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Do Factors Affecting Firms' Cash Holdings Differ Across Sectors?: Evidence from Türkiye

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ABSTRACT

This paper explores whether the factors influencing firms' cash holdings vary across different sectors, such as (i) basic materials, (ii) consumer cyclicals, (iii) consumer non-cyclicals, (iv) energy, (v) healthcare, (vi) industrials, (vii) real estate, (viii) technology, and (ix) utilities. Firm-level factors encompass market-to-book ratio, size, cash flow, net working capital, capital expenditures, leverage, cash flow volatility, R&D expenses, and dividend payment. External factors include periods of economic uncertainty, that is, times of financial crisis. The paper's dataset includes 385 firms listed on Borsa Istanbul, Türkiye and 4,375 firm-year observations from 2001 to 2022. Data analysis is conducted using the Driscoll-Kraay robust standard errors panel data estimation method, which ensures unbiased and consistent results despite heteroscedasticity, autocorrelation, and cross-sectional dependence. The findings indicate that variables such as cash flow, net working capital, capital expenditures, leverage, R&D expenses, and dividends are key determinants shaping cash holding behavior in firms within Türkiye as a developing country, regardless of the sector in which these firms operate. In times of economic uncertainty, firms tend to increase their cash reserves. Moreover, the impact of the firm size and market-to-book ratio on cash holding levels varies across different sectors. In conclusion, although some factors have a consistent impact across various sectors, sector-level analyses reveal unique characteristics and dynamics within each sector that shape the factors influencing firms' cash management strategies.

Keywords: Cash Holdings, Cash Reserves, Cash Management, Sectoral Differences, Panel Data Analysis.

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INTRODUCTION

Businesses generate and develop all kinds of strategies to make profits and grow; however, how companies handle their existing cash and maintain it within the firm is an important consideration. Studying these aspects provides deeper insights into the internal and external operational processes of companies. The management of cash flow and the factors that determine cash reserves are critical for any company. These aspects vary across companies due to their unique characteristics and over time for different reasons.

In perfectly frictionless capital markets, the decision to hold cash is irrelevant, as companies can readily obtain funds at minimal costs, but the practical challenges and complexities encountered in real-world scenarios render these policies both relevant and insightful (Jia and McMahon, 2019). When aligning cash holding policies to the real world, extensive literature discusses various cash holding theories such as free cash flow and pecking order, along with various motives, including transaction, precautionary, and speculative reasons, which often yield conflicting results and make it challenging to generalize about cash holding determinants (Aftab, Javid, & Akhter, 2018).

Numerous papers have explored the factors determining cash holdings (i.e., Gounopoulos and Zhang, 2024; Opler, Pinkowitz, Stulz, & Williamson, 1999; Seifert and Gonenc, 2018). In particular, the specific context of a firm's sector has emerged as a crucial determinant of its cash holding decisions (i.e., Fukuda, 2018; Lee, 2024; MacKay and Phillips, 2005; Schoubben and Hulle, 2012). For instance, MacKay and Phillips (2005) demonstrate that industrial differences significantly affect firms' financial structures and, consequently, their cash holding strategies. Moreover, in the literature, the factors influencing cash holdings have been investigated independently across different sectors, such as: basic materials (Widiastuti, 2023), energy (Zafar, 2021), healthcare and technology (Li and Luo, 2020), sports and leisure (Dimitropoulos and Koronios, 2021), and tourism

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and hospitality (Zhang and Gao, 2023). Consequently, understanding sector-specific cash holding patterns is essential for developing tailored cash management strategies that align with the unique financial demands of each sector.

This paper aims to explore the factors that determine cash holdings of firms across various sectors listed on Borsa Istanbul (BIST), Türkiye. It addresses a gap in the existing literature by examining and comparing the determinants of cash-holding levels across different sectors, highlighting both commonalities and distinctions, as well as the unique dynamics of each sector in influencing cash-holding decisions. This approach provides significant value by examining how internal factors influence cash holdings at both aggregate and sectoral levels. Additionally, studying changes in cash-holding behavior during uncertain times improves our understanding of how firms adapt in crises. By identifying factors shaping cash-holding behavior across sectors, the paper offers insights on how businesses can adjust their financial strategies to sector-specific dynamics, ensuring alignment with broader risk management objectives. Sector-specific dynamics like market competition and innovation intensity influence company-specific cash-holding needs, and firms must design financial strategies accordingly. Considering these factors helps businesses build resilience and maintain stability amidst uncertainty, ensuring sustained competitiveness.

We rely on firms the listed on BIST and use a dataset that includes 385 firms and 4,375 firm-year observations from 2001 to 2022. To identify the most appropriate estimation model for our dataset, we first conduct specification tests for panel data models. The next step is testing the empirical model for autocorrelation, heteroskedasticity, and cross-sectional dependence. To address these problems and ensure the consistency and accuracy of the results, the paper utilizes the Driscoll-Kraay robust standard errors method for panel data estimation. Driscoll-Kraay is robust toward problems such as autocorrelation and heteroskedasticity and delivers consistent estimates under the existence of cross-sectional dependencies (Hoechle, 2007). This approach ensures reliable results despite the aforementioned issues in the model's error terms.

The findings from the overall sample reveal that firms in Türkiye generally show increased cash holding levels with higher market-to-book ratios, cash flow, R&D expenditures, and dividends. In contrast, increased levels of working capital, capital expenditures, and leverage are generally associated with lower cash holdings. Moreover, the findings reveal that while certain factors impacting firms' cash holding strategies vary by sector, most of the

other factors exert a uniform influence, such as cash flow, net working capital, capital expenditures, leverage, R&D expenses, and dividends, on cash holding strategies across various sectors. Specifically, during a crisis period characterized by heightened economic uncertainties and risks, firms augmented their cash reserves to maintain operational activities and manage unforeseen expenses. This behavior signifies a strategy to mitigate liquidity risks amid crises. The rise in cash reserves during the pandemic illustrates firms' efforts to preserve financial stability and enhance operational flexibility. As a result, this paper makes significant contributions to the existing literature through an in-depth examination of the factors influencing cash holding behaviors and the variations across different sectors.

Following the introduction, the second section of the paper presents the conceptual framework and theoretical background. The third section outlines the research methodology and introduces the panel data analysis approach. In the fourth section, the results are presented and discussed in relation to existing literature. The fifth section offers key insights drawn from the research.

LITERATURE REVIEW

Integrating effective cash management practices into a firm's strategy enhances its competitive edge. Firms with well-managed cash flows can invest in innovation, expand their market presence, and respond swiftly to competitive pressures. This financial agility creates a sustainable competitive advantage, enabling firms to outperform rivals and secure long-term success. Therefore, effective cash management is not merely a financial function but a strategic tool essential to driving a firm's overall success. Effective cash management enables not only the successful implementation of strategic actions but also adapts to the different challenges and opportunities arising in varied sectoral environments (MacKay and Phillips, 2005; Schoubben and Hulle, 2012). The characteristics of innovation and the level of market competition determine a firm's cash requirements and payment practices. The extent of innovation efficiency, intensity of competition, and structure of the sectors will influence the cash balance of the firms. Lyandres and Palazzo (2016) indicate that a firm's ideal level of cash reserves is influenced by the anticipated intensity of competitive pressures it faces within its respective industries. Additionally, Morellec, Nikolov, & Zucchi (2013) highlight that competition in the product market has a substantial influence on a company's decisions regarding cash reserves and financing strategies, leading to higher cash reserves and more frequent equity issues in highly competitive markets.

Schoubben and Hulle, (2012) argue that a firm's position within its sector and its competitive environment are significant factors influencing its cash holding decisions. Lee (2024) posits that firms facing industry-wide shocks are more likely to increase their cash reserves as a precautionary measure. This insight is based on research into asset sales and market liquidity, which sheds light on the economic mechanisms driving this phenomenon. Fukuda (2018) suggests that cash holding ratios differ not only based on firm-specific characteristics but also across various sectors. For instance, the research indicates that service industries tend to have higher cash holding ratios. This trend may be attributed to the labor-intensive nature of these industries, which necessitates maintaining substantial working capital to cover employees salaries. This consistent requirement for liquidity ensures that firms can meet payroll obligations without interruption, thus maintaining operational stability.

MacKay and Phillips (2005) show that industrial differences significantly affect firms' financial structures and, consequently, their cash holding strategies. According to researchers, firms shape their financial structures and cash management strategies based on the dynamics of the sector they operate in. Lee (2024) supposes that literature examines how sectoral dynamics influence financial policy and finds that a firm's strategies, including those related to cash holdings, are shaped by its interactions with other companies in its industry. The researcher also mentions that companies facing high product market competition and increased industry cash-flow volatility, reflecting the general risk level of the sector, tend to have higher cash balances. These companies increase their cash reserves to mitigate predation risk.

In sum, sector-specific dynamics may be key determinants of firms' cash management practices and their general operational efficiency. For instance, an entity operating in a very competitive sector could face pricing pressures that squeeze its profit margins, possibly resulting in lower cash flow and hence a run-down in its cash holding. In the same way, technological changes or supply chain disturbances of any sector may result in facing cash flow problems and even complicate cash management. The explanation of these factors within a cash management framework is crucial for the structuring of adequate strategies. Competition intensity in a sector, technological progress, regulation frameworks, and other elements about specific sectors can have a significant influence on cash flows in a company and even lead to liquidity risks.

METHODOLOGY

Sample and Variables

In this paper, the determinants of cash holding behaviors across various sectors are analyzed utilizing financial statement data. The data, which encompass firms from nine distinct sectors excluding the financial sector, are sourced from the LSEG Eikon database. Sectoral classifications are conducted in accordance with the LSEG The Reference Data Business Classification (TRBC). The companies are classified into the following sectors: (i) basic materials, (ii) consumer cyclicals, (iii) consumer non-cyclicals, (iv) energy, (v) healthcare, (vi) industrials, (vii) real estate, (viii) technology, and (ix) utilities. After excluding observations with missing data, it comprises a total of 385 firms and 4,375 firm-year observations for the period from 2001 to 2022. To minimize the influence of outliers, each variable is winsorized at the 5th percentile for lower outliers and at the 95th percentile for upper outliers. The detailed definitions of the variables used in the paper are shown in Table 1.

Table 1: Variables Definitions

Variables	Definitions
CASH	Cash Ratio = Cash and Cash Equivalents / Total Assets
MB	Market-to-Book Ratio = (Total Assets - Equity + Market Value) / Total Assets
SIZE	Size = Natural logarithm of total assets
CASH FLOW	Cash Flow = (Net income + Depreciation) / Total Assets
NWC	Net Working Capital = (Current Assets – Cash and Cash Equivalents – Short Term Liabilities) / Total Assets
CAPEX	Capital Expenditures = Capital Expenditures / Total Assets
LEVERAGE	Leverage = Total Liabilities / Total Assets
CF_VOL	Cash Flow Volatility = The absolute difference between the percentage change in CASH FLOW from the previous year and the average of this change by firm
R&D	R&D Investment Ratio = Research and Development Expenses / Total Sales
DIVIDEND	Dividend Status = 1 for firms paying cash dividends, 0 otherwise
CRISIS_2008	Global Financial Crisis Indicator = 1 for the year 2008, 0 for other years
CRISIS_COVID	Pandemic Crisis Indicator = 1 for the years 2020 and 2021, 0 for other years

Descriptive Statistics

Table 2 presents the changes in the number of observations and mean of cash over the years. There is a consistent upward trend in the number of observations from 2001 (12 observations) to 2022 (351 observations). This steady growth indicates an expanding market presence. The cash mean values exhibit some fluctuations over the years: In the early 2000s, the cash mean hovers around 0.1. A noticeable increase occurs in 2020, with the cash mean reaching 0.130, followed by 0.140 in 2021. The significant rise in cash mean, particularly after 2019, could suggest a response to economic uncertainties, increased market volatility, or a strategic shift towards higher liquidity for risk management. This steady increase indicates a substantial change in cash holding behavior among businesses.

Table 3 presents the sample distribution by sectors. The majority of observations are from the consumer cyclicals sector (26.6%), followed by basic materials (20.3%) and consumer non-cyclicals (14.1%). Sectors such as energy and healthcare have fewer observations, with 2.67% and 2.00% respectively. However, the energy sector has the highest average cash percentage at 0.182. The healthcare sector follows with an average cash percentage of 0.132. Consumer cyclicals and consumer non-cyclicals sectors have the lowest cash means at 0.087 and 0.078 respectively. This data suggests that while some sectors have a larger sample size, others, though smaller in sample size, might have higher average cash holdings. This distribution highlights the need to understand sector-specific financial characteristics and liquidity preferences.

Table 4 presents the mean, standard deviation, median, and other statistical metrics for the variables, providing a comprehensive overview of the financial standing of the sample firms. The average cash ratio is 0.104, suggesting that, on average, firms maintain approximately 10% of their assets in cash. The average MB ratio is 1.485, suggesting that firms are generally valued above their book value by the market. The average firm size is 19.93, with a wide range (16.42 to 23.05) demonstrating heterogeneity in firm sizes. The mean cash flow ratio is 8%, which reveals that while some firms incur cash outflow (with a minimum value of -8.7%), others report significantly high cash inflow ratios. The average net working capital is 6.3%. The range from -24.7% to 41.0% shows that some firms have negative working capital, indicating they might be using liabilities to finance their operations. The average investment rate is 4.6%, indicating that firms typically allocate a small portion of their assets to investments. Firms with

Table 2. Sample Distribution by Years

Years	Number of Obs.	%	CASH Mean
2001	12	0.27	0.196
2002	28	0.64	0.108
2003	54	1.23	0.086
2004	61	1.39	0.079
2005	156	3.57	0.093
2006	167	3.82	0.095
2007	169	3.86	0.099
2008	169	3.86	0.097
2009	172	3.93	0.107
2010	185	4.23	0.111
2011	202	4.62	0.108
2012	230	5.26	0.096
2013	245	5.6	0.096
2014	257	5.87	0.096
2015	261	5.97	0.103
2016	261	5.97	0.083
2017	263	6.01	0.085
2018	269	6.15	0.089
2019	271	6.19	0.101
2020	275	6.29	0.131
2021	317	7.25	0.140
2022	351	8.02	0.127

Table 3. Sample Distribution by Sectors

Years	Number of Obs.	%	CASH Mean
Basic Materials	892	20.39	0.110
Consumer Cyclicals	1,164	26.61	0.087
Consumer Non-Cyclicals	620	14.17	0.078
Energy	117	2.67	0.182
Healthcare	88	2.01	0.132
Industrials	644	14.72	0.121
Real Estate	434	9.92	0.104
Technology	270	6.17	0.155
Utilities	146	3.34	0.073

higher investments might hold less cash. The average leverage ratio is 21%, indicating a preference among firms for using other sources over debt. The average cash flow volatility is 2.040, with a high standard deviation indicating significant differences in cash flow volatility across firms. Additionally, research and development expenditures are notably low, with an average of 0.2%, highlighting that most firms dedicate minimal resources to R&D. The average dividend is 37.1%, with a median of zero, suggesting that many firms do not pay dividends.

Table 4. Descriptive Statistics

Variables	Number of Obs.	Mean	St. Deviation	Median	Minimum	Maximum
CASH	4,375	0.104	0.108	0.066	0.001	0.393
MB	4,375	1.485	0.838	1.197	0.583	3.798
SIZE	4,375	19.93	1.75	19.80	16.42	23.05
CASH FLOW	4,375	0.086	0.102	0.071	-0.087	0.380
NWC	4,375	0.063	0.171	0.046	-0.247	0.410
CAPEX	4,375	0.046	0.049	0.030	0.000	0.189
LEVERAGE	4,375	0.208	0.179	0.179	0.000	0.579
CF_VOL	4,375	2.040	2.711	0.983	0.065	10.72
R&D	4,375	0.002	0.004	0.000	0.000	0.017
DIVIDEND	4,375	0.371	0.483	0.000	0.000	1.000

Table 5. Correlation Matrix

		1	2	3	4	5	6	7	8	9	10
CASH	**1**	1.00									
MB	**2**	0.22***	1.00								
SIZE	**3**	0.12***	-0.10	1.00							
CASH FLOW	**4**	0.35***	0.33***	0.18***	1.00						
NWC	**5**	-0.05***	0.04**	-0.27***	0.18***	1.00					
CAPEX	**6**	0.01	0.18***	0.07**	0.17***	-0.09***	1.00				
LEVERAGE	**7**	-0.23***	-0.14***	0.22***	-0.32***	-0.38***	0.14***	1.00			
CF_VOL	**8**	-0.11***	-0.06***	-0.16***	-0.15***	-0.04***	-0.04***	0.05***	1.00		
R&D	**9**	0.08***	0.03***	0.03*	0.11***	0.12***	0.10***	-0.07***	-0.09***	1.00	
DIVIDEND	**10**	0.19***	0.03***	0.33***	0.27***	0.05***	0.05*	-0.11***	-0.25***	-0.01	1.00

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 5 presents the pairwise correlation coefficients among the variables. Upon examining the relationship between the dependent variable (cash) and the independent variables, it is observed that cash exhibits a positive and significant correlation with MB, size, cash flow, dividend payments, and R&D. This implies that an increase in these variables corresponds to an increase in cash holdings. Conversely, cash demonstrates a negative and statistically significant correlation with leverage, net working capital, and cash flow volatility, suggesting that increases in these variables are linked to a reduction in cash holdings. The correlation coefficient between capital expenditures and cash is not statistically significant, indicating no meaningful relationship between these two variables. Finally, since there is no high correlation coefficient (±0.50) among the independent variables, concerns regarding multicollinearity, a potential issue in multivariate analyses, are not present.

Econometric Approach

To analyze the determinants of cash holdings among firms listed on BIST across different sectors, the paper incorporates the variables used by Opler et al. (1999). In their seminal work, Opler et al. (1999) analyze the factors that determine corporate cash holdings. Drawing upon established theoretical models like transaction costs, information asymmetries, agency costs, financing hierarchy theory, and precautionary motives, the study provides empirical evidence that variables such as the market-to-book ratio, size, cash flow, net working capital, capital expenditures, leverage, cash flow volatility, R&D expenses, and dividend payment significantly influence corporate cash holding decisions. Following Opler et al. (1999), these variables are incorporated into the empirical model as firm-level determinants of cash reserves. Furthermore, the model also considers crises as a key factor influencing corporate cash holding decisions. To achieve this, dummy variables representing specific crisis periods, such as the 2008 global financial crisis

and the COVID-19 crisis, have been incorporated. These variables are coded as 1 during crisis years and 0 in non-crisis years. Financial crises typically create environments of increased uncertainty, restricted access to capital markets, and a heightened precautionary stance among firms. Therefore, during such crises, companies are expected to hold more cash (Lozano and Yaman, 2020). By adding these dummy variables, the model not only facilitates the analysis of the impact of financial crises but also allows for a more precise evaluation of the influence of other determinants, addressing a significant gap identified in the study by Opler et al. (1999).

The model is as follows:

$$CASH_{it} = \alpha + \beta_1 MB_{it} + \beta_2 SIZE_{it} + \beta_3 CASH\ FLOW_{it} + \beta_4 NWC_{it} + \beta_5 CAPEX_{it}$$
$$+ \beta_6 LEVERAGE_{it} + \beta_7 CF\_VOL_{it} + \beta_8 R\&D_{it} + \beta_9 DIVIDEND_{it}$$
$$+ \beta_{10} CRISIS\_2008_{it} + \beta_{11} CRISIS\_COVID_{it} + \varepsilon_{it}$$

In the model, the indices i and t represent firms and years, respectively. ε_{it} is the error term. The detailed definitions of model variables are shown in Table 1.

The data are analyzed using panel data analysis. Panel data analysis involves the simultaneous examination of cross-sectional observations (countries, regions, firms, etc.) and time series data. In panel data analysis, it is crucial to first determine whether to use the classical-pooled model, random effects model, or fixed effects model. As in other econometric models, assumptions about the error terms are essential for the interpretation of regression coefficients in panel data analysis. This method considers deviations associated with both time series and cross-sectional analyses.

Tables 6 and 7 provide the results of the estimation model determination tests and the validity of the underlying assumptions tests conducted on the full sample, without sector-specific analyses. Given the comparison of the significance and direction of the coefficients for the independent variables in the research model across different sector samples, it is deemed more appropriate to apply the estimation model and robust standard errors method identified from the findings in Tables 6 and 7 consistently across all sub-samples.

Table 6 presents the test statistics applied to determine the most suitable panel data model for the dataset. The results of the F (Chow) test indicate that fixed effects are significant in this model, with an F value of 10.51 and a p-value of 0.000. The Breusch-Pagan LM Test, which examines the presence of random effects in the model, shows that random effects could be significant in the model, with an χ^2 value of 5746 and a p-value of 0.000. However, the Hausman test results indicate that the fixed effects model is more suitable than the random effects model, with a χ^2 value of 71.7 and a p-value of 0.000.

Table 7 presents the results of tests conducted to assess the validity of the assumptions underlying the fixed effects panel data estimation model. Wooldridge Panel Data Autocorrelation Test reveals the presence of autocorrelation within the model, with an F value of 156.98 and a p-value of 0.000. The Modified Wald Test indicates that there is heteroscedasticity problem in the model, with a χ^2 value of 4.0e+34 and a p-value of 0.000. Furthermore, the Pesaran Cross-Sectional Dependence Test reveals the presence of dependence amongst residuals of cross-sectional units, showing cross-sectional dependence, with a CD value of 376.7 and a p-value of 0.000. Overall, these tests show the presence of cross-sectional dependence, heteroskedasticity, and autocorrelation. Using the Driscoll-Kraay robust standard errors technique corrects these problems and retrieves unbiased and consistent estimators. Hoechle (2007) pointed out that the method of Driscoll-Kraay adjusts the estimated standard errors by considering cross-sectional dependence, heteroskedasticity, and autocorrelation. The standard errors of the estimated regression coefficients are thus calculated in a more reliable manner, whereby this enhances the robustness and reliability of the analysis results.

Consequently, the data analysis is conducted using a fixed effects panel data estimation model, and the standard errors are adjusted by the Driscoll-Kraay method, which is robust to potential issues of cross-sectional dependence, heteroskedasticity, and autocorrelation.

FINDINGS

The first column of Table 8 includes all publicly traded non-financial sector firms without sectoral differentiation. Subsequently, panel data analysis is conducted on sub-samples of firms across different sectors.

Initially, the coefficient estimates of the variables within the full sample are discussed as follows to ascertain whether the results align with theoretical expectations and prior research findings:

Market-to-Book Ratio: The coefficient for the *MB* variable is 0.003, with a t-statistic of 1.94. This coefficient indicates that as the market value/book value ratio increases, firms tend to hold more cash. This implies that firms with higher market value/book value ratios prefer to maintain larger cash reserves, potentially for future investment opportunities or operational needs. Opler et al. (1999) argue that higher market-to-book ratios lead to

Table 6. Panel Data Estimation Model Determination Tests

Test	F-Value	P>|z|	χ2	P>|z|	χ2	P>|z|	Decision
F (Chow) Test	10.51	0.000					Fixed Effect
Breusch-Pagan LM Test			5746	0.000			Random Effect
Hausman Test					71.70	0.000	Fixed Effect

Table 7. Test of Assumptions of Fixed Effects Panel Data Estimation Model

Test	F-Value	P>|z|	χ2	P>|z|	CD Value	P>|z|
Wooldridge Panel Data Autocorrelation Test	156.98	0.000				
Modified Wald Test for Heteroscedasticity			4.0e+34	0.000		
Pesaran Cross-Sectional Dependence Test					376.7	0.000

larger cash reserves due to higher potential costs from financial distress. Additionally, these firms' significant and intermittent investment activities necessitate maintaining larger cash reserves to cover these expenditures. This finding is consistent with previous studies (Gounopoulos and Zhang, 2024; Opler et al., 1999; Ozkan and Ozkan, 2004).

Size: The coefficient for the *SIZE* variable is -0.002, with a t-statistic of -0.93. The coefficient is not statistically significant; however, it exhibits a negative sign. It is frequently noted in the literature that larger firms generally have access to more resources, leading to lower cash holding ratios (Gounopoulos and Zhang, 2024; Opler et al., 1999; Seifert and Gonenc, 2018).

Cash Flow: The coefficient for the *CASH FLOW* variable is 0.185, with a t-statistic of 11.56. This coefficient indicates that as a firm's cash flow increases, its cash holding ratio also increases. Companies with strong cash flow generally keep larger cash reserves to improve their liquidity and take advantage of unexpected opportunities. Additionally, they may allocate more cash for investment and operational needs. This finding is consistent with prior studies (Gounopoulos and Zhang, 2024; Seifert and Gonenc, 2018; Opler et al., 1999).

Net Working Capital: The coefficient for the *NWC* variable is -0.157, with a t-statistic of -12.65. This finding indicates that an increase in working capital leads to a decrease in the cash holding ratio. Higher working capital implies that firms may need to hold less cash to meet operational needs (Dimitropoulos and Koronios, 2021). This finding is consistent with prior research (Gounopoulos and Zhang, 2024; Seifert and Gonenc, 2018; Opler et al., 1999).

Capital Expenditures: The coefficient for the *CAPEX* variable is -0.159, with a t-statistic of -4.10. This finding indicates that an increase in capital expenditures results in a reduction of the cash holding ratio. Capital expenditure pertains to the allocation of financial resources for the acquisition of fixed assets. This allocation can diminish the liquidity position of a corporation. This finding is consistent with previous research (Gounopoulos and Zhang, 2024; Seifert and Gonenc, 2018).

Leverage: The coefficient for the *LEVERAGE* variable is -0.092, with a t-statistic of -6.63. This finding indicates that an increase in leverage results in a reduction of the cash holding ratio. Firms with high leverage ratios generally hold less cash to meet their debt obligations. Moreover, firms may rely on alternatives such as borrowing to manage cash shortfalls, as leverage indicates their debt issuance capability. Higher debt financing increases the cost of liquidity investments, leading to reduced cash holdings (Ozkan and Ozkan, 2004). This implies that leverage negatively affects cash holdings aligning with previous studies (Gounopoulos and Zhang, 2024; Opler et al., 1999; Seifert and Gonenc, 2018).

Cash Flow Volatility: The coefficient for the *CF_VOL* variable is -0.000, with a t-statistic of -0.55. The coefficient is not statistically significant. Opler et al. (1999), Ozkan and Ozkan (2004), and Seifert and Gonenc (2018) determined that cash flow volatility has a positive effect on cash holdings. Currently, there is no empirical evidence to support the claim that Turkish firms with more volatile cash flows hold higher levels of cash reserves.

R&D Investment Ratio: The coefficient for the *R&D* variable is 0.618, with a t-statistic of 2.59. This coefficient indicates that as a firm's R&D spending increases, its cash holding ratio also increases. Opler et al. (1999) argue that firms with significant R&D expenses are expected to have higher financial distress costs due to information asymmetries, as a result, these firms are likely to hold more liquid assets. This finding is consistent with prior studies (Seifert and Gonenc, 2018; Opler et al., 1999).

Dividend Status: The coefficient for the *DIVIDEND* variable is 0.015, with a t-statistic of 2.11. This coefficient suggests that firms distributing dividends possess greater cash holdings compared to their non-dividend-paying counterparts. This could indicate that dividend-paying companies are either in more robust financial positions or are adopting a more conservative approach to cash management. A study by Jia and McMahon (2019) suggested that higher dividend payouts lead firms to retain more cash, which aligns with the precautionary motive for maintaining cash reserves. However, this finding is not aligned with some prior studies (Seifert and Gonenc, 2018; Opler et al., 1999).

Crises: The coefficient for the *CRISIS_2008* variable is 0.002, with a t-statistic of 0.64, indicating no significant effect on the cash holding ratio. While the coefficient for the *CRISIS_COVID* variable is 0.023, with a t-statistic of 7.84, indicating that the COVID-19 crisis led to an increase in the cash holding ratio. Uncertainty compels firms to augment their cash reserves as a precautionary strategy, ensuring sufficient liquidity to support continuous operations and sustain investments (Lozano and Yaman, 2020). This finding is consistent with previous studies (Lozano and Yaman, 2020).

Afterwards, Table 9 is constructed to facilitate a more granular analysis of the sectoral variations initially presented in Table 8. Table 9 provides a comprehensive overview of the findings from the full sample and individual sectors. As illustrated in the table, the factors affecting cash holding levels exhibit some variation across sectors. The economic significance of certain variables shifts from positive to negative or vice versa, while the statistical significance of other variables changes from significant to insignificant or vice versa, when compared to the overall sample and findings from previous studies. This variation underscores the dynamics and market conditions of each sector and their influence on firms' cash management strategies. The most notable findings can be explained as follows:

Firstly, the market-to-book value of assets serves as an indicator of future investment opportunities. When these opportunities are projected to be profitable, companies are inclined to increase their cash reserves to fulfill forthcoming investment requirements (Purnamasari and Fitdiarini, 2016). Consequently, a positive impact on cash holdings is anticipated. However, unlike this expectation, the market-to-book ratio negatively affects cash holdings in the consumer non-cyclical, healthcare, technology and utilities sectors. In other sectors, this effect is either positive or statistically insignificant. Li and Luo (2020) posit that companies within the healthcare and technology sectors encounter heightened industry competition, leading to a substantial increase in their investments in new products and services to enhance their competitive edge. In these sectors, firms invest their cash reserves in remaining competitive in a highly competitive environment. When the market-to-book value increases, firms may be less enthusiastic about holding more cash reserves and prefer to use such resources to increase their edge above competitors rather than wait for another possible investment in the future. Furthermore, firms with higher growth opportunities in consumer non-cyclical and utility sectors may be able to benefit from economies of scale and superior access to capital, explaining the negative relation.

Secondly, in the full-sample analysis, it is observed that the size of a firm does not have a statistically significant impact on its cash holding levels in Türkiye. Literature often relates to the argument that larger firms usually enjoy more resources and, thus, have lower cash holding ratios. This pattern is observed specifically in the real estate and utilities sectors. Consequently, it can be inferred that financial institutions in Türkiye alleviate the cash holding requirements for large firms, particularly in these sectors, by providing easier access to financing. In contrast, firm size significantly positively impacts cash holdings in the consumer non-cyclical, energy, and technology sectors. The free cash flow hypothesis can be utilized to support this relationship in the sense that dispersed ownership in large firms enhances managerial discretion; thus, the accumulation of substantial cash holdings is viable (Aftab et al., 2018). Further, since the consumer non-cyclical sector is non-cyclical and is known to maintain steady cash inflow, companies in this sector can easily maintain big cash balances. Similarly, the capital-intensive nature of the energy sector and the rapid innovation cycles within the technology sector require significant liquidity to address operational demands and fund new initiatives.

Table 8. Panel Data Analysis Results

Variables	Full Sample	Basic Materials	Consumer Cyclicals	Consumer Non-Cyc.	Energy	Healthcare	Industrials	Real Estate	Technology	Utilities
MB	0.003*	0.001	0.016***	-0.022**	0.020*	-0.018*	-0.002	0.006	-0.031***	-0.014**
	(1.94)	(0.18)	(4.00)	(-2.60)	(1.90)	(-1.82)	(-0.37)	(1.12)	(-3.29)	(-2.51)
SIZE	-0.002	-0.004	-0.002	0.019***	0.050***	0.004	0.005	-0.039***	0.006*	-0.010*
	(-0.93)	(-1.00)	(-0.46)	(6.09)	(2.93)	(0.30)	(1.16)	(-7.57)	(1.86)	(-1.85)
CASH FLOW	0.185***	0.284***	0.184***	0.233***	-0.040	0.264**	0.256***	0.151***	0.187**	0.305***
	(11.56)	(8.51)	(3.72)	(8.37)	(-0.41)	(2.46)	(3.87)	(5.77)	(2.68)	(3.36)
NWC	-0.157***	-0.218***	-0.188***	-0.099***	-0.079	-0.352***	-0.108***	-0.132***	-0.263***	-0.173**
	(-12.65)	(-4.90)	(-4.35)	(-4.81)	(-0.77)	(-5.88)	(-6.13)	(-4.69)	(-5.35)	(-2.48)
CAPEX	-0.159***	-0.176***	-0.207***	-0.072	-0.174	-0.168*	-0.054	-0.306	-0.385	0.065
	(-4.10)	(-3.79)	(-7.93)	(-1.02)	(-0.61)	(-2.01)	(-1.25)	(-1.35)	(-0.93)	(1.01)
LEVERAGE	-0.092***	-0.125***	-0.110**	-0.027	-0.153**	-0.084	-0.049*	-0.062***	-0.228***	-0.042
	(-6.63)	(-4.22)	(-2.68)	(-1.55)	(-2.16)	(-0.61)	(-1.96)	(-3.05)	(-5.28)	(-0.88)
CF_VOL	-0.000	-0.001	-0.001	-0.000	0.005	-0.003	0.003	0.002***	-0.003**	-0.000
	(-0.55)	(-1.50)	(-1.25)	(-0.25)	(1.47)	(-0.65)	(1.55)	(3.54)	(-2.17)	(-0.40)
R&D	0.618**	3.306**	-1.664***	2.173**	6.238*	-1.814	1.169*	16.582**	0.191	-21.430
	(2.59)	(2.77)	(-3.61)	(2.65)	(1.79)	(-0.66)	(2.07)	(2.80)	(0.20)	(-1.01)
DIVIDEND	0.015**	0.023	-0.004*	0.019	0.029	0.039*	0.007	0.015*	0.010	0.026**
	(2.11)	(1.35)	(-1.73)	(1.50)	(1.54)	(1.99)	(0.45)	(1.76)	(1.00)	(2.51)
CRISIS_2008	0.002	-0.001	0.010*	0.001	0.023	0.023*	-0.006	0.036***	-0.044***	-0.000
	(0.64)	(-0.26)	(1.86)	(0.23)	(1.66)	(1.81)	(-0.75)	(6.22)	(-6.55)	(-0.01)
CRISIS_COVID	0.023***	0.026***	0.020***	0.032***	0.014	0.019**	0.015***	0.024***	0.014***	0.012
	(7.84)	(4.24)	(3.93)	(5.25)	(1.41)	(2.23)	(3.67)	(8.63)	(3.46)	(1.70)
Intercept	0.159***	0.191**	0.135*	-0.288***	-0.925**	0.086	0.013	0.867***	0.151*	0.265**
	(2.97)	(2.32)	(1.72)	(-4.80)	(-2.64)	(0.34)	(0.14)	(8.43)	(1.95)	(2.29)
Number of Obs.	4,375	892	1,164	620	117	88	644	434	270	146
Number of Firms	385	71	95	49	12	12	59	41	27	19
R² Value	0.564	0.545	0.543	0.522	0.697	0.638	0.580	0.619	0.615	0.569
F-Value	309.4	395.9	695	84.18	116.6	67.64	60.62	88.85	94.22	18.21

t-statistics are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9. Summary of Analysis Results by Sectors

	Full Sample	Basic Materials	Consumer Cyclicals	Consumer Non-Cyc.	Energy	Healthcare	Industrials	Real Estate	Technology	Utilities
MB	+	Ø	+	-	+	-	Ø	Ø	-	-
SIZE	Ø	Ø	Ø	+	+	Ø	Ø	-	+	-
CASH FLOW	+	+	+	+	Ø	+	+	+	+	+
NWC	-	-	-	-	Ø	-	-	-	-	-
CAPEX	-	-	-	Ø	Ø	-	Ø	Ø	Ø	Ø
LEVERAGE	-	-	-	Ø	-	Ø	-	-	-	Ø
CF_VOL	Ø	Ø	Ø	Ø	Ø	Ø	Ø	+	-	Ø
R&D	+	+	-	+	+	Ø	+	+	Ø	Ø
DIVIDEND	+	Ø	-	Ø	Ø	+	Ø	+	Ø	+
CRISIS_2008	Ø	Ø	+	Ø	Ø	+	Ø	+	-	Ø
CRISIS_COVID	+	+	+	+	Ø	+	+	+	+	Ø

+: significant and positive effect, - significant and negative effect, and Ø nonsignificant effect

Thirdly, the remaining nuanced differences across sectors can be summarized as follows: firms in the consumer cyclicals experience a reduction in cash holdings, due to higher R&D expenditures. Similarly, paying dividends depletes cash and might lead to a lack of liquidity in the majority of other operational requirements. These factors may indicate that companies in this sector may encounter difficulties in maintaining adequate cash levels when investing in R&D and paying out dividends. Additionally, firms in the technology sector experienced a reduction in cash levels during the 2008 global financial crisis. This decline in cash reserves was likely influenced by decreased consumer spending and the need for continued investment in innovation, despite the economic downturn.

Finally, factors such as cash flow, net working capital, capital expenditures, leverage, R&D, dividends, and crises tend to demonstrate almost similar patterns statistically and economically across different sectors.

In conclusion, this paper reveals several key insights into the determinants of cash holding behavior in Turkish firms, as a developing economy status. These results across different sectors underscore the importance of sector-specific factors when testing firm-level determinants of cash holdings. Nonetheless, while certain factors influencing firms' cash holding strategies may vary across sectors, many others exert a consistent influence regardless of the sector. Specifically, variables such as cash flow, net working capital, capital expenditures, leverage, R&D, and dividends should be recognized as the primary determinants of cash holding behavior in Turkish firms. These findings are consistent with the broader literature (i.e., Dimitropoulos and Koronios, 2021; Gounopoulos and Zhang, 2024; Lozano and Yaman, 2020; Opler et al., 1999; Ozkan and Ozkan, 2004; Seifert and Gonenc, 2018) which identifies a similar set of variables – as significant drivers of corporate cash holding decisions. Furthermore, results confirm that firms in the Turkish market tend to increase their cash reserves during periods of economic uncertainty, aligning with the theoretical understanding of cash as a precautionary buffer against unexpected shocks.

However, while these core factors exert an almost uniform influence across sectors, the above-mentioned variations highlight the importance of nuanced, sector-level analysis. This observation is in agreement with previous studies that emphasize the importance of sector context in cash management. For instance, MacKay and Phillips (2005) argue that industry-specific dynamics are pivotal in shaping firms' financial structures and cash management strategies. Similarly, Schoubben and Hulle (2012) highlight the role of a firm's industry position and competitive landscape in determining cash holding behavior. The paper's findings lend further credence to these arguments, suggesting that while some drivers are universal, their impact can be moderated by sector-specific characteristics.

The connection between competition and cash holdings, supported by various studies, also offers further insight. Lyandres and Palazzo (2016) propose that competitive pressures directly affect a firm's optimal level of cash reserves. This is reinforced by Morellec et al. (2013), who find that increased market competition typically leads to larger cash reserves and a higher frequency of equity issuances. Furthermore, Fukuda (2018) points out the sectoral diversity in cash holding patterns, with labor-intensive service industries often holding more cash to secure operational stability. This point is important to consider in the analysis of the sector specific nature of the findings in the research. In addition to the competition aspect, disruptions within an industry are another important factor to consider. Lee (2024) notes that firms faced with industry-wide disruptions often respond by increasing their cash reserves as a protective action. Taken together, the existing literature and current findings of this paper indicate that cash holding practices may be influenced by a complicated interaction between financial considerations, sector dynamics, competitive conditions, and operational needs.

CONCLUSION

Effective cash management is essential for implementing strategic initiatives and navigating sector-specific challenges and opportunities. This study examined the factors influencing cash reserves among firms across different sectors in Borsa Istanbul, Türkiye. The results reveal that the characteristics of firms are pivotal in determining their cash holding decisions. These findings align with existing research in literature.

The findings from the overall sample reveal that firms in Türkiye generally show increased cash holding levels with higher market-to-book ratios, cash flow, R&D expenditures, and dividend. Conversely, increases in working capital, capital expenditures, and leverage are associated with lower cash holding levels. More specifically, a high M/B ratio indicates a firm is valued highly in the market, prompting these firms to increase cash reserves to maintain investor confidence and seize opportunities. Cash flow tends to lead to larger cash reserves, which can be used to seize future investment opportunities and safeguard against financial uncertainties. High working capital enhances a firm's ability to finance daily operations, minimizing cash needs. Capital expenditures allow firms to channel their cash reserves into long-term growth and investment opportunities, lowering cash holding levels. Firms characterized by substantial leverage allocate their available cash primarily towards debt repayment, resulting in diminished cash reserves. As a firm's R&D expenditures rise, it tends to increase cash

reserves to alienate the financial distress costs that arise from information asymmetries. Dividend-payers maintain higher cash reserves compared to non-payers, which can likely be attributed to their stronger financial positions or more conservative cash management strategies, indicative of a precautionary motive. Lastly, firms increased their cash reserves during the economic uncertainty.

The findings derived from sectoral differences emphasize the variability of factors influencing cash holdings across various sectors. Key findings include the market-to-book value of assets having a negative impact on cash holdings in sectors like consumer non-cyclical, healthcare, technology, and utilities. It is attributed to heightened competition in healthcare and technology sectors, where firms prefer investing in competitive advantages rather than holding cash. Firms within the consumer non-cyclical and utilities sectors that possess growth opportunities may leverage economies of scale and improved access to capital, which could account for the observed negative relationship. Firm size shows no significant impact on cash holdings in the overall sample, but sector-specific trends reveal lower cash reserves in larger firms, particularly in real estate and utilities, due to possible easier financing access. Conversely, larger firms in consumer non-cyclical, energy, and technology sectors maintain higher cash reserves due to stability, capital intensity, and innovation needs, respectively. The impacts of cash flow, R&D, Dividend, and crises on cash holdings almost remain positive and consistent across sectors. In a similar vein, the variables of working capital, capital expenditures, and leverage generally exert a negative influence on cash holdings across various sectors.

Finally, the objective of this paper is to enhance comprehension of the determinants and sectoral distinctions in cash-holding practices. The findings offer fresh insights into how firms in diverse sectors manage their cash reserves, highlighting the importance of considering sector-specific factors in such analyses. These variations emphasize that cash management strategies must be adapted to the unique characteristics and risk profiles of each sector to support firms' sustainable growth and financial stability. Understanding these differences provides valuable guidance for financial managers and investors, enabling them to make more informed and effective decisions.

Future research that explores how macroeconomic factors influence cash holdings across different sectors will enhance our understanding of cash management dynamics. A comparable paper could also explore whether the factors influencing firms' cash holdings vary across different countries.

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