Unlocking Value: The Role of Net Operating Working Capital Management on Firm Performance and Investment Decisions

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ABSTRACT

This study investigates the impact of working capital management on firm performance using a sample of companies from Western Europe and the United Kingdom between 2004 and 2023. Specifically, the impact of short-term corporate decisions on firm performance and long-term investment decisions is researched through an industry-based net working capital approach. The results indicate that efficient working capital management enhances stock and operating performance for firms with positive excess net working capital in case of converging industry median levels by reducing unnecessary capital tied-up. We also document that long-term investment decisions serve as a channel through which effective working capital management influences firm performance. In particular, the findings imply the importance of internally generated resources being utilized into more valuable long-term investments with the aim of creating value for growth-stage companies.

JEL Classification: G31, G32

Keywords: Working Capital Management, Short-Term Decisions, Financial Management, Firm Performance, Investment, Risk

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Mustafa Kerem Kurtul

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1. INTRODUCTION

Effective management of Net Working Capital (NWC) is often the lifeline of a firm's financial health, directly influencing its ability to sustain operations, seize investment opportunities, and ultimately drive performance. The recent pandemic period revealed the critical importance of effective NWC management once again. As the economy slowed down and faced a major crisis, many firms witnessed the deterioration of their NWC, which offset the value they had previously created or even led to bankruptcy for some firms that were already financially struggling. This stark reality underscores the critical role that NWC management plays in maintaining firm performance and ensuring long-term goals. At the end of 2023[1], the total amount invested in working capital (comprising inventories and receivables) in Western Europe, including the United Kingdom (UK), amounted to €1.96 trillion. This investment accounts for 17.1% of total assets and 25.6% of total revenues. Almost 72% of this working capital is funded by accounts payable (i.e., supplier credit), amounting to a total NWC of €541.4 billion as of 2023.

The fact that firms allocate a significant portion of their cash reserves to working capital highlights the critical importance of its management for enhancing profitability and deserves closer scrutiny, especially in the recent world economic landscape. Persistent high inflation and interest rates are driving up borrowing costs, making the efficient use of cash increasingly critical (PwC, 2023). Firms seek to maintain profitability to either grow or survive. To achieve this, firms consistently engage in both short-term and long-term investments to gain or sustain a competitive advantage. Short-term investments are particularly important in light of Fazzari and Peterson's (1983) findings, which indicate that increased net working capital can reduce fixed investments. Also, short-term financial decisions are a mixture of separate and interrelated decisions (Sartoris & Hill, 1983), where many variables can interact, leading to different outcomes for different firms depending on their strategy, context, or industry needs.

One of the potential limitations of the study, despite local prices being adjusted for inflation to each country's respective base year, could arise from the selection of multiple countries, potentially leading to discrepancies in reporting and balance sheet data due to any overlooked issues. Another potential problem that could distort the results of our research is the profitability measure chosen, return on assets (ROA). Due to the large number of companies, the operational profit measure, EBITD, might vary due to the different reporting standards of each company, which could lead to biased results. Nevertheless, ROA has been deemed an appropriate variable due to its widespread use in the literature as a profitability measure. It incorporates total assets and, considering that one of the regression analyses also examines changes in fixed assets, ROA provides a comprehensive measure of interest (see also, Equation 4).

Practitioners emphasize that a significant amount of working capital occupies a substantial part of company balance sheets, highlighting that this presents both a major opportunity and a challenge for improvement (PwC, 2023). Therefore, in this study, while the ultimate aim is to examine the impact of NWC management on firm value through stock performance, we also investigate the source of this impact from the perspectives of operational performance, taking on corporate investment after changes in NWC. Subsequently, we inspect changes in the overall risk level

[1] According to data collected from LSEG Workspace for the most recent active firms.

associated with changes in adjusted industry-mean NWC in case of total risk being the driver of stock performance.

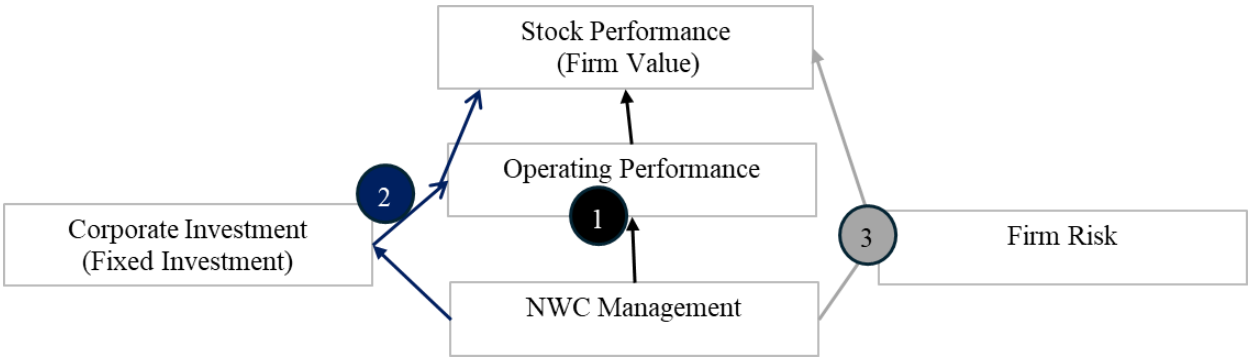
The scope of the research is based on Western European companies, namely France, Switzerland, Germany, the Netherlands, Austria, Belgium, Luxembourg, and the United Kingdom. The primary reason for selecting this region as the scope is due the the fact that EU firms have been leading the way in NWC improvement compared to other regional peers, which was normally higher, as payment regulations have been rolling out according to PwC (2023). These regulations are briefly as follows[2]: Late Payment Directive, Payment Services Directive, Mandatory e-invoicing, Regulation on Cross-border Payments, PCI-DSS Compliance. Additionally, the impact of changes in the excess adjusted industry-mean NWC, which is the primary variable investigated in our study, on firm value can produce more effective results. This is due to the nature of more developed capital markets and the long 20-year selected period, which partially eliminates the possibility of market inefficiency that could result in biased estimates in both the short and long term.

Numerous studies have examined the relationship between NWC and profitability within individual country contexts. However, research focusing on NWC and firm value is limited and based primarily on unidirectional performance metrics (typically profitability ratios *or* firm value) which is insufficient in revealing the underlying drivers of this relationship. This lack of relationship construction is illustrated in Figure 1, where most of the literature focuses only on the arrows labeled with the number 1. Moreover, generating internal capital is absolutely vital for companies that are in the growth stage, as highlighted by PYMNTS Intelligence (2024). Top-performing growth companies in the EU tap into NWC and take external capital for growth opportunities, while bottom-performing companies tie up capital for emergency reasons. This also shows that NWC management is gaining importance not only for traditional reasons but also for creating value in both strategic and tactical terms. This study shows that younger companies tend to have more industry-adjusted excess net working capital, and reducing this excess significantly improves their firm performance.

This paper aims to first examine the relationship between excess NWC changes and performance metrics, such as excess return compared to benchmark portfolios as a proxy of firm value and ROA as for firm performance metric as illustrated by arrows labeled 1 in Figure 1. Then, to investigate whether corporate investment acts as the mechanism influencing firm performance by investing relatively higher return opportunities with the internally generated cash by reducing excess NWC, arrows labeled by 2 in Figure 1, as first conducted by Aktas et al. (2015) based on the existing information. We also test if the company risk is a potential driver of stock performance, which is labeled by 3 in Figure 1. Besides, this study encompasses eight different countries with the most up-to-date data and strives to reach more comprehensive conclusions by leaving out country-specific effects, thereby extending the scope of previous local studies.

[2] For more information: Highradius : European Union Regulations - Regulating Working Capital

Figure 1 *- Research Outline and Main Findings*



The general framework of the study is illustrated in Figure 1. The main findings are as follows:

We find significant evidence of a negative relationship between NWC management and both stock and operating performance. Even though this relationship is statistically significant for companies with positive excess NWC in both the main (see Table 6) and additional robustness regression model (see Table 10), for negative excess NWC, the main regression model shows significance for stock performance (see Table 6); however, it is not supported by operational performance (see Table 8) and the additional robustness model (see Table 10). For companies with abnormally high NWC, the increasing stock performance results from the reduction of unnecessary working capital, leading to more corporate investments and, in turn, enhanced operational profitability (see Table 7). As an additional check, for firms with positive excess NWC, decreasing NWC level by adopting aggressive working capital management does not lead to increasing firm risk, ruling out the possibility of risk channel as a potential driver of increasing performance for the firms with positive excess NWC in the case of releasing cash (see Table 9). There is a statistically significant negative relationship between firms with negative excess NWC and firm risk, which validates the prior literature that aggressive WCM results in higher firm risk (see Table 9).

The next section begins with an extensive theoretical background to set the stage for our study on working capital followed by a prior literature review. The research continues by developing a methodology that includes a description of the data and variables used in the empirical analysis. It also provides summary statistics and preliminary analysis to gain insights into subgroup characteristics for companies with negative and positive excess NWC, which serves as pre-knowledge before employing multiple specifications. Then, section four presents the empirical results. An alternative regression model is presented for robustness check afterward in section five. The study's main findings and research implications are discussed and summarized again in the conclusion section.

2. LITERATURE REVIEW

2.1 Capital Concepts

The concept of "Working Capital" was first discussed by Karl Marx, who distinguished between fixed and circulating capital. Circulating capital corresponds to what we now refer to as working capital, emphasizing its importance in the day-to-day operations of a business (Lukkari, 2011). Thus, we can classify the total capital required by a business into two main categories as fixed capital and working capital. According to International Financial Reporting Standards (IFRS) fixed assets are defined as tangible items that are held for use in the production or supply of goods or services, for rental to others, or for administrative practises, and are expected to be used during more than one period. That is to say, these long-term funds are required to create production facilities through the purchase of fixed assets such as plant and machinery, land, and buildings. These fixed assets are critical for firm growth and expansion to be able to maintain competitive advantage and support long-term growth strategies (Chudson, 1945).

On the other hand, working capital is part of the total capital that is allocated for purchasing current assets, i.e. for meeting the daily needs of a business unit. The primary reason why working capital arises is because of the time gap between production and realization of *cash* from sales, which varies from industry and even to firms' *operating cycle* (see Figure 4). It means revolving a circular flow of cash starting with cash paid for the purchase of material and ending with cash receipt after the sale of finished goods. This is how working capital is a circular cash flow from cash to inventories and back to cash (Gitman, 2005).

The level of fixed assets affects working capital requirements. As Hill et al. (2010) emphasized firms with high levels of fixed assets may have lower working capital needs because fixed investments often come with longer payment terms and less frequent cash outflows compared to variable expenses. However, in this study, we will investigate the impact of short-term funds on long-term assets, referring to this relationship as corporate investment in the subsequent sections.

2.2 Working Capital Balance Sheet Concepts

Working capital can be defined in various ways depending on the perspective taken: Gross working capital, net working capital, operational working capital, and financial working capital.

Gross working capital refers to the total current assets, which include investments in cash and cash equivalents, marketable securities, accounts receivable, and inventory that are expected to be converted into cash within a year. These assets are essential for the company to carry out its daily operations without disruption.

Guthmann and Dougall (1948) are the first ones that define working capital as current assets minus current liabilities which is referred to as net working capital. In other words, NWC indicates, beyond specifically focusing on current assets, fundamentally how much *investment* in working capital is *financed* by both long-term and short-term liabilities. A positive net working capital, or conservative working capital policy, indicates that the company is financing a portion of its current asset investments with external financing options or internally using free cash flow (Hill et al., 2010), ensuring liquidity but also implies opportunity costs or additional interest costs. Conversely, a negative net working capital, or aggressive policy, implies that the company is using short-term

debt to finance not only its current assets but also some of its fixed assets, indicating a need for additional resources to meet its short-term debt obligations.

The *operational* working capital emphasizes the portion of working capital that is directly devoted to operations, such as trade receivables, inventories, and trade payables, which are bolded in Figure 2. The rest of the items belong to the *financial* decisions of the company that have very little to do with the firm's operations. It should be noted that this study only considers changes in operational working capital, which is simply defined as the sum of trade receivables and inventories minus trade payables.

***Figure 2** - Representative Balance Sheet*

Figure 2 shows the balance sheet of a sample company. The bolded financial elements represent operational working capital components, while the remaining items constitute financial working capital components.

Total Assets	Total Liabilities
Current Assets	Current Liabilities
Cash & Equivalents	Short-Term Borrowings
Marketable Securities	Accrued Liabilities
Trade Receivables	**Trade Payables**
Other Receivables	Other Payables
Inventories	Provisions
Prepayments	Deferred Revenue
Fixed Assets	Long-Term / Non-Current Liabilities
	Shareholders' Equity
Operational Working Capital	Financial Working Capital

2.3 Financial Management and Working Capital Management (WCM)

Working capital management (WCM) is a component of financial management that concentrates on short-term operational efficiency. Financial management covers a wider array of activities that aim to guarantee long-term financial stability and growth. These broader activities include financial planning, capital structure management, investment decisions, financial control, risk management, and dividend policy.

Although each activity is essential for a company, the importance of working capital management is that it is located at the center of the activities and has the ability to impact others significantly. It is considered critical since it is closely linked to capital structure and investment decisions, which are more related to long-term decisions. WCM is defined as the management of short-term investments and financing of a firm, which contains two ultimate goals: To maintain and provide sufficient liquidity to continue daily operations and utilize assets in the most profitable way (Shin and Soenen, 1998).

This dual situation creates a *trade-off* between profitability and liquidity. This mutual relationship also recognizes the significance of *effectively managing working capital*, as Shin and Soenen (1998) captured: "*Decisions that tend to maximize profitability tend not to maximize the chances of adequate liquidity. Conversely, focusing almost entirely on liquidity will tend to reduce the potential profitability of the company*".

Liquidity can be defined as almost equivalent to net working capital, whether a company meets its short-term liabilities and reflects the riskiness of the firm (Emery, 1984) or can also be viewed as *financial flexibility*, the ability to take advantage of unforeseen future opportunities. Liquidity is still needed to ensure business operations, and profitability is needed to ensure growth and shareholder value, and therefore a balance should be found between liquidity and profitability (Talonpoika, 2016).

According to the risk and return theory, which states that the higher the risk, the higher the return, and vice versa, the more liquid a company is, the more funds are confined to liquid assets, making them inaccessible for productive activities that generate profit or for investments for the long-term initiatives.

Figure 3 *- Net Working Capital Management Strategies*

According to Meszek and Polweski (2006), there are 3 types of company strategies. Aggressive: Maintaining a high short-term liabilities level, and a low level of current assets in the total assets. Conservative: Maintaining a low short-term liabilities level and a high level of current assets in the total assets. Moderate: An intermediate strategy, somewhere between aggressive and conservative. LS = Share of short-term liabilities in total assets, AS = Share of current assets in total assets.

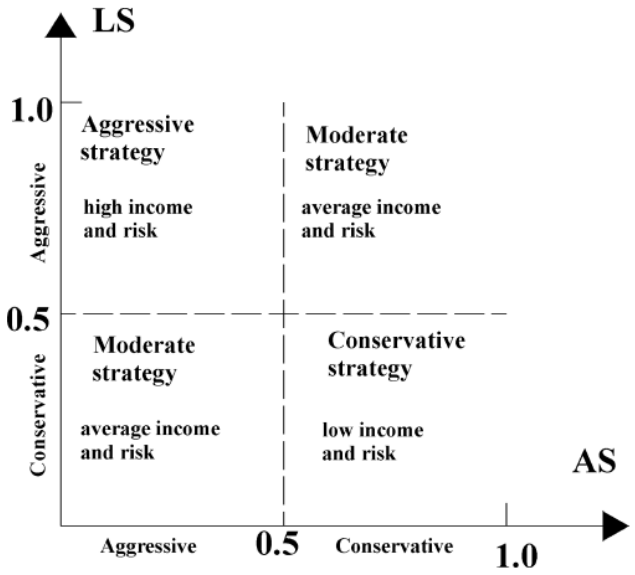


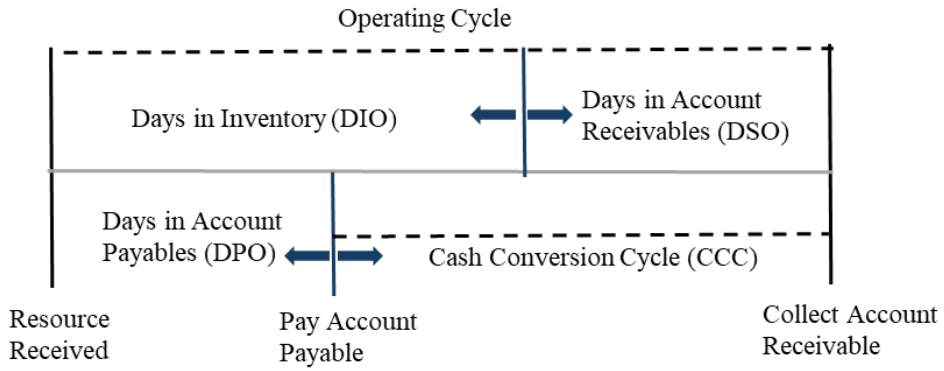
Figure 3 shows the strategies and classifications of companies for risk and return and firms might adopt their optimal strategy (*optimal NWC level*), the level at which maximizes profitability, maintaining liquidity at a sufficiently low level, and thereby aiming for shareholder maximization.

2.4 Measurement of NWC Management

There are two important metrics used in the literature for measuring NWC management. The first one is the Cash Conversion Cycle (CCC) is the metric that shows the net time interval between the collection of cash receipts from product sales and the cash payments for the company's various resource purchases. According to Jose et al. (1996), it was first introduced by Gitman (1974). The operating cycle represents the total amount of time required for a company from purchasing resources until collecting cash which creates unsynchronized flow because the disbursements take

place before cash receipts. The operating cycle varies across industries and companies, and supplier credit ultimately determines the average CCC of the company.

Figure 4 *- The Cash Conversion Cycle*



Days sales outstanding represents the average number of days worth of sales still outstanding in the account receivables. A firm can adjust its credit policies to strike the right balance between securing sales by offering credit and the opportunity cost associated with tying up resources on the balance sheet, taking into account the risk of collection within the due date.

Days payable outstanding is the length of time that a firm defers payment on its various resource purchases. Delaying payments to suppliers allows a firm to assess the quality of the products bought, and can be an inexpensive and flexible source of financing for the firm. On the other hand, late payment of invoices can be very costly if the firm is offered a discount for early payment (Deloof, 2003).

Days inventory outstanding expresses the length of time required to produce and sell the product. A firm must take into account the trade-off between potential stock-out and the cost of tying up an amount of cash.

However, these concepts should be considered jointly as Kieschnick et al. (2013) explain simply that extending more trade credit to customers increases sales and the need for more inventories, and vice versa. Kaiser and Young (2009) state that components of NWC should be managed according to their conditions and imperatives. Relative bargaining power, the intensity of competition, and switching costs all must be taken into account. Banos-Caballero et al. (2010) also emphasize the importance of market conditions that firms have to evaluate the trading-off between costs and benefits of maintaining a larger investment capital.

The other metric broadly used is NWC-to-sales. It simply measures the proportion of net working capital relative to sales. It is chosen as a measure of working capital efficiency in this study due to its simplicity, ability to provide a holistic view of efficiency, and ease of cross-sector comparison, as can be seen in Figure 3 and Table 2.

2.5 Determinants of Working Capital

The literature points out that there are both *external* and *internal* factors that lead to shaping companies' working capital management policies. Baños-Caballero et al. (2010) investigate the

determinants of WCM among Spanish firms from 1997 to 2004. Kieschnick et al. (2006) examine why firms might over-invest in working capital and the impact of such decisions on firm value underscoring the necessity of effective monitoring and incentives for management to improve WCM, suggesting that industry norms and corporate governance play pivotal roles in determining working capital strategies. Hill et al. (2010), one of the most cited studies in the literature, highlight the need for a firm-specific approach to WCM, considering unique operating and financial conditions rather than relying solely on industry averages. Lukkari (2011) has conducted a detailed bibliometric study on this topic.

Internal Funds Availability

Baños-Caballero et al. (2010) suggest that firms capable of generating more internal funds have a longer CCC. Hill et al. (2010) also reach the same results by selecting the dependent variable as working capital requirement and suggest that firms with stronger operating cash flows are more likely to enjoy the benefits of a less restrictive working capital policy than firms with weaker cash flows, as a positive WCR must be financed.

Leverage

Baños-Caballero et al. (2010) do not find any support for the hypothesis that leverage influences the measures of working capital management. However, other certain studies find a positive association with the cash cycle (Deloof, 2003; Garcia-Teruel & Martinez-Solano, 2007), while Dong & Su (2010) find the contrary for Vietnamese firms.

Growth Opportunities

Research suggests firms build up inventories when they expect sales to grow. Hill et al. (2010) identified a negative correlation between lagged sales growth and the level of working capital, a finding that aligns with the results of Baños-Caballero et al. (2010). High-growth firms need not relax trade credit terms as sales are already growing (Hill et al., 2010), indicating that suppliers are willing to offer more credit in hopes of establishing a relationship.

Size

According to Hill et al. (2010), a positive WCR must be financed, smaller firms will more closely monitor operating working capital strategies since they have fewer alternatives available to finance the working capital gap relative to larger firms, aligning with the findings with Chiou and Cheng (2006), and contradicting with Deloof (2003).

Age

Baños-Caballero et al. (2010) argue that older firms usually can get external financing more easily and under better conditions, so they tend to have more working capital which was also supported by their empirical study with Chiou and Cheng (2006).

Sales Volatility

Hill et al. (2010) found that with increasing sales volatility, which reflects anticipated demand fluctuations, there is an inverse correlation with working capital requirements. This suggests that managers respond to higher sales volatility by adopting a more aggressive approach to managing working capital.

Market Power

The length of trade credit terms is directly related to market power according to Hill et al. (2010) as more valuable customers can negotiate more generous credit terms with suppliers. Firms with a larger market share can impose longer credit terms on suppliers without consequences, as contracts with industry leaders are crucial for smaller suppliers' survival. Similarly, strong relationships with vendors allow firms with greater market power to hold less inventory. As a measure of market power, the lagged ratio of a firm's annual sales to total industry sales is used despite not finding any significant support for the claim by Hill et al. (2010).

Financial Distress

Financial distress arises when a firm cannot meet its short-term payment obligations. Firms with financial distress tend to be financially constrained and have difficulties obtaining external funds. Baños-Caballero et al. (2010) argue that this can lead to a lower trade cycle as a company at stake, also (Hill et al., 2010; Molina & Preve, 2009).

2.6 Review of Prior Literature

In the literature, single relationship-based regression models (NWC with profitability or NWC with firm value) are richly available. The literature proposes several different arguments about working capital and performance. On the one hand, additional investment in working capital stimulates more sales by granting more trade credit to customers (Deloof, 2003). Alternatively, higher working capital levels require financing, and consequently, firms face additional interest expenses, which can increase the probability of financial distress or even bankruptcy (Kieschnick et al., 2006).

Nonetheless, it is well-documented that reducing the cash conversion cycle positively affects profitability around the world in single-country studies, for example for the USA (see Jose et al., 1996; Shin & Soenen, 1998); for Japan and Taiwan (Wang, 2002); for Greece (Lazaridis and Tryfonidis, 2006); for Spain on SMEs (García-Teruel & Martínez-Solano, 2007); for Pakistan (Raheman & Nasr, 2007); for Belgium (Deloof, 2003), and Enqvist et al. (2013) highlighted that efficiency in NWC management becomes more impactful during economic downturns for the UK.

Some studies reveal that there is a specific level of NWC that maximizes firm profitability. Research by Baños-Caballero et al. (2014), and Anton and Nucu (2021), demonstrates an inverted U-shaped relationship between NWC and firm performance. This indicates that while increasing NWC up to a certain point boosts profitability, exceeding this optimal level results in higher costs outweighing the benefits. Aktas et al. (2015) also identify that firms optimizing their working capital towards an optimal level, whether by increasing or decreasing it, achieve enhanced stock and operating performance.

Some studies have focused on the impact of short-term investment decisions on long-term investment decisions. Ek and Guerin (2011) assert that NWC over-investments impede firms from investing in value-enhancing projects, while Buchmann et al. (2008) highlight that WC is a potential source of cash for financing firm growth. Fazzari and Peterson (1993) published the first paper emphasizing the role of working capital in testing finance constraints on fixed investment, highlighting its reversibility feature. They argue that working capital is excessively sensitive to

cash flow fluctuations and note a negative relationship between NWC and fixed investment, indicating that working capital can constrain investment and impact company growth. Akbar et al. (2022) conducted empirical testing revealing that excessive funds tied up in working capital negatively impact the investment portfolio of firms, suggesting that firms should use idle resources tied up in short-lived assets to boost investment activities. Banerjee and Deb (2023) investigated the interplay between capital expenditure (CAPEX), WCM, and firm performance, focusing on the role of managerial ability in US logistics firms from 1988 to 2018. They concluded that more successful management seeks to generate internal funding by enhancing WCM efficiency, and managers should implement better WCM practices to release locked-up funds, facilitating higher investments in CAPEX.

Previous empirical research analyzed the relationship between working capital management and a firm's value in single countries (Kiescnick et al., 2013; Aktas et al., 2015) for the US; (Banos et al., 2014) for the UK.

Examining U.S corporations from 1990 to 2006, Kieschnick et al. (2013) criticize the prior research mentioning on NWC and performance Shin and Soenen (1998), Deloof (2003), and Garcia-Teruel and Martinez Solano (2007) in that minimizing investing in NWC would not necessarily maximize their profitability and thereby firm value. He pointed out that both NWC and fixed asset investments reduce current-year FCFs and might affect future FCFs differently, emphasizing that company value is calculated based on future cash flows. Therefore, they emphasize that the linkage between net operating working capital management and firm value can differ from that between net operating working capital management and firm profitability because of the effect of working capital management on future sales. They found that the value of an additional dollar invested in NWC is significantly influenced by future sales expectations when applying the excess returns approach as a measure of a valuation model, following Faulkender and Wang (2006).

Banos-Caballero et al. (2014) explored firm value for non-financial UK companies. They provided strong support for an inverted *U-shaped* relation between investment in working capital and stock performance using the GMM method by selecting the net trade cycle as a dependent variable against controlling variables such as size, leverage, opportunity growth, and ROA.

Firms that converge at the optimal level improve their stock and operating performance (Aktas et al., 2015). Using a sample of 15,541 firms between 1982 and 2011, cross-sectional average and median NWC-to-sales ratio has been documented by fixed effect regressions that prove the relation between excess NWC and stock performance is *non-linear*, indicating that a one standard deviation decrease (increase) in positive (negative) excess NWC is associated with an increase of 0.90% (0.85%) in excess stock return over the next year (Aktas et al.,2015). After taking into account both capital expenditures (CAPEX) and cash outflow related to acquisitions, it is strongly suggested that for firms with positive excess net working capital (NWC), freeing up unneeded cash tied up in working capital is positively linked to an increase in corporate investment in the subsequent period.

3. METHODOLOGY

3.1 Data Collection and Sample

We construct a sample of listed firms from France, Switzerland, Germany, the Netherlands, Austria, Belgium, Luxembourg in Western Europe, and the United Kingdom, from LSEG Workspace for the period of 2004-2023. We exclude firms in the real estate, banking, financial services, and insurance sectors. The remaining firms are categorized into industries based on the Global Industry Classification Standard (GICS). In our balanced panel data sample, we have 2,490 unique firms with 49,800 firm-year observations. Throughout the study, we used winsorized variables at the 5th and 95th percentiles to mitigate the influence of extreme values. STATA software is used for all regression analyses.

Given the scope of the study encompassing 8 different countries, inflation adjustments were made by converting all *euro-denominated* figures into *real* values using the Consumer Price Index (CPI) data for the relevant years for each country, sourced from the International Monetary Fund (IMF). The data was retrieved on May 14, 2024.

Table 1 *- Aggregate Values By Years*

The table reports yearly aggregate values for total assets, revenue, cash holdings, NWC and its components, namely account receivable, account payable, and inventories. The sample contains listed non-financial firms in Western Europe and the UK from LSEG Workspace for the period 2004-2023. All euro values are in millions, and inflation adjustments have been made according to the base year CPI of corresponding countries and years. The annual growth rate of the corresponding variables is displayed in the last row.

Year	Total Assets	Revenue	Cash	NWC	AR	AP	Inv.
2004	4,957,195	3,837,014	318,251	272,789	567,214	695,120	400,695
2005	5,236,146	4,163,899	325,119	359,783	612,064	687,788	435,507
2006	5,888,903	4,460,665	352,478	404,671	663,751	760,023	500,942
2007	6,072,461	4,680,183	386,548	438,448	677,078	794,828	556,198
2008	6,688,466	5,129,133	397,226	485,813	694,042	786,961	578,733
2009	6,310,198	4,372,617	433,926	378,677	625,508	757,392	510,562
2010	6,696,893	5,004,989	481,432	385,431	692,916	859,965	552,480
2011	6,997,311	5,520,406	482,813	422,347	791,143	964,578	595,783
2012	7,255,370	5,821,813	493,018	405,955	743,977	952,566	614,544
2013	7,195,006	5,717,634	504,660	421,405	730,633	918,232	609,004
2014	7,731,828	5,975,894	547,944	395,292	750,055	988,511	633,747
2015	8,308,628	5,868,353	591,263	405,906	764,508	1,026,630	668,028
2016	8,745,921	5,697,794	617,178	414,218	785,200	1,069,994	699,012
2017	8,757,581	5,904,889	626,831	417,474	786,949	1,072,519	703,043
2018	9,362,853	6,263,798	689,398	438,449	827,657	1,137,554	748,346
2019	9,918,395	6,245,617	681,353	449,906	842,323	1,161,640	769,223
2020	9,836,891	5,431,714	875,519	398,197	754,879	1,085,804	729,122
2021	10,561,985	6,203,853	880,113	396,117	844,233	1,257,497	809,380
2022	10,321,169	6,835,151	808,069	460,493	877,696	1,296,885	879,682
2023	9,528,634	6,343,866	754,049	461,174	822,226	1,171,854	810,803
Growth Rate	**3.5%**	**2.7%**	**4.6%**	**2.8%**	**2.0%**	**2.8%**	**3.8%**

In Table 1, we provide the aggregate values of Total Assets, Revenues, Cash Holdings, NWC, and NWC components in real terms to facilitate comparison. Between 2004 and 2023, all the variables under consideration exhibit an upward trend. In particular, total assets, cash holdings, and inventories grew on average of 3,5%, 4.6%, and 3.8%, respectively. It is important to highlight that cash holdings are growing at a rate of 4.8%, which is significantly faster than the other components.

According to Bates et al. (2009), there are three primary reasons why firms hold significantly more cash than they used to which might explain such a trend. First, firms have faced greater cash flow variability. Second, firms have reduced their holdings of inventories and accounts receivable, which historically required significant cash outflows, thereby retaining more cash through more efficient asset management. Third, there has been a notable increase in research and development spending, leading R&D-intensive firms to hold more cash to finance their innovative activities and ensure liquidity for ongoing and future projects. The increase in inventory levels can be partly explained by the impact of COVID-19, which led to supply chain disruptions and fluctuations in material prices.

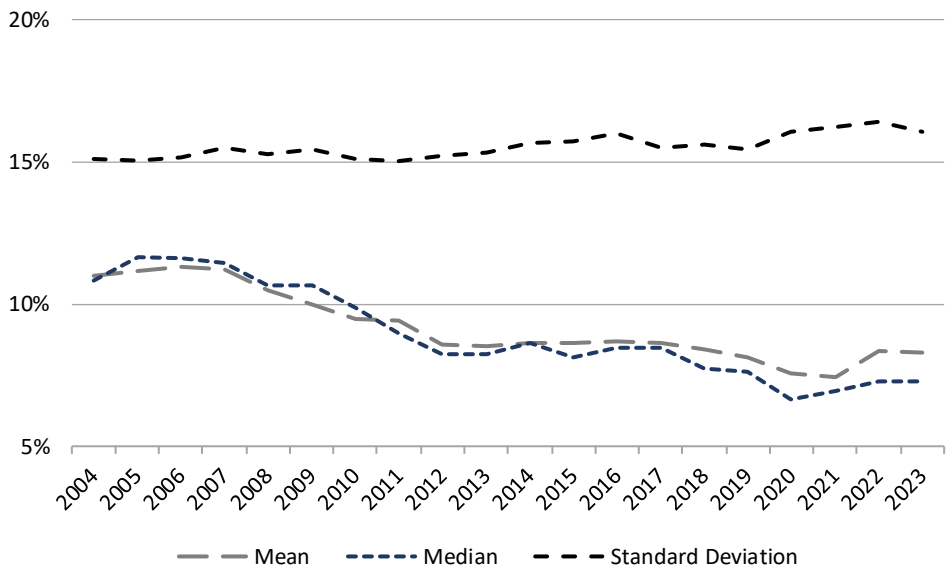


Figure 5 *- Time Series of Summary Statistics for NWC-to-sales Ratio*

Time series of summary statistics for NWC-to-sales ratio. This figure plots cross-sectional summary statistics for NWC-to-sales ratio for Western European and UK non-financial firms by year from 2004 to 2023. NWC corresponds to inventories plus receivables minus accounts payable.

Figure 5 reports the cross-sectional average and median NWC-to-sales ratio from 2004 to 2023. The decreasing time trends in average and median NWC-to-sales ratio are clearly apparent in Figure 5, although it has been on an upward trend for the last three years due to the impact of the pandemic. The yearly average (median) NWC-to-sales declined from 11% (10.8%) in 2004 to 8.3% (7.3%) in 2024. We also presented the cross-sectional standard deviation of the NWC-to-sales ratio per year in Figure 5. Firm heterogeneity in terms of NWC-to-sales ratio slightly increased (approximately 1%) throughout the sample period from 15.1% to 16%. Overall, a decline

in the NWC-to-sales ratio suggests that firms have become more efficient in managing working capital.

To determine if the time trend in the NWC-to-sales ratio from 2004 to 2023 is statistically significant, we perform a regression analysis with the NWC-to-sales ratio as the dependent variable and time, measured in years, as the independent variable. The coefficient on the time trend for the average NWC-to-sales ratio corresponds to a yearly decrease of –0.19% and has a p-value of 0.00. The R-square of the regression is 83%. The slope coefficient for the median NWC-to-sales indicates a yearly decrease of 0.26%. With a p-value of 0.00, this result is also statistically significant. Additionally, the R-squared value is 87.5%, demonstrating a *strong* decreasing time trend in the NWC-to-sales ratio over the sample period.

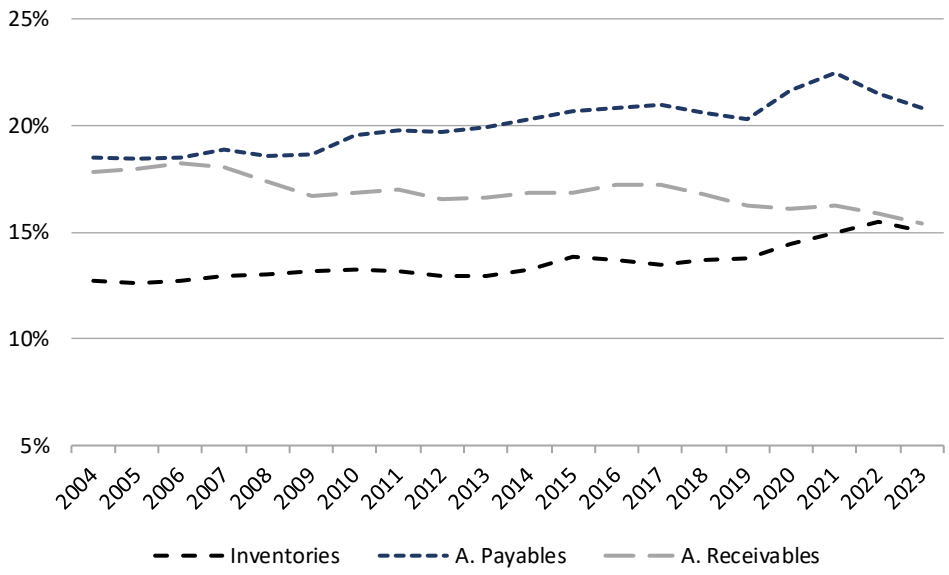


Figure 6 *- Yearly Time Series Average NWC Components*

Yearly average inventories, receivables, and accounts payable. This figure plots the cross-sectional mean values for inventories, receivables, and payables scaled by sales for Western European and UK companies by year from 2004 to 2023.

To analyze the downward trend in the NWC-to-sales ratio in more detail, each component was analyzed using time-series data scaled by their respective total sales. Figure 6, where the effects of the pandemic are more pronounced, shows that while average inventory remained almost flat until 2019, it started to increase with the onset of the pandemic. Additionally, while the ratio of accounts receivable continued to steadily decline, the ratio of accounts payable showed an upward trend, reaching a peak in 2021 due to the pandemic and then falling back to around 20%. The declining NWC-to-sales ratio is apparently achieved by stretching supplier credit and tightening trade credit over the years.

Unpublished findings show that the slope coefficients for the linear time trend are 0.12% for inventories, -0.11% for receivables, and 0.18% for payables. The three slope coefficients are

statistically significant with p-values 0.00. The corresponding R-squares are 81% for inventories, 74% for receivables, and 85% for payables.

We also conduct industry analyses to determine whether the downward trend in NWC over time, as shown in Figure 5, is widespread across various industries or limited to a specific subset of industries. We group firms into industries using GICS and exclude financial services, insurance, real estate, and banking sectors. For 20 industries, we report the median and cross-sectional standard deviation of the NWC-to-sales for the first (2004) and last year (2023) of our sampling method in Table 2. The distribution of the median and standard deviation suggests a high degree of heterogeneity in working capital practices across different industries. Using all 20 annual observations from 2004 to 2023, we regress both the median and the standard deviation of the NWC-to-sales ratio on a time trend with an intercept for each industry. The coefficient estimates for the time trend variables are presented in column 3 of Table 2. Regarding time trend evaluation through period, our regressions indicate that the time trend is negative for 18 industries out of 20 in total, and the slope coefficient is statistically significant for all industries apart from Pharmaceuticals and Biotech. & Life Sciences. However, only 4 industries out of 20 have a negative time trend coefficient for standard deviation, and again only one time trend coefficient is not statistically significant.

Table 2 *- Summary Statistics for NWC-to-sales by Industry*

The sample includes listed non-financial firms in Western Europe and the UK from LSEG Workspace for the period 2004–2023. For each industry/year in our sample period, we compute the median and standard deviation of the NWC-to-sales ratio. Columns 1–2 report the corresponding median and standard deviation for years the first and last year of our dataset. N denotes the number of observations. For each industry and using all the 20 yearly observations over the period 2004–2023, we regress the median (standard deviation) of the NWC-to-sales ratio on a linear time trend and report the slope coefficient in column 3. Slope coefficients in bold are statistically significant at the 5% (or lower) level.

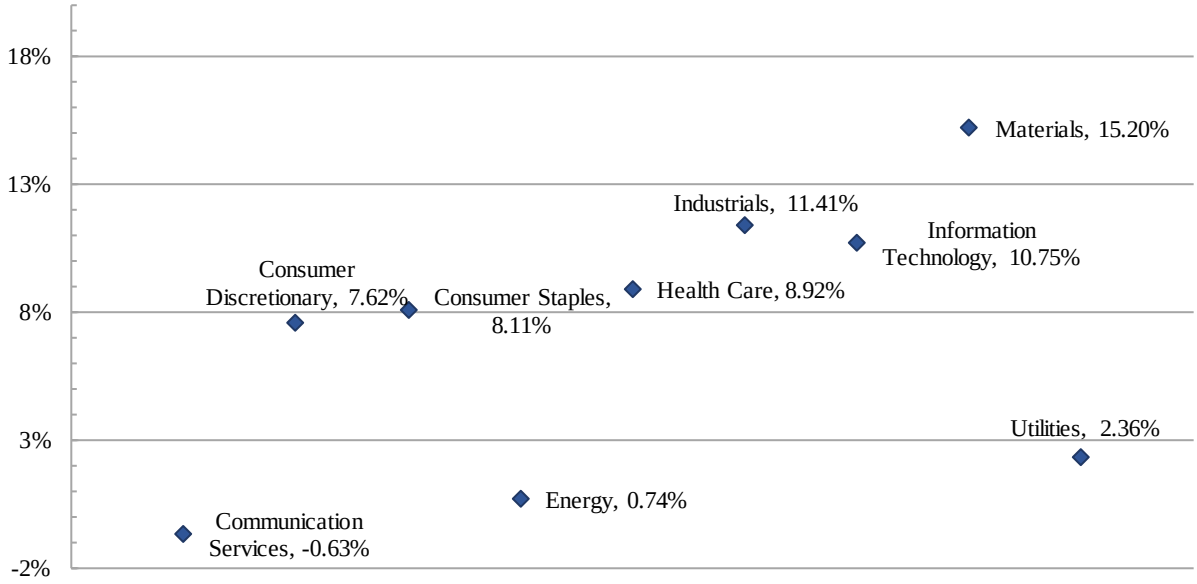
	(1)2004			(2)2023			(3) Time Trend	
	Median	St. Dev.	N	Median	St. Dev.	N	Median	St. Dev.
Automobiles & Components	14.1%	13.5%	26	11.3%	10.4%	41	**-0.0018**	**-0.0008**
Capital Goods	19.3%	12.7%	224	17.5%	14.4%	325	**-0.0017**	**0.0011**
Commercial & Professional Ser.	7.3%	12.3%	77	2.7%	12.1%	116	**-0.0022**	**0.0002**
Consumer Discretionary	5.7%	9.9%	40	4.6%	12.4%	86	**-0.0012**	**0.0010**
Consumer Durables & Apparel	22.5%	11.2%	73	19.6%	11.8%	89	**-0.0035**	**0.0009**
Consumer Services	-4.3%	8.4%	53	-10.5%	11.1%	91	**-0.0036**	**0.0015**
Consumer Staples	-2.2%	11.0%	18	-0.9%	12.0%	29	**-0.0006**	**0.0012**
Energy	1.1%	14.2%	39	1.8%	16.8%	85	**-0.0004**	**0.0011**
Food, Beverage & Tobacco	10.3%	13.4%	75	11.0%	13.9%	93	**-0.0012**	**0.0006**
Health Care Equipment & Serv.	16.4%	15.8%	61	9.9%	16.9%	112	**-0.0023**	**0.0012**
Household & Personal Products	17.4%	13.7%	11	8.1%	16.7%	22	**-0.0031**	0.0001
Materials	19.4%	12.8%	96	15.1%	14.2%	169	**-0.0026**	**0.0013**
Media & Entertainment	1.4%	14.8%	89	-2.5%	13.1%	136	**-0.0021**	**-0.0007**
Pharm., Biotech. & Life Sci.	4.4%	20.7%	62	2.7%	19.7%	126	0.0001	**-0.0002**
Semiconductors	23.9%	15.7%	20	25.0%	16.2%	36	**0.0006**	**0.0018**
Software & Services	8.3%	12.9%	113	2.0%	13.1%	183	**-0.0041**	**-0.0005**
Technology Hardware & Equip.	18.7%	14.2%	85	20.0%	15.3%	119	**-0.0001**	**0.0009**
Telecommunication Services	-0.1%	11.2%	12	-1.4%	11.1%	23	**-0.0021**	**0.0003**
Transportation	0.5%	13.0%	39	-3.3%	11.8%	51	**-0.0021**	**0.0008**
Utilities	4.7%	11.8%	31	3.0%	14.0%	46	**-0.0024**	**0.0009**

Table 2 justifies the decrease in NWC ratio is a common phenomenon across a large set of industries, and the heterogeneity in terms of working capital management through time has increased in most industries. The industries that experienced the most decline among others are Consumer Supplies, Health Care Services, and Household & Personal Products.

Figure 7, where we present the general tendency of the NWC ratio in terms of broader GICS Sector codes, is also useful for showing the differences across the industry. Companies operating in high capital-intensive sectors such as Energy and Utilities, and those with subscription-based predictable revenue models like Communication Services, tend to have lower NWC levels. In contrast, firms dealing with raw materials tend to lock up more working capital in their balance sheets due to the complexity of supply chain management and lead times.

***Figure 7** - Median NWC-to-sales Ratio by Main Sectors*

The sample includes listed non-financial firms in Western Europe and the UK from LSEG Workspace for the period 2004–2023. The companies are classified into broader sector groups based on their main sector names to illustrate the differences in NWC ratio between industries in terms of broader sector context.



Lastly, we perform country analysis in terms of median NWC-to-sales and standard deviation in Table 3. It also provides similar results to the industry analysis, showing that the decline in the NWC-to-sales ratio is a prominent feature across countries over 20 years. Regressions conducted in column 3 for the time trend show that all coefficients for both the median and standard deviation are statistically significant, while the heterogeneity among companies within each country has increased. Interestingly, the fact that the number of firms remained the same in Luxembourg and the NWC-to-sales ratio has significantly decreased indicates a declining trend independent of company composition.

Table 3 *- Summary Statistics for NWC-to-sales by Countries*

The sample includes listed non-financial firms in Western Europe and the UK from LSEG Workspace for the period 2004–2023. For each country/year in our sample period, we compute the median and standard deviation of the NWC-to-sales ratio. Columns 1–2 report the corresponding median and standard deviation for years the first and last year of our dataset. N denotes the number of observations. For each country and using all the 20 yearly observations over the period 2004–2023, we regress the median (standard deviation) of the NWC-to-sales ratio on a linear time trend and report the slope coefficient in column 3. Slope coefficients in bold are statistically significant at the 5% (or lower) level.

	(1)2004			(2)2023			(3) Time Trend	
	Median	St. Dev	N	Median	St. Dev	N	Median	St. Dev.
Austria	19.5%	11.0%	31	14.1%	13.9%	39	**-0.00208**	**0.00084**
Belgium	11.8%	12.8%	44	9.1%	14.7%	70	**-0.00169**	**0.00074**
France	10.8%	15.4%	317	7.9%	16.9%	434	**-0.00195**	**0.00056**
Germany	16.0%	14.3%	299	11.9%	14.3%	440	**-0.00200**	**0.00059**
Luxembourg	15.4%	6.3%	4	11.8%	6.3%	4	**-0.00163**	**0.00042**
Netherlands	9.4%	15.3%	41	7.9%	15.9%	70	**-0.00192**	**0.00064**
Switzerland	18.9%	15.0%	108	15.2%	15.4%	143	**-0.00157**	**0.00074**
United Kingdom	5.1%	14.6%	400	3.0%	16.1%	778	**-0.00199**	**0.00071**

3.2 Variable Definitions and Empirical Methods

3.3 Independent Variable of Interest

For each industry, the industry-mean adjusted NWC-to-sales ratio has been utilized as the main independent variable of interest, which allows us to control for industry effects that vary across industries as shown in Table 2 (see also, e.g., Hill et al., 2010; Aktas et al., 2015). To calculate excess NWC, we subtract the ratio of the median firm NWC-to-sales ratio from the ratio of a given firm in the corresponding industry and year and denote *excess NWC* throughout the paper. Excess NWC, whether positive or negative, is assumed to indicate over-investment (positive or more conservative NWC management) tied up in working capital, or under-investment (negative or more aggressive NWC management) used to finance long-term assets.

We assume that companies aim to attain a level of working capital management that aligns with the industry median, which is considered the standard benchmark for efficient operations within the industry. Therefore, by making such assumptions, we proceed with the fact that companies above this level would have positive excess NWC that a company over-invested in working capital. This type of company could be more efficient by adopting more aggressive working capital management (i.e. reducing inventory, tightening trade credit given to customers, or extending supplier credit). A negative excess of NWC indicates the company has already adopted an aggressive policy and reached the condition that risk outweighs the benefits of NWC due to potential stock-outs or customer dissatisfaction. A hypothetical company of this type could benefit from extending its working capital days by considering the findings on the U-shaped relationship and the suggested optimal level of NWC as identified by Baños-Caballero et al. (2014), Anton and Nucu (2021), and Aktas et al. (2015).

3.4 Dependent Variables

3.4.1 Market Value of Firm

The first and main dependent variable is excess stock return adjusted for firm size and market-to-book ratio as a measure of firm value performance. In line with Faulkender and Wang (2006), we define excess return at year t as the difference between the buy-and-hold return of sample firm i and the buy-and-hold return of a benchmark portfolio:

$$Excess\ Return_{i,t} = \prod_{t=1}^{T}(1 + R_{i,t}) - \prod_{t=1}^{T}(1 + R_{p,t}) \quad (1)$$

Faulkender and Wang (2006) provide the reasons in detail why the excess returns approach is superior to estimating stock performance than a market-to-book ratio. Kieschnick et al. (2013) and Aktas et al. (2015) leveraged this approach and used benchmark adjusted stock return where the benchmark return is the return of a size and book-to-market sorted portfolio based on twenty-five Fama-French value-weighted portfolios.

We also follow the same measure as a measure of stock performance and collect each given firm's yearly stock returns and subtract corresponding portfolio returns to compute excess return over a 1-year horizon. Since our sample data consists of Western European and UK companies, using the Fama-French value-weighted portfolio is challenging due to structural changes between the US and European markets.

Therefore, we construct our own benchmark portfolio based on the companies in the dataset by dividing the sample firms into quintiles based on their market capitalization and book-to-market ratio and calculating the average return for firms in the same size and book-to-market quintiles for each year.

$$\bar{R}_{i,j,t} = \frac{1}{N_{i,j,t}} \sum k \in (Q_{Size}, Q_{Bm}) R_{k,t} \quad (2)$$

where $N_{i,j,t}$ is the number of firms in quintile (i,j) in year t, and $R_{k,t}$ is the return of firm k in year t. $\bar{R}_{i,j,t}$ is the average return for the firms in the same size and book-to-market quintiles.

$$ER_{i,t} = R_{i,t} - \bar{R}_{i,j,t} \quad (3)$$

Finally, we subtract the average return for the corresponding quintile in year t ($\bar{R}_{i,j,t}$) from the firms' actual return in corresponding year t ($R_{i,t}$), which gives us our main dependent variable of interest, $ER_{i,t}$, as an excess return by a firm in year t.

Hypothesis 1: Converging the industry median NWC either by increasing (negative excess NWC) or decreasing (positive excess NWC) results in improved stock performance for a company.

We expect there is a negative relationship between stock performance and excess NWC. Reducing unnecessary short-term investments can create value by redirecting the freed-up cash to better NPV (Net Present Value) investments. Also, companies that apply an aggressive policy and additional

investment into their short-term investments can reduce risk levels and increase future sales by extending trade credit to the customers.

3.4.2 Investment Channel

Effectively managing working capital across companies of different sizes can reduce their dependence on external funding. By optimizing the utilization of current assets and liabilities, businesses can free up cash that would otherwise be tied up, allowing them to allocate these resources towards more productive investments or growth opportunities. This enhanced financial flexibility can lead to improved profitability and overall financial health for the business. We consider CAPEX, and cash acquisition as measures of total investments due to each variable yield long-term benefits to companies (Bates et al., 2009). The investment variables are scaled by total assets at the beginning of the period for each year. In the investment regressions, we use the change in investment as the dependent variable as Aktas et al. (2015), because in an efficient capital market, only the unanticipated component of investment is expected to correlate with superior stock performance (see, e.g., McConnell and Muscarella (1985)) and firms could smooth fixed investment in the short run with working capital (Fazzari & Petersen, 1993).

Hypothesis 2: Cash released from short-term investments is redirected to long-term investments.

Financially flexible firms have a greater ability to take advantage of investment opportunities. Therefore, we expect a decline in excess positive NWC to increase corporate investment. For firms already adopting aggressive policies with negative excess NWC, long-term assets are partly funded by working capital. Therefore, we do not expect a negative relationship between changes in NWC and corporate investment for these specific types of firms.

3.4.3 Operational Performance

For the operating performance test**,** we have selected ROA as a proxy for operational performance. Kieschnick et al. (2013) criticize the selection of ROA as a measure of operational performance, asserting that any potential increase in operational and firm value performance could be implied by the DuPont equation as indicated in Equations 4 and 5 below.

$$ROA = \frac{Net\ Income}{Sales}\ x\ \frac{Sales}{Total\ Assets} \qquad (4)$$

In this formula, the first component is called gross operating margin, and the second ratio is called asset turnover. The total assets include current and fixed assets. Thus, a company could improve its ROA by reducing working capital and, in turn, total assets, through asset turnover ratio.

$$ROE = ROA\ x\ \frac{Total\ Assets}{Equity} \qquad (5)$$

As the DuPont model further indicates, this increase in operational efficiency also boosts Return on Equity (ROE), and thus shareholder value, while holding the leverage component and assets per equity constant. Also Deloof, (2003) states that the fact that financial assets which are mainly shares in other firms, could be a significant part of total assets for firms, their operating activities

will contribute little to the overall return on assets and, therefore should not be a proxy for operational performance.

When it comes to short-term management, it's important to recognize its dynamic nature, as clearly indicated in the literature section. Therefore, a change in one component could potentially have an impact on others, such as sales and financial leverage. As Aktas et al. (2015) also indicate this argument, however, implies that the firm is able to keep its sales unaffected while decreasing its NWC. This is only possible if the firm had initially overinvested in NWC (i.e., above the optimum level). Otherwise, future sales and cash flows are likely to be affected by any non-optimal change in NWC.

In our ROA calculation, we already exclude potential financial and tax interactions by using EBITD instead of net income, and in our investment regressions, we include not only CAPEX but also business acquisitions. Therefore, a company can utilize its investments not just in fixed assets, but also in high NPV investment opportunities when they arise. For this reason, using ROA is preferred over using gross operational margin.

Hypothesis 3: Future operational performance is negatively related to excess NWC.

We state that future stock performance is expected to be negatively related to excess NWC due to undertaking additional investments. In turn, we expect that future operational performance is also negatively related to excess NWC, which could be a key factor underlying enhanced stock performance.

3.4.4 Risk Channel

Firm risk is a plausible alternative explanation for the increase in stock performance following a decrease in working capital. As an additional analysis to ensure that stock performance is not driven by increasing risk after changing excess NWC, we assess the risk channel on excess NWC as risk is measured by annualized standard deviation of daily stock returns (see also, e.g., Armstrong & Vashishtha (2012)).

Hypothesis 4: For companies with negative excess NWC, there is a negative relationship between firm risk and excess NWC due to already aggressive working capital policies.

Companies that follow an aggressive NWC policy are already at a risky level due to liquidity risk. Further deteriorating this deficiency will increase the risk even more, so a negative relationship between risk and excess NWC is expected for companies with negative excess NWC. However, for companies already above the industry average, we do not expect the same because we anticipate that reducing this level will increase efficiency rather than risk.

3.5 Summary Statistics of Variables

Table 4 reports summary statistics of variables. The mean firm has a 1-year excess return of -7.28%, while the median firm is -8.07%, which indicates a very minor left skew that data distributed nearly symmetrical. The 1-year ROA has a median value of 4.90% in our sample, while the mean value of 1.75%, indicating distribution of ROA is negatively skewed and many firms have weak operating profit or in trouble with operating losses. Our mean value of investment variables, CAPEX, and cash acquisition represent 5.31%, and 3.89%, of total assets, respectively. These two variables are positively skewed.

***Table 4** - Summary Statistics Variables*

This table provides summary statistics on sample firms. Variables marked with an asterisk (*) are dependent variables. Q1 and Q3 denote the first and third quartiles, respectively. The sample includes listed non-financial Western Europe and UK firms from LSEG Workspace for the period 2004–2023. Excess NWC is the industry-median-adjusted NWC-to-sales ratio. Variable definitions are provided in Appendix A. All euro values are in millions and adjusted by countries's respective consumer price indexes. N denotes the sample size. The last column shows the direction and magnitude of the skewness of the relevant variable.

Variable	Mean	Median	Q1	Q3	St. Dev.	N	Skewness
NWC-to-sales	9.00%	8.80%	-2.32%	20.72%	15.64%	34,382	-0.0091
Excess NWC	0.06%	0.00%	-8.79%	9.24%	13.52%	34,382	-0.0275
Excess Return*	-7.28%	-8.07%	-31.57%	15.49%	31.99%	35,713	0.1045
ROA*	1.75%	4.90%	-2.51%	9.70%	11.82%	37,575	-1.0036
CAPEX*	5.31%	4.02%	1.92%	7.55%	4.23%	32,189	0.9236
Business Acquisition*	3.89%	1.47%	0.30%	5.37%	5.02%	8,507	1.3732
R&D	6.32%	3.21%	1.05%	9.12%	7.11%	12,542	1.2797
Risk*	44.41%	37.78%	26.90%	57.13%	21.59%	35,689	0.8341
Total Assets	1087.86	135.87	22.86	982.30	1891.65	37,752	1.8344
Sales	992.78	149.31	21.43	988.50	1652.27	34,726	1.7488
Market Capitalization	940.97	124.24	22.82	857.90	1621.71	35,068	1.8224
Tobin's Q	1.60	1.28	0.95	1.99	0.86	37,752	1.0517
Cash Flow	6.52%	24.93%	-3.69%	75.04%	176.23%	34,228	-1.0022
Fixed Asset Growth	7.05%	0.47%	-10.69%	16.69%	28.63%	32,685	0.9680
Sales Growth	6.38%	4.01%	-5.62%	16.01%	18.09%	31,967	0.4641
Intangible Assets	20.96%	14.98%	3.89%	35.08%	18.95%	33,251	0.6532
Leverage	21.81%	19.95%	8.21%	33.13%	15.29%	32,142	0.3656
Age	20.20	12.00	2.00	25.00	26.23	47,820	2.1314
Book-to-market	0.68	0.55	0.28	0.98	0.49	34,532	0.7705
Cash Reserves	15%	10%	4%	21%	13%	37,260	0.9528
Sales Volatility	118%	21%	4%	122%	191%	33,303	1.7415
Financial Distress D.	28.57%	0.00%	0.00%	100%	45.17%	32,470	0.9484
Market Share	1.15%	0.75%	0.1%	0.44%	3.9%	34,726	1.7353

Cash flow has a mean of 6.52% significantly lower than its median of 24.93%, indicating a negative skew and potentially large negative outliers. The mean values for total assets, sales, and market capitalization are significantly higher than their medians, indicating the presence of outliers skewing the mean. Sales volatility has a standard deviation of 191%, showing high variability with some firms experiencing significant fluctuations.

3.6 Economic Specifications and Methods

The variation in NWC across firms may be a result of firm-specific unobservable factors, which, if correlated with the independent variables can cause estimation results to suffer from heterogeneity bias. Considering the panel data characteristics and the regressions of company-specific and industry-specific variables, we employ the fixed effects regression model to control for unobservable potential heterogeneity. This decision is further supported by the results of the Hausman test to detect endogenous predictor variables. The null hypothesis, which posits that the

coefficient vectors for fixed and random effects are equal, is rejected with a p-value of 0.000. This indicates that the fixed effects model is the preferred specification for these data.

Also, to enhance the reliability of the regressions, the correlation matrix of the independent variables can be found in Appendix B. We do not observe any correlations that would suggest that multicollinearity is an issue for our selected variables.

We study the impact of excess NWC on firm performance, including both stock and operating performance, and whether a potential investment channel drives performance regressions using the following fixed effects regression model: (see, e.g., Aktas et al., (2015)).

$$V_{i,t} = \alpha_i + \mu_t + \beta_1 \, Excess\ NWC_{i,t-1} + \beta_2 Controls_{i,t-1} + \acute{\varepsilon}_{i,t} \qquad (6)$$

Where V refers to the dependent variable that is either stock or operating performance or investment and α and μ refer to firm and year fixed effects respectively. A positive β_1 coefficient measures the increase in firm performance or investment associated with a one-unit increase in excess NWC across time. Conversely, a negative β_1 coefficient measures the increase in firm performance or investment associated with a one-unit decrease in excess NWC across time. Controls refer to a set of control variables known to affect firm performance or investment.

Equation 6, all right-hand size variables are lagged by one period to mitigate the concern that the relevant dependant variable is determined simultaneously in equilibrium and potential endogeneity concerns. In executing regression, we employ standard error clustering at the firm level in the statistical tests to mitigate heteroskedasticity and autocorrelation that might present within specific firms.

To examine whether the impact of excess NWC differs between being positive and negative, we construct an asymmetric model in Equation 7 that captures the effect of positive (negative) excess NWC on firm performance or investment channel to test the non-linear relationship between NWC and performance (see, e.g, Baños-Caballero et al., (2014); Aktas et al., (2015)). This allows us to separate companies with positive and negative excess NWC relative to the respective industries they operate in and examine their effects separately.

The considered specification is the following one (see, e.g., Aktas et al. (2015)) :

$$V_{i,t} = \alpha_i + \mu_t + (\beta_1 \, Excess\ NWC_{i,t-1} \ x\ D) + (\beta_2 Excess\ NWC_{i,t-1} \ x\ (1\text{-}D)) + \beta_3 Controls_{i,t-1} + \acute{\varepsilon}_{i,t} \qquad (7)$$

where D is a dummy variable that takes the value of one if the corresponding excess NWC is positive (indicating abnormally high cash tied up in net working capital), and zero otherwise (indicating negative excess NWC relative to the respective year-industry median).

Our firm performance and investment channel regressions rely on firm-specific control variables known for determining net working capital levels (see, Determinants of Working Capital). We deploy sales volatility, sales growth rate, operating cash flow, and financial distress dummy variables following Hill et al. (2010). Damadoran (2012) argues that older companies require less net working capital for each unit sale. Unlike Aktas et al. (2015), the company age is calculated based on the founding date instead of the initial public offering year. Bates et al. (2009) argue that market share is a critical determinant that allows for competitive advantage through economies of

scale and provides greater negotiating power as well as substitution effect between cash and working capital is documented.

Moreover, we take into account the possible effects of market value as a proxy for firm size, leverage Banos-Caballero et al. (2010), Chiou and Cheng (2006), risk, and intangible assets Coles et al. (2008) in performance regressions. In the investment regressions in addition to some control variables stated below, we include Tobin's Q as a proxy for growth opportunities (Aktas et al., 2015).

Since their omission could raise concerns about omitted variable bias, we include them in our regressions to enhance the reliability of regression results. Variable definitions are presented in Appendix A, and summary statistics are presented in Table 4.

3.7 Preliminary Analysis

Table 5 reports the average and median values of our dependent and control variables for subsamples based on the sign of the excess NWC assigned by dummy variables specified in Equation 7. For each variable, the last two columns display the p-values from the test of mean and median differences between negative and positive excess NWC subsamples, respectively.

As shown in Table 5, firms with negative excess NWC experienced slightly better stock performance compared to firms with positive excess NWC. There are no significant differences between firms in ROA, CAPEX, and engaging with business acquisition. Sales volatility figures validate that firms react to sales volatility by managing NWC more aggressively consistent with Hill et al. (2010), and Deloof and Jeger (1996) as figures larger for negative excess firms.

Firms with a negative excess NWC are mostly older, with an average company age of 24.5 years compared to 18 years for others. They are larger in terms of sales, fixed assets, intangible assets, and market capitalization, and have relatively more market power in terms of market share, as intuitively expected from the bigger and older firms. Additionally, they are less risky with a risk indicator of 43% compared to 41% for others, and are less likely to experience financial distress. These firms also tend to hold more cash reserves and are able to generate more cash flow. They tend to undertake more R&D investments as well as slightly higher growth opportunities, which is almost opposite to what was found by Aktas et al. (2015), who showed firms with negative excess NWC are smaller, younger, and slightly riskier compared to the companies with positive excess NWC. Also,

On the other hand, companies with a positive excess in NWC are viewed as less mature, having lower cash flow, and a higher risk of financial distress, reflecting more growth-stage company characteristics. The investors also value this group of companies lower compared to the other group of companies (see for example Tobin's Q and market-to-book ratios). This indicates that more effective NWC management is crucial for these companies to survive, presenting an opportunity to improve performance and differentiate themselves from their counterparts.

In a nutshell, Table 5 highlights notable differences in firm characteristics between the two subgroups (positive versus negative excess NWC). Therefore, it is important to factor in these characteristics when conducting the multivariate analyses.

Table 5 - *Sample Characteristics of Positive and Negative Excess NWC*

This table compares the sample characteristics of firms with negative and positive excess NWC. The sample includes listed non-financial firms from Western Europe and the UK from LSEG Workspace for the period 2004–2023. Excess NWC is the industry-median-adjusted NWC-to-sales ratio. Variable definitions are provided in Appendix A. For each variable, the last two columns display the p-values from a test of mean differences and the Mann-Whitney test for median differences between negative and positive excess NWC subsamples, respectively.

Variable	Positive Excess NWC (D=1)		Negative Excess NWC (D=0)		p-value pos. ex. & neg. ex.	
	Mean	Median	Mean	Median	Mean	Median
NWC-to-sales	19.97%	20.67%	-1.82%	-1.49%	0.0000	0.0000
Excess NWC	11.03%	9.31%	-10.78%	-8.72%	0.0000	0.0000
Excess Return	-7.07%	-7.83%	-7.55%	-8.41%	0.0820	0.1387
ROA	1.75%	4.81%	1.75%	4.99%	0.5177	0.2694
CAPEX	5.29%	4.05%	5.34%	3.99%	0.8722	0.3797
Business Acquisition	3.88%	1.54%	3.90%	1.41%	0.5763	0.5814
Risk	45.03%	38.16%	43.61%	37.32%	0.0000	0.0000
Total Assets	947.50	120.77	1253.87	156.52	0.0000	0.0000
Sales	910.84	162.26	1075.34	133.24	0.0000	0.0000
Market Cap.	849.82	104.52	1052.87	152.73	0.0000	0.0000
Tobin's Q	1.58	1.27	1.62	1.31	0.0000	0.0000
R&D	5.89%	3.24%	6.85%	3.15%	0.0000	0.5426
Cash Flow	4.06%	23.29%	9.23%	26.44%	0.0067	0.0000
Fixed Asset G.	7.07%	0.68%	7.03%	0.25%	0.9145	0.0257
Sales Growth	6.11%	4.06%	6.67%	3.96%	0.0054	0.5836
Intangible Assets	19.59%	13.17%	22.51%	17.78%	0.0000	0.0000
Leverage	21.40%	19.62%	22.27%	20.40%	0.0000	0.0000
Age	17.93	9.00	24.47	16.00	0.0000	0.0000
Book-to-market	0.72	0.59	0.64	0.50	0.0000	0.0000
Cash Reserves	14%	10%	15%	11%	0.0000	0.0000
Sales Volatility	103%	19%	133%	23%	0.0000	0.0000
Financial Distress D.	29.59%	0.00%	27.66%	0.00%	0.0000	0.0000
Market Share	0.41%	0.08%	0.46%	0.07%	0.0000	0.0000

4. EMPIRICAL ANALYSIS

This section is organized as follows: First, we examine the relationship between excess NWC and stock performance as a proxy for firm value. Next, we assess whether corporate investment serves as a potential channel through which a decrease or increase in excessive NWC directs resources into investments. We then investigate whether the cash released or tied up following changes in excessive NWC and corporate investments affects operating performance. Lastly, we will conduct a sanity check to determine if potential performance results are driven by the risk channel.

4.1 NWC and Stock Performance

Table 6 presents the results of stock performance regressions based on Equation 6 and Equation 7, with and without controlling variables in order. The dependent variable is the adjusted excess return specified in Equation 3. All the independent variables are lagged by one year, and regressions include firm and year fixed effects. The variable of interest is excess NWC, which reflects the deviation of the firm's NWC level from the industry mean in year t. Columns 1 and 2 report the linear model that focuses on all excess NWC without considering whether the excess NWC is tied up or if the NWC level is below the industry mean. Columns 3 and 4 analyze the relationship by separating the excess NWC level into over-investment (D=1) and under-investment (D=0), examining each segment individually.

The relationship between excess NWC and stock performance is negative in both columns 1 and 2 and statistically significant at conventional levels. Nevertheless, these results do not apply to every company. A company already below the industry average that follows an aggressive NWC management policy is expected to face increased risk and decreased performance if it further reduces its NWC level. To capture this, we apply the non-linear regression models presented in columns 3 and column 4, including two interaction variables to distinguish companies with positive excess NWC (Excess NWC_{t-1} x D) and negative excess NWC (Excess NWC_{t-1} x (1-D)) as Equation 7.

The results in column 4 indicate that a decrease in excess NWC in the previous year increases stock performance in the subsequent year only for companies that have already over-invested in NWC. For firms with negative excess NWC, it is the increase in excess NWC that is associated with increasing stock performance in the subsequent year. The coefficient estimates of the first interaction term (D=1) and the second interaction term are both statistically significant with values of -0.578 (p-value = 0.000) and 0.0105 (p-value = 0.000), respectively. The economic effects of regressions are quite strong: a one within-firm standard deviation decrease (increase) in positive (negative) excess NWC is associated with an increase of 4.23% (0.08%) in excess stock return over the next period.

Regarding control variables, firm size, leverage, cash reserves, risk, cash flow, sales growth, and dummy financial distress are statistically significant at conventional levels. Excess return decreases with firm size and leverage and firm age as consistent with the literature. Stock performance is positively associated with risk, cash flow generation, cash reserves, and tangible and intangible asset growth, as one would expect.

***Table 6** - Excess Net Working Capital and Stock Performance*

This table reports the fixed effect stock performance regressions. The dependent variable is the adjusted return in year t. The independent variables are lagged by one period. Columns 1–2 report the estimation of the linear model specified in Equation 6, and columns 3–4 the estimation of the asymmetric model specified with dummy variable in Equation 7. Excess NWC is the industry-median-adjusted NWC. D is a dummy variable that takes a value of one if the corresponding excess NWC is positive, and zero otherwise. Variable definitions are provided in Appendix A. Standard errors are robust and clustered at the firm level.

Variable	(1)		(2)		(3)		(4)	
	Coef.	P-value	Coef.	P-value	Coef.	P-value	Coef.	P-value
Excess NWC_{t-1}	-6.245	0.013	-10.398	0.002				
Excess NWC_{t-1} x D					0.0254	0.026	-0.536	0.000
Excess NWC_{t-1} x (1-D)					0.0091	0.001	0.010	0.000
Firm Size			-14.339	0.000			-14.402	0.000
Intangible Assets			0.306	0.946			1.180	0.797
Leverage			-9.346	0.553			-9.571	0.042
Age			-0.833	0.082			-0.833	0.082
R&D			-22.230	0.180			-19.261	0.239
Risk			7.657	0,039			7.423	0.045
Fixed Asset Growth			-0.003	0.998			0.057	0.970
Cash Reserves			11.374	0.037			12.908	0.017
Sales Volatility			-0.007	0,094			-0.007	0.096
Cash Flow			1.703	0.000			1.6848	0.000
Sales Growth			-5.035	0.042			-5.1771	0.036
Market Share			-3.345	0.135			-3.016	0.174
Financial Distress D.			-3.843	0.008			-3.764	0.009
Firm & Year Fixed Ef.	Yes		Yes		Yes		Yes	
Adjusted R-squared	0.0251		0.091		0.026		0.093	
Fisher Statistic	25.4	0.000	18.46	0.000	25.19	0.000	19.17	0.000
Number of Observation	30,347		8,191		30,347		8,191	

The data presented in column 4 suggests the existence of an optimal level of working capital that aligns with Aktas et al. (2015) and Baños-Caballero et al. (2014), and firms converge that level (either by reducing or increasing NWC) increase their stock performance substantially, especially apparent for firms with excess positive NWC.

4.2 NWC and Investment Channel

The stock performance regressions indicate that companies that can lower their excess NWC tend to see an improvement in their stock performance. Conversely, for companies with insufficient investment in working capital, an increase in NWC results in better performance. In this subsection, we primarily aim to explore whether corporate investment serves as a possible mechanism that enables a company to invest more after releasing unnecessary cash tied up in NWC.

With the improvement of NWC, the reduction in funds available for daily activities and the decreased use of revolving credit by companies are expected to make the company more financially flexible in both the short and long term. Therefore, it is anticipated that companies will invest more as a result of the decrease in unnecessary NWC. In Table 7, the change in investment

variables are incorporated into Equation 7. All independent variables are lagged by one period and all regression include year and firm fixed effects. In column 1, we analyze total corporate investment as the dependent variable. We then apply the same regression models, selecting the dependent variable as a component of it specifically as CAPEX in column 2 and cash business acquisition in column 3.

In Column 1, the coefficient estimate for positive excess NWC is -0.0009 (p-value = 0.000), and for negative excess NWC, it is 0.00002 (p-value = 0.000). It is crucial to emphasize that, as evidenced by the regression results in Table 7, the coefficients of the investment regressions align with those in the stock performance regression in Table 6. Additionally, in the CAPEX regression, the negative excess NWC is not statistically significant, while other regressions' dependent variable coefficients are significant. In an economic sense, a one within-firm standard deviation decrease in excess NWC is associated with an increase of 0.60% in the unanticipated component of corporate investment (relative to total assets) over the next period which corresponds to €13.2 million for an average firm in our data sample.

Chan et al. (2001) find that R&D investments significantly positively impact firm market valuation, indicating that investors value these expenditures as they are perceived to contribute to future growth and innovation. An unreported regression was performed by including R&D expenses in the total investment regression (Column 1) due to the long-term yield effects of R&D, particularly for technology-oriented companies such as pharmaceutical and technology industries that require high R&D expenses to maintain their competitiveness. Both p-values for excess NWC dummy variables were found to be insignificant when combining R&D into corporate investment regression. Similarly, in the regression of excess NWC on change in R&D expenses alone, the p-values were estimated also insignificant. It is possible that differences in reporting standards could disrupt the data, so it is decided to exclude it as a dependent variable in the investment regressions.

When considering regressions of individual components of corporate investments, companies with unusually high levels of NWC are releasing this cash and using it for CAPEX (with a coefficient of -0.00062 and a p-value of 0.004) and cash acquisitions (with a coefficient of -0.29250 and a p-value of 0.015). Notably, it is noteworthy that this ratio is particularly high for company acquisitions. These results demonstrate that investments are potentially funded by cutting NWC investments for firms that have abnormally higher NWC investments. The findings are strongly supported by the sample characteristics, revealing that companies with positive excess NWC are typically younger, smaller, and hold fewer assets compared to the other group of companies. Smaller companies face challenges accessing external capital, especially in financial distress, leading them to rely more on internally generated funds for investments.

To sum up, a firm with over-investment in NWC increases stock performance and investments by reducing unnecessary cash tied up in day-to-day business. Nevertheless, whether the increase in firm value (stock performance) results from improved operating performance—via the channel of investments—or increased risk will be examined in subsequent sections.

Table 7 - *Excess Net Working Capital and Investment Channel*

The table shows the results of the fixed effects investment regressions with the asymmetric model specified in Equation 7. We define corporate investment as the sum of CAPEX and cash acquisitions, divided by total assets at the beginning of the period. In column (1), the dependent variable is the change in investment. In column (2), the dependent variable is the change in CAPEX. In column (3), the dependent variable is the change in cash acquisition. The independent variables are lagged by one period with respect to the dependent variables. D is a dummy variable taking value one if the corresponding excess NWC is positive and 0 otherwise. Variable definitions are provided in Appendix A. Standard errors are robust and clustered at the firm level.

Variable	(1) Change in Investment		(2) Change in CAPEX		(3) Change in Acquisition	
	Coef.	P-value	Coef.	P-value	Coef.	P-value
Excess NWC_{t-1} x D	-0.00091	0.000	-0.00062	0.004	-0.29250	0.015
Excess NWC_{t-1} x (1-D)	0.00002	0.000	0.00000	0.842	0.00124	0.000
Firm Size	-0.01528	0.000	-0.00752	0.000	-0.05626	0.000
Leverage	-0.08558	0.000	-0.02299	0.000	-0.47069	0.000
Risk	0.00132	0.620	-0.00289	0.410	0.05495	0.631
Cash Reserves	0.08749	0.000	0.02817	0.000	0.25579	0.007
Sales Volatility	0.00000	0.487	0.00000	0.655	0.00006	0.174
Sales Growth	-0.03086	0.000	-0.00830	0.001	-0.16404	0.000
Age	-0.00078	0.155	-0.00083	0.002	-0.00290	0.413
R&D	-0.15046	0.000	-0.08850	0.000	-0.92410	0.002
Cash Flow	0.00134	0.058	0.00036	0.446	-0.01503	0.055
Tobin Q	0.03707	0.000	0.01778	0.000	0.15732	0.000
Financial Distress D.	-0.0059	0.005	-0.0069	0.000	.0.0341	0.155
Firm & Year Fixed Effects	Yes		Yes		Yes	
Adjusted R-squared	0.0787		0.0538		0.1214	
Fisher Statistic	16.15	0.000	14.58	0.000	97.92	0.000
Number of Observations	8,740		8,731		2,039	

4.3 NWC and Operating Performance

Table 8 reports the regression of operating performance. In previous regressions, it has been estimated that the next year's firm value (stock performance) and annual change in corporate investments have an inverse relationship with companies holding unnecessary NWC. If this is the case, additional investment should boost operating performance, and the increased stock performance is expected to arise from improved operating performance, as measured by ROA in our regression.

In column 1, our linear model estimates that there is a negative relation between excess NWC and operational performance, which is almost statistically significant at the 5% level, aligning with the literature. For positive and negative excess NWC, the coefficients in column 2 are -0.0822 and 0.0292, respectively, with only the p-value for positive excess NWC being significant. The economic effect is quite strong for firms that have abnormally high cash tied up in NWC. A one-within-firm standard deviation decrease in excess NWC is associated with an increase of 4.54% in ROA over the next year.

***Table 8** - Excess Net Working Capital and Operating Performance*

This table reports the fixed effects operating performance regressions. The dependent variable is the ROA in year t. The independent variables are lagged by one period with respect to the dependent variables. Column 1 reports the estimation of the linear model in Equation 6, column 2 is the estimation of the asymmetric model in Equation 7. D is a dummy variable taking value one if the corresponding excess NWC is positive (i.e., firms with abnormally high levels of cash tied up in NWC) and 0 otherwise. Variable definitions are provided in Appendix A. Standard errors are robust and clustered at the firm level.

Variable	(1)		(2)	
	Coef.	P-value	Coef.	P-value
Excess NWC_{t-1}	-0.0321	0.053		
Excess NWC_{t-1} x D			-0.0822	0.002
Excess NWC_{t-1} x (1-D)			0.0292	0.290
Firm Size	0.0071	0.000	0.0072	0.000
Leverage	-0.0066	0.600	-0.0069	0.578
Risk	-0.0270	0.000	-0.0264	0.000
Cash Reserves	-0.0231	0.161	-0.0250	0.125
Sales Volatility	-0.00001	0.044	-0.0001	0.056
Sales Growth	0.0324	0.000	0.0314	0.000
Age	0.0015	0.312	0.0015	0.294
R&D	-0.1794	0.000	-0.1704	0.002
Cash Flow	0.0108	0.000	0.0083	0.000
Fixed Assets	0.0021	0.553	0.0020	0.557
Intangible Assets	-0.0228	0.114	-0.0218	0.135
Market Share	-0.0043	0.530	-0.0051	0.460
Financial Distress D.	-0.0319	0.000	-0.0317	0.000
Firm & Year Fixed Effects	Yes		Yes	
Adjusted R-squared	0.076		0.072	
Fisher Statistic	11.80	0.000	11.61	0.000
Number of Observations	8,131		8,131	

These results indicate that a decrease in unnecessary NWC increases stock performance and operational performance over subsequent periods *only* for firms that have positive excess NWC, which is different from the findings of Aktas et al. (2015). However, for companies with negative excess NWC, although investing to address the working capital deficiency positively impacts stock performance and annual changes in investments, it has not been proven to significantly improve operational profitability. Considering the characteristics of companies with negative excess NWC, shown in Table 5, these companies are relatively larger and have more market power. Therefore, it can be inferred that these companies, already having greater capital access, do not see any positive impact on their operational profitability from additional NWC investments, rather they take advantage of their size and power and maintain lower NWC compared to their industries.

In conclusion, the operational performance regression indicates that companies with abnormally high NWC experience improved stock performance due to the reduction of unnecessary working capital. This reduction allows for increased investments and, consequently, leads to enhanced operational profitability that results in improved stock performance. However, for companies with a deficiency in NWC, increased profitability was not found to be an explanatory factor for increased stock performance.

4.4 NWC and Firm Risk

Firm-specific risk might be a reasonable alternative factor explaining the increase in stock performance following a reduction in working capital (Fama & French, 1993; Goyal & Santa-Clara, 2003). To assess if the risk channel affects our performance, we analyze the relationship between firm risk and excess NWC, and other controlling variables that could affect firm risk, and the results are presented in Table 9.

***Table 9** - Excess Net Working Capital and Firm Risk*

This table presents the fixed effects of firm risk regressions. The firm risk, which is defined as the annualized standard deviation of firm daily returns in year t, is the selected dependent variable. The independent variables are lagged by one period with respect to the dependent variables. Column 1 reports the estimation of the linear model in Equation 6, and column 2 the estimation of the asymmetric model in Equation 7. Excess NWC is the industry-median-adjusted NWC. D is a dummy variable taking value one if the corresponding excess NWC is positive (i.e., firms with abnormally high levels of cash tied up in NWC) and 0 otherwise. Variable definitions are provided in Appendix A. Standard errors are robust and clustered at the firm level.

Variable	(1)		(2)	
	Coef.	P-value	Coef.	P-value
Excess NWC_{t-1}	-0.0443	0.009		
Excess NWC_{t-1} x D			0.0180	0.522
Excess NWC_{t-1} x (1-D)			-0.1082	0.001
Firm Size	-0.00001	0.000	-0.00001	0.000
Leverage	0.1387	0.000	0.1222	0.000
Cash Reserves	-0.0801	0.000	-0.0807	0.000
Sales Volatility	0.0001	0.000	0.0001	0.000
Sales Growth	-0.0152	0.019	-0.0139	0.032
Age	0.0056	0.002	0.0057	0.000
Book-to-market	0.0271	0.000	0.0273	0.000
Cash Flow	-0.0065	0.000	-0.0037	0.002
Financial Distress Dummy	0.0394	0.000	0.0389	0.000
Firm & Year Fixed Effects	Yes		Yes	
Adjusted R-squared	0.2621		0.2626	
Fisher Statistic	143.11	0.000	138.04	0.000
Number of Observations	21,053		21,053	

In column 1, the linear model indicates that excess NWC is negatively related to firm risk, demonstrating that aggressive NWC management leads to an increase in firm risk in the subsequent year as expected from the insights from the literature. For firms with positive excess NWC, decreasing NWC level by adopting aggressive management does not lead to increasing firm risk due to the insignificance of the dummy variable (p-value = 0.522). This result *eliminates* the possibility of risk channel as a potential driver of increasing performance for the firms with positive excess NWC in the case of releasing cash. On the other hand, there is a statistically significant negative relationship (p-value = 0.001) between firms with negative excess NWC and firm risk, which validates the prior literature that aggressive WCM results in higher firm risk. Putting it differently, it means that additional investment to compensate for the deficiency in NWC reduces firm risk, which might lead to increased stock performance, and vice versa.

5. ROBUSTNESS CHECK

In our primary regression models, our main variable is based on the industry median, representing the optimal NWC that firms in the same industries strive to achieve. Companies below and above this threshold are categorized as having excess NWC (negative and positive, respectively). In this subsection, we conduct a regression-based approach to determine the excess NWC and stick to the same regression models specified in Equation 7. To estimate excess NWC, we adopt a two-stage procedure. We first calculate a firm's NWC-to-sales ratio using linear regression for each year, following Hill et al. (2010). The determinants of the regression include sales volatility, sales growth, operating cash flow, age, and a dummy variable for financial distress. The variable definitions are in Appendix A.

The NWC-to-sales ratio is regressed on these determinants separately for each industry and year, ensuring that our procedure implicitly controls for industry and year effects. We exclude the first year's regressions (2004) due to insufficient observations for each industry's regressions, which are classified by GICS as before. In total, we have 19 years and 20 industries, leading to 380 industry/year regressions for our first-stage estimations. The first-stage regressions have an average adjusted R^2 of 23.59%, and the average Fisher statistic is 2.57, indicating that on average the considered regression model fits the data sufficiently well.

For each firm in a given year, the excess NWC is calculated as the residual from the first-stage regression, specified as the difference between the NWC-to-sales ratio and its predicted value. This residual represents the unnecessary cash tied up in working capital. Given that observed excess NWC is derived from the first-stage statistical procedure, estimation errors at the first stage might have an impact on the validity of inferences drawn in the second stage (Aktas et al., 2015). Therefore, we standardize the excess NWC by its standard error and use the standardized excess NWC as an independent variable in Table 10. The reasons for standardizing are as follows: First, we aim to minimize the impact of estimation errors from the initial regression. Second, we prioritize statistically significant excess NWC values to enhance the reliability of inference. Third, we aim to stabilize variance across observations, reducing heteroskedasticity. Lastly, we seek to improve the validity and reliability of the estimations.

Panel A reports the performance regressions while Panel B presents the investment regressions to demonstrate whether there are potential investment channels that pave the way for enhancing firm performance. Positive excess NWC is negatively related in all regressions as expected and validates the results of Table 6, Table 7, and Table 8, except for the change in CAPEX regression in Panel B, where the coefficient is insignificant.

Negative excess NWC coefficients show that addressing the shortage in NWC by investing in short-term assets does not lead to any stock or operating performance improvements (statistically insignificant for both and opposite signs), but has a positive effect on corporate investments in Panel B. In Panel A, we used the linear model presented in Equation 6 to confirm the initial findings, although the results are not reported here. Leveraging the two-stage procedure again, excess NWC is found negatively associated with both 1-year excess return (-0.002, p-value = 0.000 and adjusted R^2 = 0.06) and ROA as a proxy for operating performance (-0.008, p-value =0.001 and adjusted R^2 = 0.058), which provides results that support our previous findings.

***Table 10** - Regression-based Excess Net Working Capital Tests*

We adopt a two-stage method for the regression-based tests. We first estimate the firm's working capital needs using variables given to affect the NWC-to-sales ratio (first stage). Then, we use first-stage estimations for each industry/year regressions in stock and operating performance (Panel A), and investment (Panel B) regressions for the residual from the first stage as a measure of the firm's excess NWC (second stage). The table reports the second-stage regressions with all right-hand side variables lagged by one period. The excess NWC is calculated by dividing the excess NWC by its standard error. D is a dummy variable identifying positive excess NWC and 0 otherwise. Variable definitions are provided in Appendix A. Firm size represents the log value of sales (see, also Deloof (2003)). Standard errors are robust and clustered at the firm level.

Panel A. Performance Regressions

Variable	Stock Performance		Operating Performance	
	Coef.	p-value	Coef.	p-value
Stand. Excess NWC_{t-1} x D	-0.244	0.044	-0.014	0.000
Stand. Excess NWC_{t-1} x (1-D)	-0.117	0.360	0.001	0.875
Firm Size	-8.052	0.000	0.015	0.001
Intangible Assets	1.125	0.797	-0.017	0.247
Leverage	4.271	0.339	-0.040	0.002
Age	-0.134	0.767	0.696	0.533
R&D	-38.996	0.033	-0.194	0.001
Risk	13.620	0.000	-0.046	0.000
Fixed Asset Growth	-4.597	0.004	0.009	0.015
Cash Reserves	-1.309	0.807	0.006	0.696
Firm & Year Fixed Effects	Yes		Yes	
Adjusted R-squared	0.0224		0.0604	
Fischer Statistics	6.19	0.000	9.29	
Number of Observations	8,227		8,168	

Panel B. Investment Regressions

Variable	Change in Investment		Change in CAPEX		Change in Acquisition	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
Stand. Excess NWC_{t-1} x D	-0.003	0.001	-0.000	0.607	-0.055	0.037
Stand. Excess NWC_{t-1} x (1-D)	0.003	0.013	0.002	0.014	0.225	0.285
Firm Size	-0.006	0.000	-0.004	0.000	0.514	0.341
Leverage	-0.058	0.000	-0.023	0.000	-0.627	0.054
Risk	0.000	0.879	0.000	0.877	-0.063	0.458
Tobin's Q	0.010	0.000	0.005	0.000	0.031	0.526
Cash Flow	0.000	0.247	0.000	0.536	0.008	0.600
Sales Growth	-0.033	0.000	-0.011	0.000	-0.391	0.040
Cash Reserves	0.070	0.000	0.022	0.000	0.637	0.057
Age	0.000	0.207	-0.001	0.014	0.009	0.691
Firm & Year Fixed Effects	Yes		Yes		Yes	
Adjusted R-squared	0.050		0.0316		0.010	
Fischer Statistics	26.03	0.000	19.630		2.380	
Number of Observations	20,531		20,515		4,537	

6. CONCLUSION

This study complements previous research on the impact of short-term asset and liability management, WCM, on stock performance, corporate investments, and operational efficiency. While previous studies' examination of this relationship provides particular one-way outcomes, either NWC on profitability or firm value, we provide comprehensive evidence of the channel between WCM, firm value, change in long-term investment decisions, and operational performance using a sample over 20 years between 2004 and 2023 in Western Europe and UK firms. Employing fixed effect of estimations, we document that firms that have invested above the industry median level of NWC, experience an improvement in stock and operating performance subsequent year following the adoption of a more aggressive policy. We reveal that corporate investment is a channel through which leads to superior firm performance for the same classified firms, implying that efficient WCM redeploys underutilized resources to pursue higher NPV projects so as to create value for the firm. We eliminate the possibility of the results being driven by increasing firm risk following decreasing NWC by conducting an additional model.

However, we do not find any significant evidence on optimal NWC level that balances costs and benefits and maximizes the firm's value similar to previous studies by Baños-Caballero et al. (2014) and Aktas et al. (2015). The fact that firms' low levels of NWC indicates that instead of liquidity concerns, these firms, in general, strategically manage their short-term assets aggressively as a policy to leverage their existing market power and size considering the characteristics of the respective firms in the data set. Therefore, we fail to find a piece of evidence on the optimal level of NWC which leads to higher performance by increasing investment in working capital.

Several implications of our study may be relevant for corporate policies, managers, and practitioners. Corporate managers should emphasize the management of working capital not only during times when the cost of capital begins to rise or amid macroeconomic instability but also to get ahead and gain an advantage over their competitors in the industry. As mentioned, short-term policy decisions are central to the daily operations of business and can affect other areas of financial management. Therefore, the potential impacts and interaction of WCM should be taken into account in corporate policy formulations. Additionally, the importance of WCM should not be overlooked by practitioners focusing on business valuations when it comes to forecasting future trajectories.

We suggest that future research should explore the effects of WCM on firm value in other areas of financial management, such as dividend policy. Additionally, investigating WCM practices in relation to strategic considerations would be beneficial for future literature.

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8. APPENDIX

Appendix A – Variable Definitions

Variable	***Definition***
NWC	Net Operating Working Capital (Inventory + Receivables – Payables)
NWC-to-sales Ratio	NWC scaled by sales.
Excess NWC	NWC-to-sales minus the industry median of the NWC-to-sales ratio in the corresponding year. We used the companies in our dataset to calculate the industry mean by GICS industry classification.
CAPEX	Capital expenditure is scaled by total assets at the beginning of the period.
Cash Acquisition	Cash acquisition, scaled by total assets at the beginning of the period.
R&D	Research and development expense to total assets, computed as in Coles et al. (2008)
Total Investment	CAPEX + Cash Acquisition, scaled by total assets at the beginning of the period.
Risk	The standard deviation of daily stock returns. Annualized standard deviation is used in the regression analysis.
Leverage	Total debt, scaled by total assets.
Sales Growth	One-year growth rate of sales at time t+1: $(Sales_{t+1} – Sales_t)/(Sales_t)$
Book-to-Market	The book value of the equity is divided by the market value of the equity.
Market Value of Equity	Market value of the firm's equity at the end of the corresponding year. The regressions use the log of the variable.
Firm Size	Log value of market capitalization.
Financial Distress Dummy	Following Hill et al. (2010), a firm is considered financially distressed if the firm has difficulty in covering interest expenses. EBITD (Earnings before interest, tax, and depreciation) is below one in two consecutive years, or below 0.80 in any given year.
Operational Cash Flow	Operating cash flow scaled by lagged fixed assets.
1-Year ROA	Operating Income before depreciation (EBITD) divided by total assets.
1-year Excess Return	Excess stock return based on benchmark portfolio created by book-to-market and size criteria see Equation 3.
Cash Reserves	Cash and cash equivalents scaled by total assets.
Sales Volatility	Following Hill et al. (2010), sales volatility for a given year is the standard deviation of a firm's annual sales over the previous five-year period. Firm-year observations are included in the sample for a given year if the firm has at least three observations during the previous five-year period.
Intangible Assets	Intangible assets, scaled by total assets
Market Value of Equity	Market value of the firm’s equity at the end of the period. The regression uses the log of the variable.

Tobin's Q	The market value of equity plus total assets minus the book value of equity, divided by total assets
Age	Establishment dates of companies. The regression uses unit years and a log of the variable.
Fixed Asset Growth	The one-year growth rate of fixed assets (PP&E) at time t.
Market Share	The proportion of a company's total sales within the industry for the given year. ($Sales_t$ / Total Industry $Sales_t$) * 100

Appendix B – Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Excess NWC	1.00																
2	Firm Size	-0.01	1.00															
3	Intangible Assets	-0.08	0.10	1.00														
4	Leverage	-0.07	0.12	0.04	1.00													
5	R&D	-0.11	-0.23	-0.01	-0.14	1.00												
6	Risk	-0.11	-0.39	-0.03	0.03	0.25	1.00											
7	Fixed Assets	0.00	-0.02	0.05	-0.05	0.08	0.01	1.00										
8	Cash Reserves	-0.16	-0.24	-0.18	-0.25	0.43	0.24	0.07	1.00									
9	Sales Volatility	-0.05	0.82	0.04	0.17	-0.29	-0.30	-0.07	-0.28	1.00								
10	Cash Flow	0.14	0.17	0.16	-0.08	-0.25	-0.29	-0.01	-0.15	0.12	1.00							
11	Sales Growth	0.03	-0.01	0.04	-0.07	0.11	-0.02	0.22	0.08	-0.05	0.02	1.00						
12	Age	0.06	0.11	-0.13	0.00	-0.22	-0.18	-0.06	-0.16	0.13	0.08	-0.08	1.00					
13	Financial Distress	-0.16	-0.29	-0.01	0.00	0.35	0.44	0.04	0.30	-0.25	-0.48	0.00	-0.18	1.00				
14	Tobin Q	-0.05	0.11	0.04	-0.13	0.38	0.01	0.14	0.33	-0.15	-0.03	0.19	-0.10	0.08	1.00			
15	Book-to-market	0.08	-0.19	-0.08	0.00	-0.25	0.09	-0.11	-0.20	0.03	0.00	-0.15	0.05	0.02	-0.76	1.00		
16	Positive Excess NWC	0.05	0.02	0.00	0.02	-0.07	-0.03	-0.05	-0.06	0.02	0.07	0.04	0.01	-0.05	-0.02	0.02	1.00	
17	Negative Excess NWC	0.13	-0.03	0.02	-0.02	0.06	0.04	0.02	0.04	-0.04	-0.05	-0.02	-0.01	0.07	0.02	-0.01	0.00	1.00