For small firms less financing is available and more assets must be held in liquid form to meet daily transactions and emergency requirements (Moss and Stine, 1993). It is also expected that smaller firms often have less sophisticated working processes, systems and functional expertise, whilst arguably they have a greater need for effective cash management to finance their growth (PWC, 2014).
Operating cycle	The time needed to produce the final product directly affects working capital cycle`s length. The longer time is needed to convert raw materials into inventory, the longer time takes to sell inventory and consequently more funding might be required. Contrary, shorter the cycle is, less current assets are required to sustain short-term needs.
Leverage	Based on the Pecking order theory – the firms with higher financial leverage tend to choose more aggressive working capital strategies. The main aim is to ensure internal financing and avoid issuance of debt and equity. According Meyers (1984) the firms to finance their investments should turn to internal financing first.
ROA	If ROA is lower than cost of capital, the firm is highly motivated to reduce CCC as not to keep idle or locked-in cash but to employ it so the rate of return would match cost of capital.

Board characteristics/CEO compensation	The more CEO is paid, more incentives to reduce CCC as lower working capital requirements mean more cash for shareholders. Also, it is expected that the higher level of monitoring from outsider directors brings about more pressure on efficient working capital management. Also, for the sake of reducing risk, CEO has propensity to adopt more working capital than that which would maximize shareholders' wealth and by doing so, they can mitigate the corporate risk of financial distress for having more of liquidity (Chuech and Chien, 1999). According to Harford, Mansi, and Maxwell the firms with poor governance tend to hold lower cash balances.
Ownership	The company under private ownership might be pursuing more conservative strategy to ensure safe position; whereas listed companies might be pursuing more risky strategies. Such difference primly results from pressure on the listed companies arising from the capital markets.
Alternative management tools	The use of factoring or receivable insurance might alter firm`s usual behaviour and cause the firms to be more flexible with the trade credit terms or customers` creditworthiness level requirements.

Source:made by author

Furthermore, in the table 2 below, are two examples of the main external determinants – country characteristics and industry specifics. Hawawini, Viallet, and Vora (1986) suggests that industry practices are significant determinants of a firm's working capital management practices. For this work's analysis, manufacturing and construction industries are chosen due to their capital-intensive nature. Contrary to the service industry, for instance IT company, manufacturers must have high proportion of every working capital's component compared to the total assets. Naturally, the size of working capital for manufacturing industry is bigger. According to PWC sector analysis (2014), manufacturing companies have trapped significant amount of funds in working capital across industry. Even though it is measured that working capital has performance improved in the last years, the companies should put a stronger focus on the working capital management so trapped funds could be used for further growth. This is especially relevant in the economic downturn times when sales are declining as manufacturing/construction sectors are sensitive to the economic swings. Regarding to the other external factors, such as country specifics – the financial manager does not have influence on it, but it is important to take into consideration when analyzing and comparing the results across companies

Table 2. External working capital determinants

External	<i>Examples</i>
Country specifics	All country characteristics, such as political aspects, economic growth/maturity, capital market development, legal and institutional environment, tax policy shape the patterns of working capital management in each country. Companies operating in developed economies have been able to fine-tune their operational processes over many years and adjust their business models if needed; whereas in the emerging, fast growing economies cash and working capital are typically managed less well, as cash flows are growing each year (PWC, 2014).
Industry specifics	The business features have a significant impact on working capital. For instance, IT company would not have lots of inventory but most likely high amount of receivables; whereas retail business should have large proportion of inventory compared to the total assets. Therefore, business nature dictates the specifics of working capital management.

Source: made by author

3 Profitability

3.1 Measurement of profitability

Generated sales indicate the company's success in collecting cash, however to measure the actual efficiency of resource use and performance, earnings have to be adjusted. Gross profit is the cleanest accounting measure of true economic profitability as earnings off the income statement represents a firm's true economic profitability reduced by any investments that are treated as expenses (Novy-Max, 2013). When investigating the differences of profitability levels across companies the use of ratios helps to conduct more accurate comparison analysis and there are various accounting based measures. Profitability ratios indicate the firm's overall effectiveness of operation and are distinguished according their relation to sales or relation to investments (Horne and Wachowicz, 2004). In addition, measures of profit can be divided into the following categories: profit measures, return on measures and economic profit measures. Each of categories are designed to analyze profitability/efficiency from the different perspective. Further, the most used ratios in financial literature from each category are analyzed.

Starting with gross profit margin which is one of the primary ratios used to measure the firm's operational efficiency expressed as:

$$\text{Gross Profit Margin} = \frac{\text{Net Sales} - \text{Cost of Goods Sold}}{\text{Net Sales}}$$

The ratio shows which part of revenues results in the profit. Additionally, as it accounts only for costs related to the production, it indicates which company is more successful in selling its goods above costs when comparing to the competitors. Return on Equity (ROE) is widely used by managers, it relates the profit output with the equity input and thus compute the rate of return on equity (Brealey, Myers and Allen, 2001):

$$ROE = \frac{\text{Net Income}}{\text{Total Equity}} \qquad ROA = \frac{\text{Net Sales}}{\text{Average Total Assets}}$$

By comparing ROA among the companies, it can be seen how much of currency units of profit are generated by the company's assets employed. Both types of ratios can be counted on Net basis, meaning, taxes, and other than operational expenses such as interest payments are taken into account and subtracted from Net Sales. The comparison of net versus gross ratios can identify whether changes in profitability over time are related to the operational factors or overhead expenses or tax policies (Horne and Wachowicz, 2004).

EVA economic value added, according Stern (1990) measures true economic profit of the organization. The measure implies the difference between net operating profits after taxes and total cost of funds and it is based on the past performance of the corporate enterprise (Khan, 2004). EVA measures enterprise's economic profit on the basis of economic cost and helps the manager to realize that all resource should be paid back (Chen, Pingxin, 2002).

$$EVA = NOPAT - (TOTAL\ CAPITAL \times WACC)$$

Thus, EVA could be ranked as the most unique profitability measure as it includes not only cost of debt but cost of capital as whole.

Since this work is focused on working capital management which directly relates to the operational efficiency, the relevant profitability measures result from gross basis as this type of profitability measurement is most commonly used in researches related to working capital influence.

3.2 The determinants of profitability

The main determinants of profitability have been a topic for the numerous analyses for many years and due to ever changing economic, business environment - still is. The variables explaining profitability might be classified as either resulting from firm-level characteristics that can be affected by the management decisions or from industry characteristics. Additionally, regarding the firm-level factors, the managerial decisions are crucial because it must be planned carefully how many inputs are employed in order to achieve the planned level of production and consequently to bring value for the shareholders. According Barney (1991), firm performance is rather determined by internal than external variables. Based on this research's scope, the determinants of profitability resulting from firm-level characteristics are more relevant for further analysis as the subject consists of the companies from the particular industries – manufacturing and construction.

According Bennenbroek and Harris (1995), market power together with efficiency are important profitability determinants for the manufacturing sector. Goddard (2005) after conducting research on manufacturing companies across Europe, states that firm's size, gearing ratio, market share and liquidity are the major determinants due their strong correlation with profitability. The firm's size is commonly measured using three different metrics: natural logarithm of sales, natural logarithm of total assets or the number of employees. For the

company's liquidity – current ratio can be distinguished as one of the most common metrics used.

$$\text{Current ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

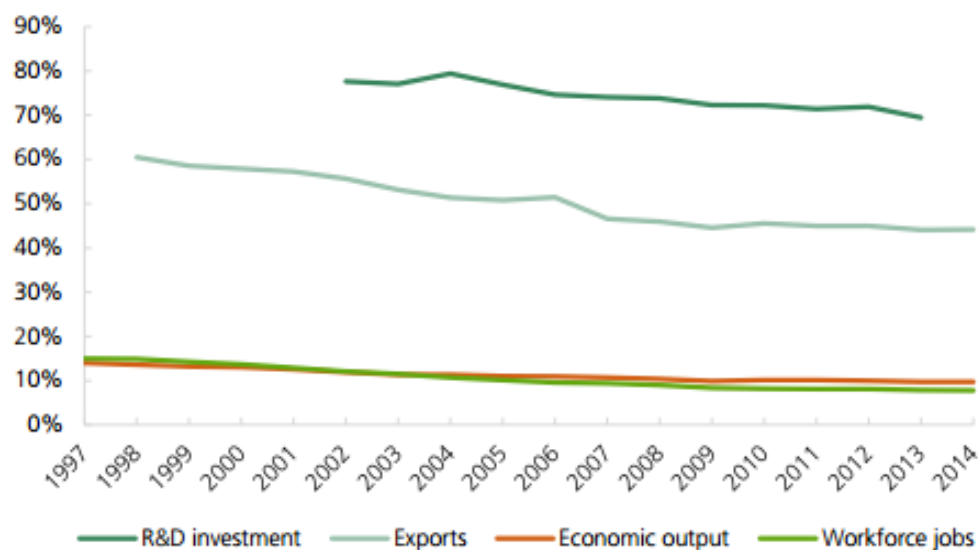
In addition, the age of a firm might be perceived as time accumulated during which firms speed up and standardize their production process by getting specialization over time (Asenso and Fellows, 1987; Akintoye, Akintola, and Martin 1991). Also, Feeny (2000) states that there is a significant connection of a positive association between capital intensity, size and profitability.

Therefore, it can be concluded that in financial literature, from the firm-level factors, having the strongest impact on corporate profitability the most accepted ones are the following: firm size, solvency and liquidity, financial leverage, investment, and age.

4 Manufacturing industry`s outlook

The UK is ninth largest world`s manufacturer and the manufacturing sector itself accounted for 10% of the country`s GDP in 2014 (House of Commons Library, 2015). However, the significance of the sector is gradually declining when comparing its gross value added (GAV) over the last decades as in 1970 it contributed around 20% to the economic output. Such change is caused by the increase in service sector`s importance over manufacturing, even though UK government introduced a tax on service sector to subsidize manufacturing in late 80s. However, the manufacturing sector accounts for majority of total R&D investment and around 50% of total current UK exports. In addition, it is still important job source and in 2014 employed 2,6 mio people. Figure 5 depicts how the indicators have changed since 1997 and it can be seen that the declining pattern is present in the main UK manufacturing sector`s figures such as - output, jobs, R&D and exports.

Figure 5. Manufacturing as a % of UK total: output, jobs, R&D and exports



Source: house of commons library, 2015

Also, a decline in jobs over time is more significant than change in the overall output. Such trend can be explained by the technological advancement and productivity increase in manufacturing processes. As manufacturers continuously invest large portion in R&D, it contributes to the increasing sophistication of the sector. Figure 6 below, depicts that compared to 1971, every decade up to 2016 brought a reduction in manufacturing jobs. The largest decline is noticed between 2001 and 2011 and such result can be attributed to the financial crisis of

2008. Nonetheless, the exception in the last 6 years occurred as growth of 4.68% is recorded. Therefore, it can be assumed that the latest increase is caused by the recovery from the economical turmoil as lost jobs are getting back to their initial place in the industry.

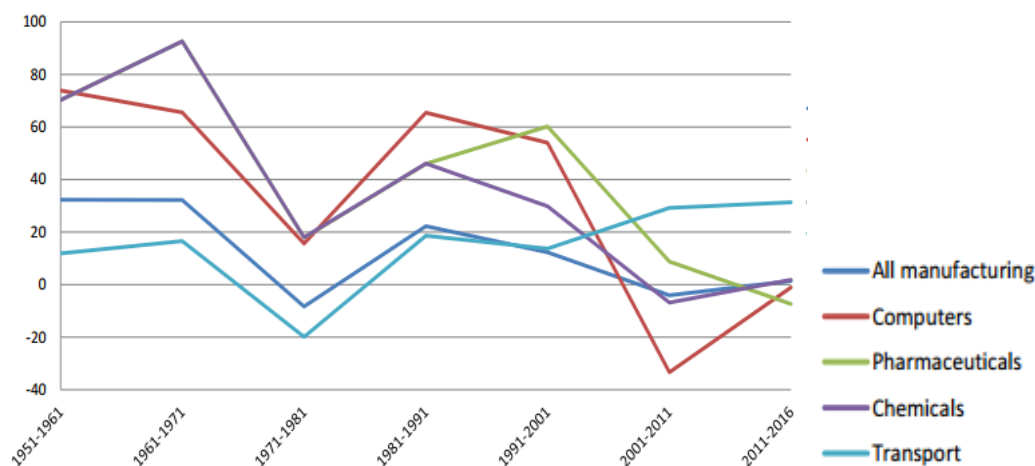
Figure 6. Change in manufacturing sectors's employment 1971-2016

Manufacturing jobs in the UK since 1971 (000s)	
1971	7,886
1981 (% growth)	5,724 (-27.42)
1991 (% growth)	4,511 (-21.19)
2001 (% growth)	3,836 (-14.96)
2011 (% growth)	2,564 (-33.16)
2016 (% growth)	2,684 (4.68)

Source: Speri political economy research institute, 2016

The R&D investments are essential for the high-technology manufactures. The main subsectors that belong to high-technology category are manufacturers of Computers, Pharmaceuticals, Chemicals and Transport. When looking at the overall manufacturing growth trend compared with high technology subsectors at the figure 7, it can be seen that transport manufacturers were the only ones that resisted to the appalling economic conditions and kept its significant growth over the last decade; whereas pharmaceutical and chemical producers experienced great reduction in their outputs.

Figure 7. Output of high-tech manufacturers vs overall output , 1951-2016



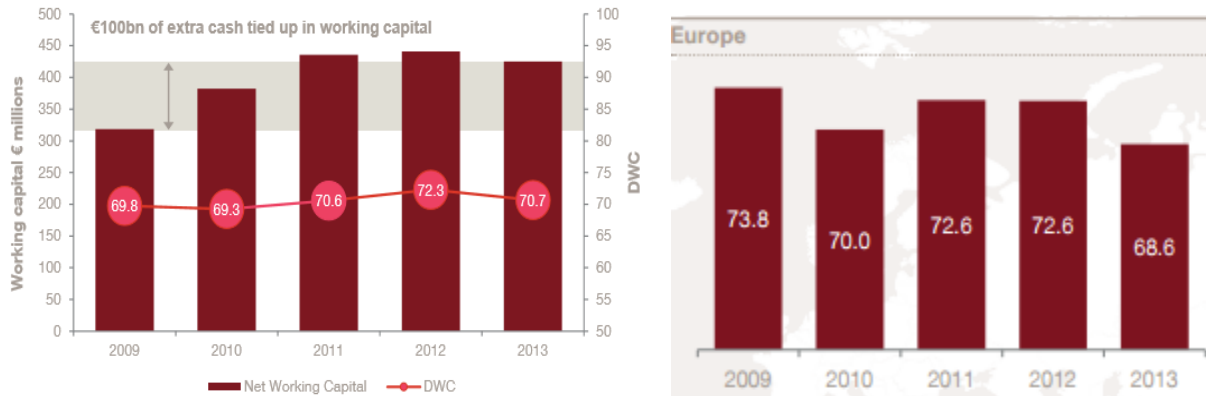
Source: Speri political economy research institute, 2016

Besides the increased efficiency due the technological advancement over the last years, the manufacturing sector also adopted lean philosophy that contributes to the efficiency. The main aim is to reduce the time in operating cycle, delivery length and eliminate wastage.

4.1 Working capital trends

According to Crowe Horwath report on USA manufacturers (2016), successful working capital management often is built around lean-thinking operation and financial improvement practices. Also, PWC (2014) conducted survey of manufacturing companies worldwide for the period of 2009-2014. The study includes 619 European, 309 American and 247 Asian companies. The results state that there is a significant opportunity for releasing cash across manufacturers so it can be used for risk reduction or new investments, acquisitions that do not require external borrowing. Moreover, it is noted that inventory and receivable management improvements contributed the most to the improved working capital measures. In the figure 8 below it can be seen the comparison between the global and Europe's manufacturing trend in working capital development over 5-year period. The conclusion is that since 2009, the companies were building up their working capital and it resulted into additional 100 bn euros being trapped. However, European manufacturers show bigger improvement in their working capital as in 2013 it decreased by 5.4%; whereas overall global performance decreased only by 2,2%.

Figure 8. Global vs Europe's manufacturing sector working capital trend, 2009-2013



Source: PWC's sector analysis, 2014

However, to benefit from releasing working capital it is firstly needed to overcome the management challenges regarding it. Crowe Horwath (2016) survey finds the following factors as the most challenging for the managers in the manufacturing companies across USA:

- Supply- chain lead times – the choice of Just in Time inventory strategy might not be the best approach when demand is fluctuating and stock-ing up inventory might bring the burden on working capital. Also, as lead times usually represent time needed

shipping goods from the vendors and time of processing customer`s order, the most optimal combination must be found.

- Inaccurate sales, inventory, and operations planning (SIOP) – especially when SIOP is not updated frequently, the manufacturing firm`s processes are not catching-up with the market trends. In addition, not in many manufacturing companies well functioning SIOP`s are established at the most efficient level, thus the managers must put their focus on how to improve the planning systems.
- Delinquent receivables – the management of receivables should ensure efficient policies are implemented in the organization. In addition, the employees should understand how exactly a proper conduct of the processes contributes to the divisional and overall company`s performance.

These issues are only few from many factors that management should take into consideration when choosing the right strategy and making sure that other employees adhere to it. Based on the recent surveys, the importance and possibilities of utilizing company`s resources better via working capital management are obvious.

5 Construction industry`s outlook

Construction industry is highly segmented and its main markets can be distinguished as private residential, private commercial (non-residential), and public construction (Finkel, 1997). The private residential construction market is closely related to the economic cycles; whereas public construction according Keynesian economics can be used as an influential tool to boost the economy.

When looking at UK construction industry`s trend during the period of 2008-2006, illustrated in figure 9, the significant decrease in the overall profitability should be addressed firstly. The profits in the last years deteriorated dramatically compared with the results in 2008. According to UK industry performance report (2016) such changes reflect the pressure on margins from higher labour and material costs, combined with a slowing in industry growth.

Figure 9. UK Construction sector`s profitability and productivity 2008-2016



Source: UK industry performance report, 2016

There is also a significant reduction in output in the real terms. Figure 10 depicts that the biggest decrease occurred in 2009 by 13.2 % and since that time the industry has been struggling to pick up its pre-crisis production level. According EY report (2015), a weak construction industry poses significant risk to the major counterparties to the sector, including government, real estate and infrastructure owners and investors. However, in 2014 there was biggest increase by 9.5% in Gross value added (real terms). It is also visible that each year construction industry contributes around 6% to UK economy. Regarding the recent boom which started in 2013, UK industry report (2016) suggests that the surge of the private housing construction is the main

factor and it is the same sector that was hit the hardest during the economic recession. The second reason – various nuclear plant projects across the country are rising. However, the overall slowdown is caused by a reduction in a number of repair and maintenance works.

Figure 10.UK construction sector's contribution to the economy

Construction sector's contribution to the economy

Gross Value Added

	£ billions (current prices)	£ billions (2011 prices)	Real % change	% of economy
2006	86	96	0.8%	6.8%
2007	91	98	2.2%	6.9%
2008	90	95	-2.6%	6.6%
2009	81	83	-13.2%	6.0%
2010	84	90	8.5%	6.0%
2011	92	92	2.2%	6.3%
2012	89	85	-7.5%	6.0%
2013	92	86	1.4%	6.0%
2014	103	94	9.5%	6.5%

Sources: ONS series KK13, KKP5, KL9D

Source: House of commons library, 2015

It is interesting to note that government tried to soften the negative impact on construction sector brought by the economic turmoil. As the result as part of the Government's fiscal stimulus package, was decided to bring forward £3 billion of capital spending from 2010-11 into 2009-2010 and 2008-09 for housing, education, transport and other construction projects, supporting industries and jobs across the country (House of Commons library, 2015).

5.1 Working capital trends

Regarding working capital management and the construction firms, it can be stated that as for the manufacturing firms, working capital is a backbone in financial management. Thus, it must be taken into account carefully to ensure smooth business operations. There is another specific feature of working capital in construction industry – for some firms is common to have negative working capital. The main reasons that contribute to the accumulation of negative working capital can be distinguished as follow:

- The up-front payments, milestones payments;
- Having more retentions on the accounts than customers;
- Invoicing for projects that are not completed yet.

In addition, in the UK established payment system between contractor and customer might differ from the other countries. The project is conceived as a series of mini-projects, and the expectation is that each miniproject should be paid-for soon after it is completed, and the convention is thus that, if it has not yet been fully paid-for, then the contractor is extending trade credit to the client (Graham and Murray, 2013).

However, there is a main drawback to have negative working capital, especially for the industry that is very sensitive to the economic swings. For instance, in case there is stagnation and no new projects coming in that could be invoiced, the construction company still has unfinished ones for which the up-front payments were received. This scenario would mean that there is a challenge to boost the current level of cash coming in and might increase risk to face liquidity issues. However, PWC (2015) report implies that construction firms could reinforce their financial foundations by as much as €95bn by improving working capital management.

According S. Engstorm (2014), there are several internal factors that can be distinguished as the most common challenges in managing working capital for the construction companies:

- The lack of the appropriate systems in place
- Lack of sufficient communication between commercial and financial managers
- Absence of cash management systems

6 Previous research

During the last decades, the researches conducted show quite mixed results about the relationship of working capital on profitability. Deloof (2003) uses the sample of 1009 Belgian companies during the period of 1992 -1996 from various markets to perform the comprehensive study on the relationship between working capital and profitability. As the most comprehensive measure for working capital management, Cash Conversion Cycle (CCC) is used. CCC is the continuing flow of cash from suppliers to inventory to accounts receivables into cash and it is expressed as:

$$CCC = \text{Collection period days (AR)} + \text{Stock turnover period (IV)} \\ - \text{Credit period days (AP)}$$

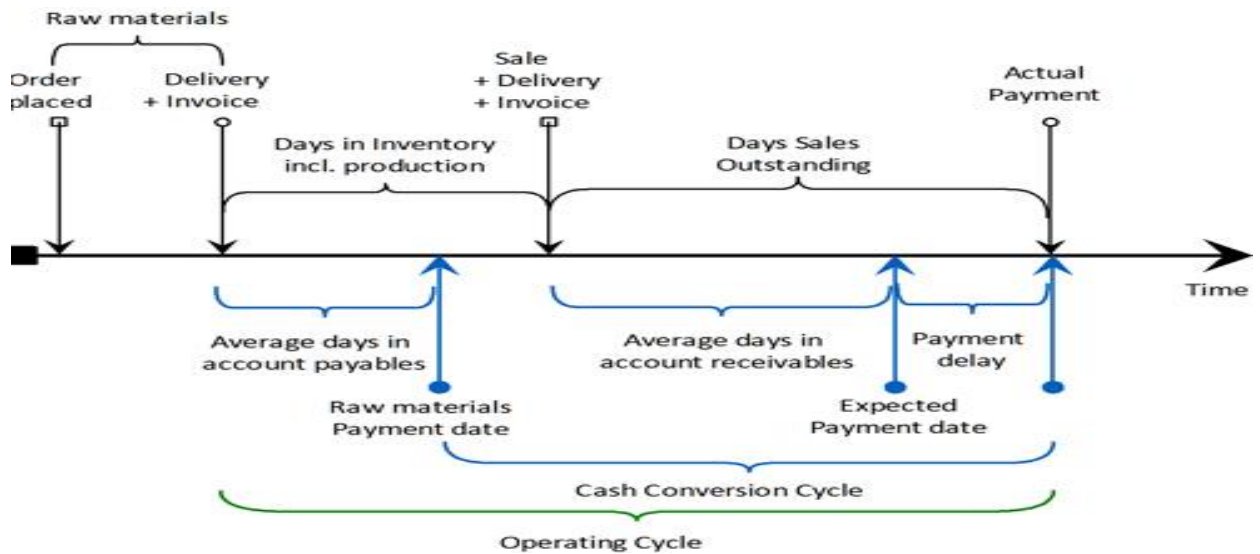
$$\text{Collection period days (AR)} = \frac{\text{Account Receivables}}{\text{Sales}} \times 365$$

$$\text{Credit period days (AP)} = \frac{\text{Accounts Payables}}{\text{Costs of Goods Sold}} \times 365$$

$$\text{Stock turnover period (IV)} = \frac{\text{Inventory}}{\text{Cost of Goods Sold}} \times 365$$

According to Attari and Raza (2012), CCC is considered as a dynamic measure because it does not only show the company's position at particular time like other static measures such as current ratio but it also takes into account ongoing company's operations in regards of its cash management. The figure 11 illustrates how the main working capital's components interrelate together and how it affects CCC over time period.

Figure 11. Cash conversion cycle's timeline



Source: Strategic discipline blog, 2013

The longer CCC, the greater the need for costly external financing (Moss and Stine, 1993). In case CCC is negative, the firm is relieved from looking for extra funds to finance its operations, as it manages to receive cash from its debtors prior it is required to pay the suppliers.

In order to measure profitability, gross operating income is distinguished as the most relevant measure to CCC. According to Deloof (2003), the financial asset of the company must be excluded of the analysis as otherwise; it would not be possible to measure the contribution to profitability arising from operational activities, thus the measure is expressed as:

$$\text{Gross operating income} = \frac{\text{Sales} - \text{Cost of Goods Sold}}{\text{Total Assets} - \text{Financial assets}}$$

Size, sales growth, the financial debt ratio, the ratio of financial assets to total assets are chosen for the control variables. As the main finding, Deloof (2003) states that cash conversion cycle and profitability has a negative relationship, thus to maximize the shareholder's value and company's profitability, working capital should be reduced to the minimum level. Moreover, the other important conclusion of the analysis is that less profitable companies have longer payable terms as they are less able to pay its debts. On the other hand, when the companies pay earlier their suppliers, the discounts are received and that contributes to the profit. Deloof's conclusions are supported by Shin and Shoenen (1998) research. They tested the sample consisting of 58, 985 USA companies during the period of 1975-1994. However, differently from Deloof, the net trade cycle (NTC) is used as the measure unit for working capital management.

$$NTC = (Accounts\ Receivables\ (AR) + Inventories(IV) - Account\ Payables\ (AP)) \times \frac{365}{Sales}$$

Overall, the findings of Shin and Shoenen (1998) are in favor for the short cash conversion cycle as their conclusion leads that CCC has a negative relation to the firm's profitability. Also, they investigated the importance of WCM and liquidity. The findings support the idea that the efficient management can protect company in the short-run if faced with liquidity issues. Such goals can be reached by shortening CCC what indicates better liquidity and contributes to the shareholder's value. Also, Shin and Shoenen distinguish Weighted CCC as solid measure for working capital. However, the authors conclude that there is a high level of difficulty in obtaining needed information to calculate Weighted CCC (WCCC). Gentry, Vaidyanathan and Lee (1990) developed WCCC and defined it as the measure of the weighted number of days funds tied up in receivables, inventory and payables, less the weighted number of days cash payments are deferred to suppliers. Thus, WCCC focuses on the real resource commitment of working capital, and decomposes inventories into three parts instead of one (raw materials, work in process, finished inventories).

Next, the analysis of 131 companies from Athenes stock exchange for the period 2001-2004, conducted by Lazaridis and Tryfonidis (2006) states the same conclusion - the inverse relation between CCC and gross operating income exists. In addition, Eljelly (2004), raises the issue of profitability versus liquidity. To investigate the tradeoff of liquidity and profitability, the author uses the sample of 929 listed Saudi Arabia's companies. The regression and correlation analysis is done and the most important measures used throughout the work are current ratio and CCC. The main finding is that there is a negative relation between company's profitability and its liquidity level, thus when setting working capital level it is important to evaluate current liabilities in order to reach the efficiency in WCM.

However, compared to the previously listed authors Gill, Biger and Mathur (2011) come to the the contradictory findings, as the research result state that there is a positive relation between CCC and company's profitability. The subject of this research was a sample of American companies listed on the stock exchange during 2005-2007 period. Similarly to other researches, Gill, Biger and Mathur (2011) used CCC and gross operating profit as the measures of WCM's efficiency and company's profitability. OLS regression analysis to find the relationship between variables was carried out. In addition, as the control variables – natural logarithm of sales, fixed financial asset, debt ratio were included. According to Gill, Biger and Mathur (2011) main finding the corporate profitability might decrease with CCC, if the costs of higher

investment in working capital rise faster than the benefits of holding more inventory or granting more trade credit to customers. Regarding the components of CCC, only accounts receivables is found as significant to corporate profitability with a negative effect. Similarly, Sharma and Kurmar (2011), examined the relationship between profitability and working capital management of 263 Indian publicly listed non-financial firms during period of 2000-2008. The result of the research states that there is a positive relationship between working capital management, measured as CCC and firm's profitability, measured as ROA. In addition, the authors used size of the firm – natural logarithm of assets, sales growth, firm's leverage and current ratio as control variables.

Regarding account payable period and profitability relationship was found that lower gross operating profit is associated with an increase in the number days of accounts payables (Lazaridis and Tryfonidis 2006, Deloof 2003, Shin and Shoenen 1998, Raheman and Nasar 2007, Garcia-Teruel and Solano-Martinez 2007, Sharma and Kurma 2011). When profitability decreases, less cash is generated from operations and companies are able to survive by delaying payment to creditors (Padachi, 2005). Such reasoning might indicate that less company is profitable – it waits longer to cover their short-term obligations and also misses out on the suppliers' discounts for the early payments.

The negative relationship between account receivables and profitability might indicate that less profitable firms will pursue a decrease of their accounts receivables in an attempt to reduce their cash gap in the cash conversion cycle (Lazaridis and Tryfonidis 2006, Garcia-Teruel and Solano-Martinez 2007, Deloof 2003 for Belgian firms, Raheman and Nasr 2007).

The negative relationship between number of days in inventory and corporate profitability suggests that in the case of a sudden drop in sales accompanied with a mismanagement of inventory will lead to tying up excess capital at the expense of profitable operations (Lazaridis and Tryfonidis 2006, Garcia and Martinez, Deloof 2003). However, according to Mathuva (2010) there is a positive relationship between inventories and profitability. It can be explained by the reasoning that the firm with higher inventory levels avoids costs in case the production halts due shortage of inventory. Similarly, Obermaier and Donhauser (2012) came to conclusion that the least profitable firms have the lowest inventory level. However, there is an evidence that inventory management is rather more dynamic process. Elsayed and Wahba (2016) performed analysis of 84 listed firms on the Egyptian stock market during the period of 2005-2010 in order to see the effect of the company's organizational life cycle. Specifically, the

results show that while inventory to sales ratio affects organization performance negatively in the initial growth stage and the maturity stage, it exerts a positive and significant coefficient on performance in either the rapid growth stage or the revival stage

Lamberson (1995) investigated how working capital position responds to the changes in the level of economic activity. He sampled fifty small firms during the period 1980-1991 under assumption that the level of investment in working capital and economic activity has a positive correlation. For the measurement of company's liquidity, financial ratios such as quick, current, inventory to total asset ratios were calculated and compared across the years. However, the main finding of the work is that liquidity increased slightly during economic expansion with no noticeable change in liquidity during economic slow-downs. Moreover, the changes in the inventory level as the response to the changed economic activity were not found. In addition, Einarsson and Marquis (2001) conclude that company's external financing has an inverse relationship to business cycle as in case of economic state worsens, it increases.

6.1 Hypotheses

In order to analyze changes in working capital management during the economic downturn in comparison to its management during the period before financial crisis and to answer the research question: *Is there an association between working capital and profitability and is the association stronger during a crisis?* - every main component of the working capital will be analyzed. In addition, CCC was chosen as a proxy of the evaluation of the overall working capital management efficiency and gross operating income as the measure of the company's profitability. For the measure of economic performance – real GDP growth, which is broadly used as the measure of the economic growth was chosen as the independent variable. Based on the majority of the previous researches, shorter CCC means more efficiently used working capital (Garcia-Teruel and Solano-Martinez 2007, Deloof 2003, Lazaridis and Tryfonidis 2006). As, generally, the profitability of companies have decreased during the economic turmoil due the decrease in sales, it is expected that CCC increases during this time. Thus, the first suggested hypothesis that will be applied to the manufacturing and construction sectors equally is:

H1: CCC is negatively associated to company's profitability and the association is stronger during the economic turmoil.

Furthermore, the work's aim is to analyze the presence of the relationship between each working capital's component and profitability. The right mixture of different policies regarding main CCC components leads to the optimal level of CCC. Deloof (2003) used accounts receivables as one of the measures of trade credit policy. Researches conducted with the prevailing conclusion that during normal economic times, there is a negative correlation between accounts receivables and firm's profitability. Also, it is assumed that companies must extend the length of receivable collection as the other companies are struggling during the economic downturn. When company's profitability decrease as the result of the appalling economic conditions, it should negatively affect accounts receivable, thus the next hypothesis is as follow:

H2: The accounts receivables are negatively associated to the firms' profitability and the association is stronger during the economic crisis period.

More profitable companies pay their current liabilities earlier (Deloof, 2003). This conclusion comes from the idea that more profitable company pays its payables earlier and it can use trade discounts offered in return of the early payments. Also, delaying account payables, it might be perceived as the short-term financing alternative, thus companies might be willing to extend their payables when short in cash. It is not easy for a firm to raise money during the period of economic recession, when cash supply is relatively tight (Cheng&Chiou, 2006). Therefore, it is expected that the account payables are longer during the economic downturn.

H3: The accounts payable are negatively associated to the firm's profitability and the association is stronger during the economic crisis period.

It is expected that during the economic downturn, the sales decrease, and consequently it affects directly the inventory level/turnover. Such assumption comes from the fact that slower inventory turnover pace causes an increase in the storage costs. In addition, economic downturn comes with the reduced demand for the production, therefore it can result the inventories to be written off. It is also expected that companies are eager to reduce inventory levels due to the possible storage and management costs in case there is a decrease in demand.

H4: Inventories are negatively associated with profitability and the association is stronger during the economic downturn.

7 Methodology

To answer the research question, the sample of 908 UK manufacturing and 315 construction companies was designed. For data extraction, Amadeus data base, consisting financial information of over 19 mio European companies, was used. The main criteria for the selected companies are as follow:

1. Companies that belong to UK manufacturing and construction sectors. These particular sectors were chosen due their capital-intensive nature. Consequently, it is assumed that finding the optimal working capital strategy is an essential task for the financial managers. Therefore, it is expected that the impact on the firms` profitability coming from working capital management in such companies should be stronger expressed compared to other sectors.
2. Companies that have available financial information for the period 2006-2013. The choice for the analysis` period aims to include pre-crisis years, the years of crisis and the following years of the economic recovery to find out whether there were changes in company`s behaviour during this dynamic period. Thus, 2006-2007 represents the period just before the crisis when companies in the UK were performing relatively well; whereas, 2008- 2011 is considered as the key years of the economic recession.

According to Amadeus data base classification, manufacturing sector is divided into 17 subsectors that are presented in the table 3. Moreover, depending on the amount of capital used and product type, each sector can be attributed to the heavy industry or light industry manufacturers type.

Table 3. Subsectors of manufacturing industry

Heavy industry manufacturers	Light industry manufacturers
Manufacture of wood and of products of wood	Manufacture of food products
Manufacture of paper and paper products	Manufacture of beverages
Manufacture of rubber and plastic products	Manufacture of tobacco products
Manufacture of other non-metallic mineral products	Manufacture of textiles
Manufacture of basic metals	Manufacture of wearing apparel
Manufacture of coke and refined petroleum products	Manufacture of leather and related products
Manufacture of electrical equipment	Manufacture of basic pharmaceutical products
Manufacture of motor vehicles, (semi) trailers	Other manufacturing
Manufacture of other transport equipment	

Source: Amadeus database

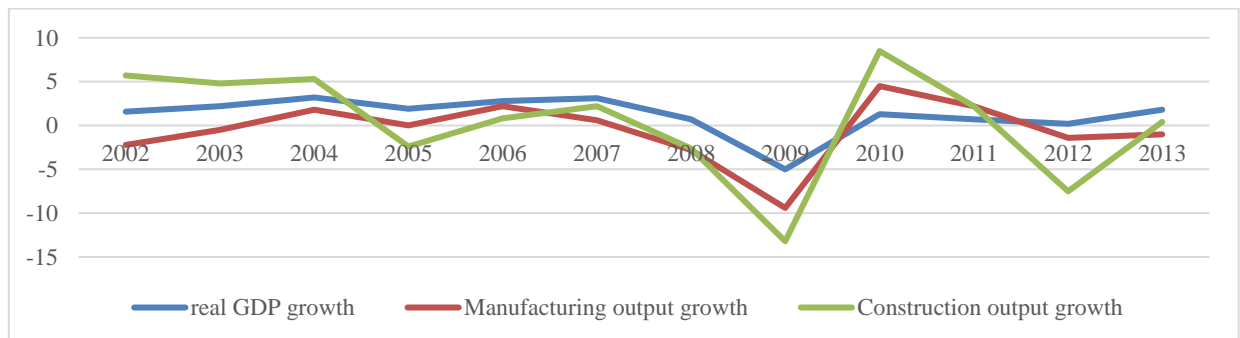
Initially, all available data for companies that operate as heavy industrial manufacturers was extracted, which resulted into the list of 35, 273 different firms. However, data was checked and cleared in case it does not hold logical figures. For instance, the companies that have their total assets or receivables expressed as negative values were eliminated. The same was applied to the companies that had no available information regarding the needed variables for this work's analysis.

Similarly, the construction sector is distinguished in construction of buildings and specialized construction activities' subsectors. For the analysis, both sectors were taken into the sample.

Annual real GDP % growth is taken as a measure of economic downturn and upturn.

According Eurostat data, real GDP growth trend changed dramatically in 2008 as it dropped by -0,46%, comparing to the previous year. Moreover, the following year brought even bigger slump in the productivity as it fell as low as -5%. Additionally, to see if the selected industries for this work's analysis are sensitive and response to the changes in GDP growth without the year lags, index of production and % change of output in the construction sector are depicted in figure 10. Index of production is seasonally adjusted metric to measure the output for manufacturing industry and both output metrics are prepared by UK office of national statistics.

Figure 12. UK real GDP annual growth, manufacturing and construction sector growth %, 2002-2013



Source: Eurostat, ons.gov.uk

From figure 10 above, it can be seen that output growth of both sectors in question moves in the same direction as UK real GDP. The highest drop occurred in 2008 - 2009 and it is obvious that construction industry was affected harder as the decrease in output is significantly higher than in manufacturing industry. However, after 2009, the trend in industries' output diverted as construction sector experienced sharp growth followed by sudden output's decrease in 2010 and the manufacturers maintained modest growth up to 2013.

As the result of 8 years being taken into account and 908 manufacturers with 315 construction firms being recognized as valid for this analysis, the final balanced data panel for the whole period consists of 7264 and 2520 observations respectively. The techniques that are going to be used to measure the significance of working capital components are – the descriptive statistics, Pearson correlation analysis and pooled Ordinary Least Square (OLS) regression. SPSS program, version 24, is used to conduct the mentioned analysis. Descriptive statistics is a helpful tool for the better understanding of the characteristics of the analyzed; whereas Pearson correlation indicates about the signs of correlation between working capital components and profitability. Finally, as Pearson correlation analysis is not used to identify the cause-effect relationship, pooled OLS regression analysis will be conducted to detect such relation. Based on its outcomes, the raised hypothesis will be accepted/rejected and the research question answered.

Besides the cash conversion cycle and its main components, the following variables will be taken into account as the control variables in the regression equation. The natural logarithm of total assets is chosen as a measure of the company's size, the financial debt ratio (Financial debt/Total assets) representing company's financial strategy and current ratio as the expression of the company's financial health. The control variables were selected based on the previous literature and available data. Also, to evaluate not only CCC impact on profitability but its components' as well, there will be tested 4 models using pooled OLS. Each CCC's component will be included in the regression analysis separately, thus the regression equations are as follow:

$$\text{Gross Operating Income} = \beta_1 + \beta_2 CCC + \beta_3 CR + \beta_4 FD + \beta_5 \ln TA + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

$$\text{Gross Operating Income} = \beta_1 + \beta_2 DSO + \beta_3 CR + \beta_4 FD + \beta_5 \ln TA + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

$$\text{Gross Operating Income} = \beta_1 + \beta_2 DPO + \beta_3 CR + \beta_4 FD + \beta_5 \ln TA + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

$$\text{Gross Operating Income} = \beta_1 + \beta_2 DSI + \beta_3 CR + \beta_4 FD + \beta_5 \ln TA + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

$$\text{Cash Conversion Cycle (CCC)} = DSO + DSI - DPO$$

$$\text{Days sales of inventory (DSI)} = (\text{Inventory}/\text{Cost of sales}) \times 365$$

Days sales outstanding (DSO) = (Receivables/Sales) x 365

Days payables outstanding (DPO) = (Payables/Cost of sales) x 365

Current ratio (CR) = Current assets/Current liabilities

Financial debt ratio (FD)=Total long term debt/total assets

Gross operating income =Gross income/ (total assets-financial assets)

X1, X2 are the dummy variables, representing recession (2008-2011), and pre/post-crisis periods (2006-2007/2012-2013), E is an error term

7.1 Descriptive statistics

Firstly, from the descriptive statistics of manufacturing firms during 2006-2013 (table 4), it can be seen that median for CCC is 54 and mean is 60 days which are quite close figures. This figure presents the average time needed for UK manufacturing companies to receive cash for their products. Compared to the results from the previous researches: Deloof (2003) found that average CCC time is 44.48 for Belgium companies, 188 days for Greek companies (Lazaridis and Tryfonidis, 2006), hence it can be concluded that sector and country differences are present.

Also, it can be seen that data is evenly divided around the mean as the numbers do not differ significantly and the standard deviation equals to 40.90. The same can be concluded for the collection period and credit period days as mean and median are close. However, it is interesting to note that days of receivables, are twice longer than days of payables as on average collection period equals to 56 days; whereas credit period is only 33 days. Regarding the Days sales of inventory, the data is more sparsely distributed as there is a bigger gap between mean and median. The average of days sales of inventory is around 47 days but it can increase up to 665 as the maximum value indicates. Such a wide range between the minimum and maximum days of inventory can be explained by the individual characteristics of the companies. Even though, the companies belong to the manufacturing industry, every production process is different, requiring different amounts of components to manufacture the end-product. For instance, paper manufacturers have a shorter inventory turnover period than transport business or basic metal manufacturers. Thus, the nature of the product, lead time, production process, or business model as well as strategies affect significantly the level of inventory.

Financial debt ratio reflects the companies' chosen financing structure. The average among manufacturing companies equals to 0.59; whereas median is 0.55 and the standard deviation is 0.36. That shows that companies do not hesitate to take more financial risk and to be highly

leveraged is a standard in this sector. In addition, the maximum reaches 4.87, meaning that some companies hold much more debt than assets and might be exposed to the high level of financial risk. However, current ratio indicates about the short-term financial health and the average equals to 2.07. As the rule of thumb – CR higher than 2 represents conservative firm's strategy. Therefore, it can be concluded that most of the manufacturers can cover their short-term liabilities and do not face great risk of not being able to meet their obligations. On the other hand, it can be stated that companies collected too much short-term assets on their balance sheet and the efficient asset allocation should be questioned.

Table 4. Descriptives of the manufacturing companies, whole period 2006-2013

	Gross operating income	CCC	Collection period days	Credit period days	Days sales of inventory	CR	Financial debt	LnTA
N Valid	7264	7264	7264	7264	7264	7264	7264	7264
Minimum	-0.30	-151	0	0	0.54	0.14	0	1.14
Median	0.37	54	56	33	37.99	1.69	0.55	4.12
Maximum	3.6	867	209	142	665	8.91	4.87	7.45
Mean	0.43	60	56.63	33.92	47	2.07	0.59	4.16
Std. Deviation	0.29	40.90	28.58	20	39.03	1.30	0.36	0.76

Source: made by author, using SPSS 24 version

Table 5. Descriptives of the construction companies, whole period 2006-2013

	Gross operating income	CCC	Collection period days	Credit period days	Days sales of inventory	CR	Financial debt	LnTA
N Valid	2520	2520	2520	2520	2520	2520	2520	2520
Minimum	-1.38	-248.87	0	0	0	0	0	1.75
Median	0.15	65	22.16	28.99	53	1.60	0.63	9.82
Maximum	7.1	795.15	414.89	284.25	899	31.45	9.64	16.17
Mean	0.26	67	34	37	56	2.80	0.64	9.70
Std. Deviation	0.42	49.3	40.90	34.43	34.70	3.39	0.43	2.35

Source: made by author, using SPSS 24 version

The descriptive statistics for the construction sector in table 5 depicts different trends regarding the difference between average collection and credit period days – 34 and 37 respectively. For construction sector they are much closer to each other than for manufacturing. The average days

sales inventory is higher comparing to the manufacturers, as it equals 56 days. It also takes longer time to collect cash for their products as the average CCC is 67 days. However, the similarities between industries can be found in financial debt ratio as the average of construction firms equals 0.64 and mean is 0.63. As both industries are capital intensive, it is reasonable to assume that more aggressive financing policy is adequate to support further growth. Looking at current ratio, it can be concluded that construction firms also tend to held more current assets on their balance sheets as the average is 2.80 and maximum value reaches 31.45.

Furthermore, the pre-crisis period is analyzed. Regarding the manufacturing companies, depicted in table 6, there is no significant difference noticed when comparing this period to the whole sample and all the variables show the similar values. Exception can be found in CCC as its average values is lower – 59 days compared to 60. Also, some maximum values are lower than in the whole sample. Collection period time reaches highest of 183 days and stock turnover`s maximum is 430 which might be the result of better economic conditions at the pre-crisis period.

The construction sector`s descriptives for the period of 2006-2007 are illustrated in table 7 below. The Average CCC takes 61 days, it is close to the mean of 63 and it has the shorter value compared to the whole period. Also, days sales of inventory of 53 is shorter than in the whole sample where it equaled 56. In the whole sample`s descriptives and in the pre-crisis period the construction firms have higher average CCC than manufacturers. Also, the maximum values in construction sector exceed those in manufacturers sample. CCC can occur as high as 502 and days sales of inventory 677; whereas for manufactures maximum values equal to 330 and 430 respectively. When comparing financial debt variables, the construction companies have slightly higher average ratio of 0.64 compared to 0.62 but in general both firm categories were highly leveraged before the financial crisis, so high leverage persisted before the financial turmoil in these sectors.

Table 6. Descriptives of the manufacturing companies 2006-2007

	Gross income	CCC	Collection period days	Credit period days	Days sales of inventory	CR	Financial debt	LnTA
N Valid	1817	1817	1817	1817	1817	1817	1817	1817
Minimum	-0.30	-150	0	0	0	0.19	0.09	1.36
Median	0.37	55	60	32	37	1.53	0.59	4.14
Maximum	2.050	330	183	137	430	5.58	2.06	7.19
Mean	0.43	59	59	35	35	1.79	0.62	4.19
Std. Deviation	0.29	40	28.04	21.43	38.27	0.93	0.28	0.75

Source: made by author, using SPSS 24 version

Table 7. Descriptives of the construction companies 2006-2007

	Gross income	CCC	Collection period days	Credit period days	Days sales of inventory	CR	Financial debt	LnTA
N Valid	631	631	631	631	631	631	631	631
Minimum	-0.42	-196.5	0.00	0.00	0.00	0.08	0.05	2.60
Median	0.19	63	16	29	44	1.53	0.65	9.96
Maximum	4.25	502	183	279.29	677	10.41	2.86	16.16
Mean	0.30	61	30	36	53	2.21	0.64	9.84
Std. Deviation	0.41	96.86	46.01	33.75	21.5	1.75	0.29	2.37

Source: made by author, using SPSS 24 version

Looking at the crisis period descriptives of the manufacturing companies at table 8, firstly can be noted that the minimum value of CCC shranked to -110 days and maximum grew to 868. Also, days sales of inventory maximum value reaches 665 and the average value increased by 10 days. However, current ratio average increased to 2.10. meaning that companies in this period were less reluctant to release their current asset from balance sheets. Also, average credit period days decreased to 32 as well as collection period days to 56 from 35 and 59 as it was in the pre-crisis period. This might be an indication that firms' credit terms provided by manufacturers to their suppliers were shortened. Noteworthy, that financial debt ratio reached its highest maximum value of 4.8 and the average decreased to 0.59.

Construction companies, illustrated in table 9, show similar tendencies as CCC maximum value increased to 918 days and minimum decreased to -119. Also, there is a significant reduction in the average gross operating income from 0.30 to 0.27. Days sales of inventory maximum also reached the highest value in the analyzed period as it increased to 994 days and the average increased to 65 days. The explanation behind these changes could be in difficulties to sell

inventories due the prevailing financial turmoil and as the result of lower profits. These changes show that economic downturn had a greater instant impact on the construction sector than on manufacturing. However, average credit period days stayed unchanged – 36 and collection period days increased only slightly to 34. As average financial debt ratio increased to 0.73 from 0.64, compared to the previous period, it can be assumed that firms relied on more heavier leverage.

Table 8. Descriptives of the manufacturing companies 2008-2011

	Gross operating income	CCC	Collection period days	Credit period days	Days sales of inventory	CR	Financial debt	LnTA
N Valid	3632	3632	3632	3632	3632	3632	3632	3632
Minimum	-0.51	-110	0	0	0.5	0.14	0	1.14
Median	0.37	63	55	29	38	1.71	0.55	4.08
Maximum	3.6	868	209	131	665	8.91	4.80	7.29
Mean	0.42	71	56	32	47	2.10	0.59	4.13
Std. Deviation	0.29	51.47	28.82	20	40.63	1.35	0.36	0.76

Source: made by author, using SPSS 24 version

Table 9. Descriptives of the construction companies 2008-2011

	Gross operating income	CCC	Collection period days	Credit period days	Days sales of inventory	CR	Financial debt	LnTA
N Valid	1300	1300	1300	1300	1300	1300	1300	1300
Minimum	-1.38	-119	0	0	0	0	0.03	1.28
Median	0.14	63	24	28	33	1.58	0.63	9.76
Maximum	6.86	918	341	284	994	30.02	33.97	15.75
Mean	0.27	67	34	36	65	2.81	0.73	9.62
Std. Deviation	0.48	232	37.85	34.52	35.5	3.33	1.47	2.39

Source: made by author, using SPSS 24 version

According to the last descriptive statistics set the following couple years, marking a slight economic recovery, did not bring many changes in the analyzed variable trends. CCC average value decreased to 65 days for manufacturing companies depicted in table 10, as well as its maximum value decreased do 440, which is lower comparing to the previous period. Maximum inventory turnover decreased to 454 days in the last period. Also, gross operating income has not performed significant changes and average stayed at 0.43. However, financial average debt

ratio decreased to 0.56 which is much lower than 0.62 in the pre-crisis period. It can be concluded that contrary to the construction companies, manufacturers were less relying on leverage after crisis. Also, current ratio has reached the highest average value of 2.23 indicating that manufacturers were rather collecting their current assets during the whole period than releasing it.

Table 10. Descriptives of the manufacturing companies 2012-2013

	Gross operating income	CCC	Collection period days	Credit period days	Days sales of inventory	CR	Financial debt	LnTA
N Valid	1817	1817	1817	1817	1817	1817	1817	1817
Minimum	-0.32	-127	0	0	1.22	0.15	0.03	1.29
Median	0.37	63	55	38	39	1.81	0.51	4.17
Maximum	2.45	440	186	132	454	8.8	4.70	7.455
Mean	0.43	65	55	46	48	2.23	0.56	4.21
Std. Deviation	0.29	39.26	28.54	36.43	36.43	1.39	0.35	0.76

Source: made by author, using SPSS 24 version

Regarding construction firms (table 11), gross operating income decreased drastically and its average reached 0.25 – the lowest value in the 8 year period. Average CCC decreased to 64 compared to the previous period's 67 but it is still higher than the first period's value of 61. Also, Days sales of inventory decreased to 39 days. The average collection period days increased to 37 and it is the highest average value in the entire period. That indicates that construction companies experienced decrease in the time of length during which cash is received for their goods. The average value increased by 7 days compared to the results of the precrisis period. Other significant change can be seen in financial debt ratio as it is average decreased compared to the previous period. Consequently, the conclusion can be made that construction firms during crisis had to turn to the external funding as their debt ratio indicates.

Table 11. Descriptives of the construction companies 2012-2013

	Gross operating income	CCC	Collection period days	Credit period days	Days sales of inventory	CR	Financial debt	LnTA
N Valid	645	645	645	645	645	3762	645	645
Minimum	-1.07	-119	0	0	0	0.16	0.03	1.85
Median	0.14	68	26	29	43	1.66	0.60	9.83
Maximum	7.16	205	340	264	799	31.45	7.83	15.75
Mean	0.25	64	37	36	39	3.12	0.64	9.66
Std. Deviation	0.47	106.37	41.13	35.29	41	4.09	0.51	2.36

Source: made by author, using SPSS 24 version

7.2 Pearson correlation analysis

Firstly, Pearson correlation analysis is presented for the whole periods of 2006-2013 for manufacturing and construction sectors. Pearson correlation is a widely-used test to find the degree of dependency between variables. Also, it is a first step to test the hypothesis about the existing significant relationship between variables and its direction. To see whether these relationships become stronger or weaker when the economic conditions change was decided to conduct correlation analysis for the whole and individual periods, presenting different economic times, separately. Regarding the values in Pearson correlation analysis, as there is a constraint it ranges between -1 and 1. In case the value is 0, it indicates about no correlation at all; whereas closer the value is to 1 or -1 (depending on positive or negative relation is expressed) it indicates about the stronger relationship between variables. Furthermore, Evans (1996) distinguishes Pearson correlation values into following categories according their strength:

1. .00-.19 very weak
2. .20-.39 weak
3. .40-.59 moderate
4. .60-.79 strong
5. .80-1.0 very strong

However, a significance test is taken into account before coming to the conclusion about the relationship between two variables. Thus, p value is essential value too as it indicates whether the H0 hypothesis should be accepted or rejected. In this case H0 – no linear relationship exists; whereas H1 -correlation exists.

It is important to note that Pearson correlation analysis does not show a cause-effect relationship, as it only indicates the direction to which the pair of variables move together.

7.2.1 Manufacturing sector

Firstly, the full sample is analyzed, thus table 12 depicts Pearson correlation analysis`results for the whole period in question – 2006-2013. From the p-values of independent variables, it can be seen that collection, credit period days and days sales of inventory are significant to firms`profitability at α level 1%. As credit and collection period has negative values of -0,139 and -0,068 respectively, it might be explained that increasing length of paying the short-term obligations, or waiting longer for payments from customers might lead to lower profitability. In addition, CCC shows significance of itself to gross operational income ratio as it has a negative coefficient of -0,128 at α level 1%. Such association indicates that for majority of manufacturers in the sample, once CCC is extended it is associated with decrease in company`s profitability. Regarding the strength of the correlation, it is rather weak and days sales of inventory indicates the strongest correlation to gross operating income from all CCC`s components.

Real GDP annual growth does not perform the significant correlation with gross operational income ratio; however, it shows significant positive correlation with collection and credit period days at α 1%. One of the explanations can be related to reasoning that during good economic times firms are easier on loosening up their credit terms to customers as there is less pressure from the economic environment to avoid risks. Thus, it can work as encouraging factor to provide longer credit terms. But once the economic conditions deteriorate, the firms become more concerned about the possible risks that can be caused by the extension of credits or decreased liquidity of the trade credit supplier.

As current ratio has a negative correlation to profitability, it can be implied that manufacturers with less current assets are more profitable ones. In addition, financial debt ratio shows positive correlation, thus it can be assumed that the companies that pursue more aggressive financing policy are more likely to have higher gross income. However, financial debt correlation to profitability is very weak and closest to 0. Regarding natural logarithm of total assets, as it has negative value, it might be indication that not necessarily bigger company in terms of its size results in higher profitability.

Table 12. Pearson correlation manufacturing sector 2006-2013

	Gross oper.income	CCC	Collection days	Credit days	Days sales of inventory	CR	Financial debt	LnTA	RealGDP growth
Gross oper.income	1								
CCC	-,128**	1							
Collection days	-,068**	,508**	1						
Credit days	-,139**	-,286**	,197**	1					
Days sales of inventory	-,194**	,738**	-,010	,051**	1				
CR	-,110**	,071**	-,080**	-,191**	,045**	1			
Financial debt	,044**	,019	,041**	,112**	,058**	-,321**	1		
LnTA	-,502**	-,059**	-,072**	,036**	,001	,025*	-,108**	1	
RealGDP growth	,009	,002	,036**	,035**	-,006	-,037**	,018	,032**	1

**Correlation is significant at the 0.01 level

*Correlation is significant at the 0.05 level

Source: made by author, using SPSS 24 version

Furthermore, the pre-crisis period is analyzed and as it can be seen from table 13 below there is no change in the direction of the correlation between the profitability and CCC's elements. In fact, the values of collection and credit period days are quite similar to the whole period's Pearson correlation results. However, in the pre-crisis period days sales of inventory perform stronger relationship to gross operating income as its value decreases to -0,222 at α level 1%.

Regarding the control variables, it is interesting to note that financial debt does not show a significance on profitability in the pre-crisis period. The firms size variable remains with the strongest relationship among all independent variables; whereas current ratio is the weakest and real GDP growth does not indicate significant relationship to any of other variables.

Table 13. Pearson correlation manufacturing sector 2006-2007

	Gross oper.income	CCC	Collection days	Credit days	Days sales of inventory	CR	Financial debt	LnTA	RealGDP growth
Gross oper.income	1								
CCC	-,150**	1							
Collection days	-,085**	,555**	1						
Credit days	-,142**	-,288**	,156**	1					
Days sales of inventory	-,222**	,729**	,057*	,109**	1				
CR	-,046*	,130**	-,019	-,233**	,045*	1			
Financial debt	,012	-,014	,041	,200**	,073**	-,378**	1		
LnTA	-,497**	-,073**	-,103**	,017	-,006	-,027	-,096**	1	
RealGDP growth	,009	-,017	-,018	-,017	-,020	,021	-,029	-,002	1

**Correlation is significant at the 0.01 level *Correlation is significant at the 0.05 level

Source: made by author, using SPSS 24 version

Next, table 14 consists of 4-year period values, when manufacturing industry was affected the most by financial turmoil. As mentioned earlier, in the methodology section, there was no lag between the reaction of manufacturing industry's output to sudden GDP's fall. Hence, year 2008 mark the reduction in significant industry's output.

Table 14. Pearson correlation manufacturing sector 2008-2011

	Gross oper.income	CCC	Collection days	Credit days	Days sales of inventory	CR	Financial debt	LnTA	RealGDP growth
Gross oper.income	1								
CCC	-,129**	1							
Collection days	-,071**	,474**	1						
Credit days	-,143**	-,272**	,232**	1					
Days sales of inventory	-,192**	,760**	-,010	,052**	1				
CR	-,117**	,066**	-,089**	-,201**	,034*	1			
Financial debt	,046**	,036*	,034*	,091**	,073**	-,350**	1		
LnTA	-,500**	-,047**	-,057**	,036*	,003	,030	-,110**	1	
RealGDP growth	,016	,010	,026	,012	,001	-,023	,005	,026	1

**Correlation is significant at the 0.01 level *Correlation is significant at the 0.05 level

Source: made by author, using SPSS 24 version

Similarly to the previous results, table 14 shows that there is no change in the coefficient signs between the variables. Collection days and profitability correlation is the least strong and it is also weaker than in the previously analyzed periods. Days sales of inventory remains performing the strongest relationship with gross operating income, however, it is not as strong as during the pre-crisis period.

There is a quite significant decrease in current ratio coefficient, indicating that during crisis period, this variable's association is expressed via stronger link. However, there might be other reasons besides the economic turmoil, as real GDP growth itself does not perform any significant correlations with the variables.

Finally, table 15 depicts Pearson correlation's results of the last two years from the analyzed period. In this case, CCC shows the weakest, however significant negative relationship to the firm's gross operating income from all the periods. There is also a further decrease in current ratios' value, that indicates the association between current ratio with profitability grew significantly over the analyzed period.

Table 15. Pearson correlation manufacturing sector 2012-2013

	Gross oper.income	CCC	Collection days	Credit days	Days sales of inventory	CR	Financial debt	LnTA	RealGDP growth
Gross oper.income	1								
CCC	-,104**	1							
Collection days	-,046*	,536**	1						
Credit days	-,131**	-,317**	,166**	1					
Days sales of inventory	-,172**	,697**	-,075**	-,016	1				
CR	-,142**	,051*	-,096**	-,165**	,062**	1			
Financial debt	,065**	,014	,049*	,072**	,016	-,272**	1		
LnTA	-,511**	-,073**	-,075**	,059**	,002	,045*	-,114**	1	
RealGDP growth	-,033	,022	,038	,026	,010	,018	,001	,014	1

**Correlation is significant at the 0.01 level *Correlation is significant at the 0.05 level

Source: made by author, using SPSS 24 version

7.2.2 Construction sector

Similarly, the results of Pearson correlation analysis for the whole construction sector period, indicates that cash conversion cycle negatively correlates with gross operating income. In addition, all cash conversion cycle`s components show significant negative correlation to the firm`s profitability. Regarding the control variables all of them are significant except for real GDP growth. Moreover, real GDP change does not have a significant impact on any other independent variable unlike in manufacturing sector where its association to collection and credit days was found for the whole period. Current ratio performs negative correlation, meaning that companies having less current assets held on their balance sheets are more profitable ones. As financial debt ratio shows positive relation to profitability, it can be concluded in the construction industry higher leverage results into higher profitability, what is similar to the manufacturing industry.

Table 16. Pearson correlation construction sector 2006-2013

	Gross oper.income	CCC	Collection days	Credit days	Days sales of inventory	CR	Financial debt	LnTA	RealGDP growth
Gross oper.income	1								
CCC	-,286**	1							
Collection days	-,098*	,066	1						
Credit days	-,172**	-,242**	,080	1					
Days sales of inventory	-,297**	,968**	-,137**	-,111**	1				
CR	-,105*	,262**	-,089*	-,163**	,261**	1			
Financial debt	,469**	-,059	,007	,046	-,054	-,256**	1		
LnTA	-,513**	,242**	-,014	,149**	,273**	,092*	-,201**	1	
RealGDP growth	-,037	,030	,032	,030	,028	-,003	-,002	-,001	1

**Correlation is significant at the 0.01 level *Correlation is significant at the 0.05 level

Source: made by author, using SPSS 24 version

The first period`s results, shown in table 17, indicates the significant negative relation between CCC, its separate elements and profitability. The values are quite similar to those from the whole period`s analysis with days sales of inventory remaining the variable expressed as having the strongest association to gross operating income.

Interesting to note that firm's size and its leverage perform the moderate association to the firm's profitability. Regarding natural logarithm of sales, the similar tendency was found in manufacturing industry, however, the leverage shows significantly stronger association for construction companies than for manufacturers.

Table 17. Pearson correlation construction sector 2006-2007

	Gross oper.income	CCC	Collection days	Credit days	Days sales of inventory	CR	Financial debt	LnTA	RealGDP growth
Gross oper.income	1								
CCC	-,245**	1							
Collection days	-,047*	-,056**	1						
Credit days	-,146**	-,162**	,213**	1					
Days sales of inventory	-,256**	,978**	-,207**	-,051*	1				
CR	-,103**	,295**	-,064**	-,157**	,281**	1			
Financial debt	,514**	-,062**	-,015	,023	-,055**	-,190**	1		
LnTA	-,485**	,259**	-,028	,191**	,290**	,013	-,198**	1	
RealGDP growth	,019	-,007	,002	,013	-,006	-,027	-,007	,028	1

**Correlation is significant at the 0.01 level *Correlation is significant at the 0.05 level

Source: made by author, using SPSS 24 version

As mentioned earlier, the construction industry was hit much harder than manufacturing by financial crisis, especially during its beginning. Therefore, Pearson correlation analysis for the period 2008-2011 should show whether the associations between working capital components and the firm's profitability changed their behaviour. Table 18 represents these results and the most noticeable change can be found in the increased significance between gross operating income and days sales of inventory which equals to -0,309 at α level 1%.

Table 18. Pearson correlation construction sector 2008-2011

	Gross oper.income	CCC	Collection days	Credit days	Days sales of inventory	CR	Financial debt	LnTA	RealGDP growth
Gross oper.income	1								
CCC	-,293**	1							
Collection days	-,026	-,106**	1						
Credit days	-,164**	-,132**	,251**	1					
Days sales of inventory	-,309**	,984**	-,219**	-,025	1				
CR	-,120**	,311**	-,026	-,131**	,292**	1			
Financial debt	,552**	-,058	-,039	,031	-,047	-,168**	1		
LnTA	-,546**	,284**	-,040	,179**	,312**	-,001	-,203**	1	
RealGDP growth	,014	-,016	,036	,013	-,020	-,018	,014	,001	1

**Correlation is significant at the 0.01 level *Correlation is significant at the 0.05 level

Source: made by author, using SPSS 24 version

The results of the last period (2011-2012) are depicted in table 19. There is a slight decrease in the strength of the association between CCC, its components and profitability. However, the direction stays the same – indicating a negative correlation among working capital`s components and the firm`s operating income. Interesting to note that collection period days show the weakest significant correlation from all the periods of -0.030.

Financial debt ratio`s value indicates about strong correlation with probability, and it is positive – the conclusion can be done that the firm`s having higher debt ratio were the most profitables during this period.

Table 19. Pearson correlation construction sector 2012-2013

	Gross oper.income	CCC	Collection days	Credit days	Days sales of inventory	CR	Financial debt	LnTA	RealGDP growth
Gross oper.income	1								
CCC	-,186**	1							
Collection days	-,030	-,120**	1						
Credit days	-,126**	-,131**	,284**	1					
Days sales of inventory	-,196**	,977**	-,267**	-,021	1				
CR	-,090*	,311**	-,085*	-,192**	,289**	1			
Financial debt	,701**	-,083*	,008	,014	-,080	-,231**	1		
LnTA	-,436**	,242**	,012	,247**	,274**	-,030	-,209**	1	
RealGDP growth	,023	-,034	-,041	,033	-,020	-,003	,010	,013	1

**Correlation is significant at the 0.01 level *Correlation is significant at the 0.05 level

Source: made by author, using SPSS 24 version

7.2.3 Conclusion of Pearson correlation analysis

Overall, Pearson correlation analysis for manufacturing and construction companies does not indicate that there are significant differences among these sectors in regards of the association between independent variables and profitability. However, the relation between CCC and profitability is stronger in construction sector than in manufacturing. The same applies to days sales of inventory – for both sectors it is the variable that perform the strongest relation to gross operating income. In addition, the independent variables show slightly stronger correlation during the period of 2008-2011. The independent variable from working capital's elements with the weakest association to the firm's operating profit is collection days' period for both sectors.

Also, the control variables show the same direction of correlation with the firm's profitability in both cases. Current ratio and the firm's size is found as negative correlated; whereas financial debt performs positive correlation. As the real GDP growth, does not show any significant correlation, it was decided to remove it from regression analysis and use dummy variables for the changing economic conditions.

7.3 Regression analysis

The most important feature of the regression analysis is that it does assume not only the relationship between the variables but that dependency between them exists as well. Ordinary least square regression was chosen for this work's analysis as it is commonly used in other researches related to the relationship of working capital and the firm's profitability.

However, before running the regression analysis for the sample, the main assumptions that create ideal conditions for regression analysis's results to reflect as much of truth as possible must be met. The assumptions consist of the following:

- Normality
- No multicollinearity
- Elimination of outliers
- No autocorrelation
- No homoskedasticity

To rule out multicollinearity, variance inflation factor (VIF) of the linear regression test was chosen. Usually when VIF is more than 100 there is a strong indication about multicollinearity in the sample. Also, when VIF's value is more than 10, the possibility of multicollinearity exists. As this work's sample has VIF value less than 10, it can be concluded that there is no strong correlation among the independent variables. In opposite case, the estimate coefficients of the regression would be altered and considered not valid.

Also, from the descriptive statistics (tables 11-15), it can be seen that the samples have some outliers as there are large gaps between maximum and minimum variables. As the outliers might mislead OLS results, Cook's distance and Mahalanobis distance tests were done to remove them. Outliers are data points which are located in the "outskirts" – the areas found relatively far away from the regular linear pattern. The regular linear pattern is described as the midline of the regression line.

Further, to check for autocorrelation, Durbin-Watson test was done and as the scores are around 2 for each regression, the presence of autocorrelation is rejected. As a rule of thumb, d (coefficient of Durbin-Watson test) should be between 1.5 and 2.5 to indicate independence of observations; otherwise there is autocorrelation.

7.3.1 Manufacturing sector

Regression analysis results are depicted in table 20 for four different models. Model 1 represents relationship of the firm's profitability with CCC. Regarding the results of manufacturing firms, firstly it can be noted that cash conversion cycle is significant to the company's profitability at $\alpha 1\%$ and there is a negative relationship. Thus, based on the regression results, the company's profitability increases by 0.120% when cash conversion cycle is reduced by 1 day. Such result does not differ from Pearson correlation analysis regarding the direction of variables and provides the basis for accepting hypothesis 1.

Moreover, all components of cash conversion cycle show a significant negative influence on the firm's gross operating income as expressed via models 2, 3, and 4 results.

Account payable period in model 3 is negatively associated with a 1% significance level, implying that reduction by 1 day of credit period results in profitability's increase by 0.2017%. Therefore, hypothesis 3 can be accepted as well. Such result indicates that paying short-term liabilities contributes to the company's profitability and the firms paying it later are less profitable. The rationale behind could be the significance of the utilization of the discounts for advance or earlier payments from the suppliers and that profitable UK manufacturers do not turn account payables into a substitution for the external financing. The fact that the use of account payables as the form of credit is costlier when comparing to the interest rates of long term borrowing might also contribute in reduced profitability. As analyzed companies are highly leveraged, it can be concluded that the prime source of financing is found rather in long term financing. This result is in line with the findings of Deloof (2003) for the Belgian firms, Lazaridis and Tryfonidis (2006) for the Greek firms but it differs from Gill, Biger and Mathur (2011) results for USA companies. Thus, there might be country or industry specific factors that influence significance of accounts payables. Regarding the economic conditions, the dummy variables do not perform significance.

Days of inventory sales, represented by model 4, shows a significance at $\alpha 1\%$. As the relationship to profitability is negative, the increase in inventory turnover by 1 day is related to a decrease in profitability by 0.1594%. Such result supports the majority of the previous findings (Lazaridis and Tryfonidis 2006, Deloof 2003, Shin and Shoenen 1998, Raheman and Nasar 2007, Garcia-Teruel and Solano-Martinez 2007), however, it is not in line with Mathuva (2010) and Obermaier and Donhauser (2012). Consequently, the hypothesis 4 can be accepted. The negative relationship in manufacturing sector between inventories and the firm's

profitability can be explained that in case days inventory outstanding has faster speed and stocks do not stay too long at the storages, firm`s operational profitability is higher as the consumption is higher, so consequently -the sales are increasing. “Lean manufacturing“ supports this reasoning as especially the managers try to operate in such way that limits waste and guarantees the most efficient use of resources. As described in the previous chapters – just in time inventory system took off in the last decades, thus naturally, it expected that there is a negative relationship between days sales inventory and the operational firm`s profitability.

Lastly, collection period days has a negative significant relationship at α 1%. Consequently, the increase in collection period by 1 day contributes to an increase by 0,839% to the company`s profitability. In previous research part, it was highlighted the arguments for positive effect of higher accounts receivables as the buyers might use it for the quality check of the goods. As UK manufacturers are known for its quality and highly developed processes, to use collection period as extra time to check the production quality is not really needed. Probably the closest explanation of collection period days being negatively related to the firm`s profitability is that shorter periods bring more cash on hand. Therefore, the hypothesis 2 is accepted and it is in line with Lazaridis and Tryfonidis 2006, Garcia-Teruel and Solano-Martinez 2007, Deloof 2003, Raheman and Nasr 2007.

Regarding the influence of the economic environment, there is no significance shown in all 4 regression models as p values of dummy variables are higher than 0.10.

Regarding the control variables – negative significant relationship between financial debt and the firm`s profitability implies that more leveraged companies are prone to smaller profits. Current ration and natural logarithm of sales performed negative coefficients which is in line with Pearson correlation results as well.

Table 20. Relationship of the firm's profitability with CCC and its components, manufacturing sector

Coefficient	Expected sign	1	2	3	4
Estimate					
Intercept		1.389	1.412	1.423	1.384
CCC	-	-0.001*			
Collection days	-		-0.000839*		
Credit days	+			-0.002017*	
Days sale of inventory	-				-0.001594*
CR	-	-0.018*	-0.023*	-0.030*	-0.018*
Financial Debt	-	-0.073*	-0.074*	-0.074*	-0.071*
LnTA	-	-0.198*	-0.200*	-0.195*	-0.192*
X1	+	-0.012	-0.013	-0.014	-0.011
X2	+	-0.001	-0.002	-0.003	0.000
Adj R^2			0.222	0.234	0.239
F-value		25.90	31.54	33.71	34.67
p-value		0.000	0.000	0.000	0.000

*, **, significance levels of 1% and 5%, respectively

$$\text{Model 1 - Gross Operating Income} = \beta_1 + \beta_2 \text{CCC} + \beta_3 \text{CR} + \beta_4 \text{FD} + \beta_5 \text{LnTA} + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

$$\text{Model 2 - Gross Operating Income} = \beta_1 + \beta_2 \text{DSO} + \beta_3 \text{CR} + \beta_4 \text{FD} + \beta_5 \text{LnTA} + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

$$\text{Model 3 - Gross Operating Income} = \beta_1 + \beta_2 \text{DPO} + \beta_3 \text{CR} + \beta_4 \text{FD} + \beta_5 \text{LnTA} + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

$$\text{Model 4 - Gross Operating Income} = \beta_1 + \beta_2 \text{DSI} + \beta_3 \text{CR} + \beta_4 \text{FD} + \beta_5 \text{LnTA} + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

The coefficients of R^2 varies in the range between 0.222 and 0.239. When comparing it to the previous researches, it is quite similar as Deloof (2003) had R^2 in the range of (0.277-0.32), Gill (2011) – (0.216-0.282) and Lazaridis and Tryfonidis around 0.238. Also, F values for all models are highly significant.

7.3.2 Construction sector

Regression analysis results for the construction sector are depicted in table 21. Firstly, it can be noted that CCC as in the previously analyzed manufacturing sector is significant to the firm's profitability and indicates negative relationship. The same relationship is performed by credit period and days sales of inventory, however, there is no significance between the firm's profitability and collection period.

Also, there are differences regarding the control variables and their effect on the construction firm's profitability. Contrary to the manufacturing sector, financial debt is not significant; whereas dummy variables show significance. Thus, it can be stated that UK construction industry is much more sensitive and reacts immediately to the changes to the economic environment.

Table 21. Relationship of the firm's profitability with CCC and its components, construction sector

Coefficient	Expected sign	1	2	3	4
Estimate					
Intercept		0.808	0.952	0.951	0.795
CCC	-	-0.000598*			-0.000607*
Collection days	-		-0.000295		
Credit days	+			-0.000571*	
Days sale of inventory	-				
CR	-	-0.022**	-0.13	-0.014	-0.023*
Financial Debt	-	0.018	-0.043	-0.042	0.023
LnTA	-	-0.049*	-0.058*	-0.057*	-0.047*
X1	+	-0.043*	-0.037*	-0.039*	-0.48
X2	+	-0.081*	-0.077*	-0.080*	-0.087*
Adj R^2		0.232	0.168	0.170	0.234
F-value		76.36	51.083	51.739	77.23
p-value		0.000	0.000	0.000	0.000

*, **, significance levels of 1% and 5%, respectively

$$\text{Model 1 - Gross Operating Income} = \beta_1 + \beta_2 \text{CCC} + \beta_3 \text{CR} + \beta_4 \text{FD} + \beta_5 \text{LnTA} + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

$$\text{Model 2 - Gross Operating Income} = \beta_1 + \beta_2 \text{DSO} + \beta_3 \text{CR} + \beta_4 \text{FD} + \beta_5 \text{LnTA} + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

$$\text{Model 3 - Gross Operating Income} = \beta_1 + \beta_2 \text{DPO} + \beta_3 \text{CR} + \beta_4 \text{FD} + \beta_5 \text{LnTA} + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

$$\text{Model 4 - Gross Operating Income} = \beta_1 + \beta_2 \text{DSI} + \beta_3 \text{CR} + \beta_4 \text{FD} + \beta_5 \text{LnTA} + \beta_6 x_1 + \beta_7 x_2 + \varepsilon$$

7.3.3 Conclusion of OLS regression analysis

Limitations of OLS regression

Before analyzing the results of the regression analysis it is essential to note the factors that might distort the outcomes. These factors arise from the complex nature of choosing the right regression model.

- In this work's analysis the variables for the regression equation were chosen based on the previous researches and available data. However, there might be a chance that another variable with significant influence on the firm's operating profit was omitted.
- Also, the data was collected from Amadeus data base for a large amount of companies. In order to check the appropriateness of the calculations, from whole sample randomly were selected few companies and relative ratios were calculated manually. Although, due to the size of a sample, the possibility of faulty variable values in the sample remains.
- Finally, there is a possibility of the opposite causality between variables. For instance, not necessarily working capital and its components are the factors that affect the firm's profitability. The case can be opposite and there might be as well significant relationship when analyzing the profitability's affect on working capital's components. As more detailed example can be found in the reasoning why there is negative relationship between account payables and the firm's profitability. It might be because more profitable firms pay their liabilities earlier that negative relation exists.

Once one of the the factors gets mixed up into the OLS regression analysis, the results might be affected and values of variables can be different from the expectations. Also, how well the model works in reality is the other question that cannot be tested.

OLS regression results summary

Based on the regression analysis the following hypothesis were accepted:

H1: CCC is negatively associated to the company's profitability and the association is stronger during the economic turmoil.

The hypothesis 1 is accepted as the results for manufacturing and construction sectors confirm the negative relation exists between CCC and the firm's profitability. However, it can be accepted only partially because the different economic periods do not show significance for the

manufacturing sector, only for the construction. Moreover, as Pearson correlation was conducted for each economic period, there was not significant change noticed in the strength of the correlation between the firm`s profitability and CCC. This outcome is supported by the majority researches carried out in different countries for various sector (Lazaridis and Tryfonidis 2006, Garcia-Teruel and Solano-Martinez 2007, Deloof 2003, Raheman and Nasr 2007).

H2: The accounts receivables are negatively associated to the firms` profitability and the association is stronger during the economic crisis period.

The hypothesis 2 can be accepted partially for manufacturing sector as accounts receivables showed a constant negative relation to the firm`s profitability. Regarding the construction sector is must be rejected as there is no significant relationship based on the OSL regression analysis, however, the coefficients in Pearson correlations are negative with very weak correlation.

H3: The accounts payable are negatively associated to the firm`s profitability and the association is stronger during the economic crisis period.

The hypothesis 3 is accepted as accounts payables showed stronger than other variables negative relationship towards the firm`s profitability. The results are consistent for the both sectors in question based on OLS regression analysis.

H4: Inventories are negatively associated with profitability and the association is stronger during the economic downturn.

The hypothesis 4 is partially accepted as no difference is noticed during different economic periods in the Pearson correlation. However, negative relationship with the firm`s operating profitability is persistent in both sectors.

8 Conclusion

Our economy is centered around money, and cash is one type of money expression. As the main corporate goal is to maximize shareholders value, the increase of profitability is highly sought by every organization. During last century, there were created various measures of profitability that are related to the different levels of the organizational structure – the profitability can be measured for the organization as a whole, for the operational activities only or it can be further divided to measure profitability of the different divisions. The focus of this thesis was on analysis of the operational profitability which must be the goal for every financial manager.

Especially in last decades, working capital concept (the difference between short-term assets and liabilities) has been attracting more and more attention regarding its importance on the firm's profitability. However, it could not be said that the effect of working capital and its components on the firm's profitability is completely known. There might be influence coming from the firm's profitability on the strategies of working capital or the particular set of strategies regarding working capital might contribute to the firm's profitability.

Hence, this work analyzed the operational company's profit as dependent variable on its working capital management. Manufacturing and construction firms during the period of 2006-2013 were chosen as the subject for analysis. To eliminate country specific differences (and language barrier while collecting data) – only UK companies were taken into account. The period was selected, so different economic conditions are included. The idea was to see whether deteriorating economical environment has an impact on the relationship strength of working capital management and the firm's profitability. Gross operating profit is utilized as a measure of the operational profitability; whereas CCC is used to measure efficiency of working capital management.

For the analysis Pearson correlation and OLS regression analysis were conducted. The results for both sectors conclude the same – there is a negative and significant relationship between working capital management and the firm's profitability. The results are consistent in both methods and it supports the findings stated by the previous researches of analysis for different countries and industries.

As the subject of the analysis was UK manufacturers and construction companies, after analyzing their main financial data regarding operational profitability it is noticed that there are

not many differences. Both sectors heavily rely on high leverage, have conservative policies regarding their current assets and liabilities and are vulnerable to the changing economic conditions. However, the analysis showed that the construction companies are more sensitive to the economic swings and increased their leverage during 2008-2011; whereas manufacturers stayed more consistent with their leverage throughout the period.

It is noteworthy that both sectors have quite significant amount of current assets locked up so the potential to release it is present. There is also clear negative relationship between account payables, receivables and inventories on the firm`s gross operating profitability. Therefore, it can be stated that it is crucial to take into account working capital when short-term or long-term plans are made. The financial managers must strive to find the optimum level of working capital in their company and analyze the factors that causes such dependencies.

8.1 Limitations of the research

The results should be taken with the consideration of possible influences of the factors such as omitted values in data due its large sample and being collected by Amadeus database. Also, there is possibility of constructing different regression model that would reflect the relationship between working capital and profitability more accurately when including different variables. Additionally, having direct access to the firms information it is possible to perform analysis in more detail, as for this research only outside data was available. However, the preliminary research conducted is a good starting point for analyzing further this topic with inclusion of different variables and aspects.

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