Cash Holdings in Portuguese SMEs: Exploring Drivers and Implications

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Abstract

Title: Cash Holdings in Portuguese SMEs: Exploring Drivers and Implications

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Optimal liquidity management is fundamental in maximizing firm's performance and value. Hence, this study investigates the determinants of corporate cash holdings in micro, small and medium enterprises in Portugal from 2006 to 2021. The sample is structured in panel data and the methodologies applied are random-effects, yearly dummies, yearly and industry dummies, and cross-sectional. The key findings suggest a significant negative effect of dividend payments, investment opportunities, liquid asset substitutes, firm size and longer debt maturity on cash holdings decisions. Opposingly, leverage, cash flow and cash flow volatility exhibit a significant positive association with cash reserves. Therefore, the trade-off, the pecking order and the free cash flow theories, which are the three major theoretical models in explaining the impact of firm characteristics on the levels of cash, are relevant in shedding light on liquidity management decisions in Portuguese SMEs. Furthermore, micro companies display higher cash holdings ratio in comparison with small and medium firms, demonstrating a stronger impact of payout policy, investment opportunity set, liquid asset substitutes and firm size on cash decisions. Small enterprises present a more significant effect of leverage and cash flow volatility on the levels of cash reserves, whereas cash flow and longer debt maturity impact cash holding more notably in medium firms. Moreover, the financial crisis of 2008 enhanced the associations between cash holdings and firm characteristics, excluding liquid asset substitutes and debt maturity, emphasizing the central role of cash holdings during negative economic cycles.

Keywords: Cash Holdings, Cash Determinants, Liquidity Management, SMEs, Trade-off Theory, Pecking Order Theory, Free Cash Flow Theory, Financial Crisis

JEL Classification: G3, G30, G39

Sumário

Título: Reservas de Caixa em PMEs Portuguesas: Investigando Determinantes e Implicações

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A gestão de liquidez é fundamental para maximizar o desempenho e o valor das empresas. Assim sendo, este estudo investiga os determinantes das reservas de caixa em micro, pequenas e médias empresas em Portugal, de 2006 a 2021. A amostra é estruturada em dados de painel, utilizando metodologias de efeitos aleatórios, dummies anuais, dummies anuais e setoriais, e estudo transversal. As principais conclusões indicam um efeito negativo significativo dos pagamentos de dividendos, oportunidades de investimento, substitutos de ativos líquidos, tamanho da empresa e maior maturidade da dívida sobre as decisões de reservas de caixa. Em contrapartida, a alavancagem, o fluxo de caixa e a volatilidade do fluxo de caixa exibem uma associação positiva significativa com as reservas de caixa. Deste modo, as teorias de trade-off, pecking order e free cash flow são relevantes para explicar as decisões de gestão de liquidez nas PMEs portuguesas. Microempresas apresentam um maior rácio de reservas de caixa, demonstrando um impacto mais forte da política de dividendos, oportunidades de investimento, substitutos de ativos líquidos e tamanho da empresa nas decisões de caixa. Pequenas empresas apresentam um efeito mais significativo da alavancagem e da volatilidade do fluxo de caixa nos níveis de reservas de caixa, enquanto fluxo de caixa e maior maturidade da dívida impactam mais as médias empresas. A crise financeira de 2008 ampliou o impacto de características das empresas em reservas de caixa, excluindo substitutos de ativos líquidos e maturidade da dívida, enfatizando o papel primordial das reservas de caixa durante ciclos econômicos negativos.

Palavras-chave: Reservas de Caixa, Determinantes de Caixa, Gestão de Liquidez, PMEs, Teoria de Trade-off, Teoria Pecking Order, Teoria Free Cash Flow, Crise Financeira

Classificação JEL: G3, G30, G39

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1. Introduction

Cash is a fundamental asset for companies, investors and business analysts as it provides financial stability, flexibility and strategic advantages. Moreover, optimal liquidity management is key in increasing firm's value and in maximizing shareholder's wealth (Martínez-Sola et al., 2013).

In the late 2000, firms from the European Monetary Union held 15% of their total book value of assets in cash and cash equivalents, which represented a firm average of €368 million (Ferreira and Vilela, 2004). Furthermore, Bates et al. (2009) state that the average cash to assets ratio for US industrial firms increased by 129% from 1980 to 2004. More recently, corporate cash holdings made up more than 20% of the total assets of typical US publicly traded firms (Cardella et al., 2021). Hence, cash holdings decisions are increasingly more important in the contemporary corporate world and understanding which factors influence the level of cash in a business is key for success.

In order to uncover which firm characteristics impact cash holdings decisions, three theoretical models from the classic finance literature are considered. Firstly, the trade-off theory suggests that companies identify an optimal level of cash holdings by weighing its benefits and costs (Opler et al., 1999). Then, the pecking order theory states that firms prefer to finance their investments with retained earnings, followed by debt and ultimately equity, in order to minimize the asymmetric information (Myers, 1984). Lastly, the free cash flow theory declares that managers tend to have incentives to accumulate abnormal amounts of cash with the goal of favoring themselves to the detriment of the shareholders (Jensen, 1986).

The investigation of the determinants of corporate cash holdings is a subject addressed by numerous prestigious empirical studies, with several authors contributing to the research question. Kim et al. (1998), Opler et al. (1999), Mikkelson and Partch (2003) and Bates et al. (2009) examine the impact of firm characteristics on cash holdings for US companies and, in general, the studies conclude that holding greater amounts of cash supports growth, reduces the need of external financing and is mainly reflected as a precautionary financial strategy. Furthermore, Ferreira and Vilela (2004) and Ozkan and Ozkan (2004) investigate determinants of cash holdings in European firms and find that bank debt is negatively related with cash reserves. Regarding private companies, García-Teruel and Martínez-Solano (2008) and Bigelli and Sánchez-Vidal (2012) examine cash holdings and its determinants in Spanish and Italian companies correspondingly, reporting that firms with more liquid assets tend to hold lower levels of cash holdings. Additionally, corporate governance is suggested by several studies to

be a relevant factor in influencing the level of cash holdings, with Dittmar and Mahrt-Smith (2007) demonstrating that firms with poor corporate governance deplete cash rapidly through actions that notably diminish operating performance.

Nevertheless, the great majority of the research focuses on investigating determinants of corporate cash holdings in publicly listed companies in the most developed economies, such as the US or the UK. Therefore, this study contributes to the literature by exploring the effect of certain firm characteristics on the level of cash holdings of Portuguese SMEs. The determinants of cash holdings tested in the dissertation are factors that were proposed by previous respectable papers. Moreover, the research sample comprises over 3 million observations from 2006 to 2021. To test differences on the impact of firm characteristics in cash holdings decisions per company size, the research compares the findings between micro, small and medium firms. Furthermore, the effect of the financial crisis of 2008 on the determining factors of cash holdings is also investigated.

The main findings of the study suggest a positive association between cash holdings and leverage, cash flow and cash flow volatility, whereas dividend payments, investment opportunities, liquid asset substitutes, firm size and debt maturity exert a negative effect. Thus, investment opportunities and leverage are the results that contradict the research hypotheses, that are based on theoretical assumptions and on previous empirical findings. This study suggests that investment opportunities impact on cash holdings is more aligned with the free cash flow theory, while the positive influence of leverage supports more the trade-off model. Regarding differences per firm size, micro firms present a higher cash holdings ratio and on average a superior effect on cash holdings in dividend dummy, investment opportunities, liquid asset substitutes and firm size. Small firms exhibit a more noticeable positive impact of leverage and cash flow volatility on cash holdings, whereas the influences of cash flow and debt maturity are more significant in the findings of medium companies. Lastly, the financial crisis period enhanced the effects of firm characteristics on cash holdings decisions, both positively and negatively, solely excluding liquid asset substitutes and debt maturity.

The structure of the dissertation is organized as follows. The second section presents the literature review and discusses the research hypotheses. The third section describes the data and the methodology. The fourth section exhibits the results and its analysis. Finally, the fifth section concludes and suggests further research.

2. Literature Review

The literature discussion is divided into four subsections. Firstly, the main motives for cash holdings demonstrate the relevance of liquidity in enhancing firm's performance and consequently maximizing shareholder's wealth. Secondly, the foundational theories of corporate finance acclaim the key determinants in corporations that impact managers' decisions on cash holdings. The third subsection investigates the associations between major drivers of corporate cash holdings and liquidity, by comparing the findings of previous works in each respective firm's characteristic. Lastly, the fourth subsection presents the research hypotheses of the dissertation.

2.1. Key Motives for Cash Holdings

Financial management encompasses the optimization of several aspects and the amount of cash reserves is a fundamental one. Liquid assets are at the core of a company's financials as they improve risk management, finance future investment opportunities, enhance efficiency in the normal flow of business operations, and so forth.

According to Modigliani and Miller (1958), in perfect financial markets there are no transaction costs, bankruptcy costs, taxes and asymmetric information, leading to the conclusion that the capital structure does not have an impact on the firm's value. Therefore, retaining cash holdings could be unwise in this paradigm since a firm can instead request a loan from a bank, maintaining its intrinsic value.

Nevertheless, in the real world there are numerous imperfections that augment the significance of corporate cash holdings, producing various motives for liquidity. The presence of agency conflicts between managers and shareholders (Jensen, 1986), due to for instance asymmetric information or misalignment in goals, tends to lead managers to the accumulation of cash holdings. This arises from managers perceiving cash reserves as a mean to invest in growth projects, increase their control over the firm by reducing the likelihood of hostile takeovers and as a form of insurance against economic downturns that can compromise their careers. Moreover, the agency problem and its relevance in impacting the level of corporate cash holdings was emphasized by Dittmar et al. (2003), who concluded that corporations in countries with poor protection regarding shareholders' rights possess twice as much cash as other firms in countries with good shareholder protection.

In conformity with Keynes (1936), transaction costs and precautionary motives are the major causes for corporate cash holdings. Firms can gain an advantage from holding liquid assets because these provide savings on transaction costs, primarily through the cost of raising external finance and the cost of liquidating assets (Baumol, 1952). Precautionary cash holdings intend to safeguard the firm in the case of costly or unavailable external financing, in addition to providing a buffer for future provisions and investment opportunities. Almeida et al. (2004) model the link between corporate liquidity demand and financial constraints, finding robust support that constrained firms tend to increase their cash holdings in comparison with unconstrained ones. Furthermore, Bates et al. (2009) reinforce the importance of the precautionary motive as a key determinant of the demand for cash. In concordance, Ferreira and Vilela (2004) find a negative association between the development level of capital markets and corporate cash holdings, supporting precautionary motives for liquidity.

An additional motive contributing to corporate cash holdings is related to taxes, which is particularly evident among multinational corporations. These firms may deliberately accumulate cash in their foreign subsidiaries as a mean to mitigate or avoid repatriation tax expenses (Foley et al., 2007). To conclude, corporate cash holdings are justified by numerous motives such as the agency, the transaction, the precautionary and the tax one. This results in managers seeking a balance between the benefits and the costs of liquidity, along with the strategic interests of various stakeholders.

2.2. Cash Holdings Foundational Theories

Corporate cash holdings are impacted by several firm's characteristics and those associations can be determined and elaborated by three key corporate finance theories: the Trade-off, Pecking Order and Free Cash Flow theories. Furthermore, the way a firm characteristic influences cash holdings decisions is not consensual among these models.

2.2.1. Trade-off Theory

According to the trade-off argument, firms weigh the marginal costs and marginal benefits of holding cash to set their optimal level of cash holdings (Opler et al., 1999). Hoarding cash yields many benefits such as reducing the likelihood of financial distress, allowing for the undertaking of investment opportunities with positive net present value, minimizing the need of liquidating existing assets and decreasing costs of raising external funds (Ferreira and Vilela,

2004). Opposingly, the main cost of holding cash is the opportunity cost associated to the low return of liquid assets. Hence, the trade-off theory suggests different relations between corporate cash holdings and certain firm characteristics that are briefly explored in the following passages.

Payout policy is a relevant factor since firms that pay dividends can raise funds at a low cost by reducing the amount of dividends, in opposition to firms that do not pay dividends, as these would incur in higher costs by using external financing (Ferreira and Vilela, 2004). Thus, the association of dividend payments and cash holdings is expected to be negative.

A company that holds a considerable amount of liquid assets, excluding cash and cash equivalents, is normally able to liquidate those in the event of a cash shortage, being therefore substitute assets of cash holdings. Ozkan and Ozkan (2004) studied determinants of corporate cash holdings in a UK sample, concluding that a company with more non-cash liquid assets tends to reduce their cash holdings level. Consequently, a negative relation between non-cash liquid assets and cash holdings is expected. Similarly, cash flow represents an additional source of liquidity, which can be viewed as a cash alternative (Kim et al., 1998). As a result, cash flow and cash holdings should hold a negative association. Moreover, cash flow uncertainty is a relevant characteristic since firms with higher volatility in cash flows face superior likelihood of encountering cash deficits because of unforeseen deterioration in cash flow. Therefore, cash holdings should be positively related to cash flow uncertainty (Ferreira and Vilela, 2004).

Following, a firm with a significant investment opportunity set should hold sufficient liquid assets in order to take advantage of profitable opportunities. Otherwise, the firm would have to pass on sizeable growth projects in the occurrence of a cash shortage, as external financing is costly (Opler et al., 1999). Hence, investment opportunities and cash holdings should have a positive relation.

According to Miller and Orr (1966), there are economies of scale associated with cash holdings. Thus, large firms should hold less cash in comparison with smaller firms, as these can benefit more from economies of scale. Furthermore, Barclay and Smith (1996) suggest that raising funds is relatively more expensive for smaller firms than larger firms, leading to small firms holding greater amounts of cash. Moreover, larger firms are generally more diversified and therefore have a lower likelihood of being in financial distress, resulting in a minor necessity for cash holdings (Rajan and Zingales, 1995). In summary, these arguments predict a negative relation between size and cash holdings.

Ferreira and Vilela (2004) state that leverage increases the probability of bankruptcy because of the strain that strict amortization plans put on corporate treasury management.

Consequently, companies with higher leverage should hold more cash as a form of insurance for future financial distress. However, a firm's leverage ratio can be seen as proxy for the ability of that company to issue debt and so it would be expected that firms with higher leverage maintain fewer cash holdings. As a result, the predicted relation between leverage and cash holdings is ambiguous.

Additionally, debt maturity structure is significant for liquidity decisions, as firms with higher proportions of short-term debt keep higher levels of cash, reducing the risk that derives from the non-renewal of credit lines in the presence of financial distress (García-Teruel and Martínez-Solano, 2008). Nonetheless, firms with highest and lowest credit risk issue more short-term debt, whereas intermediate credit risk firms issue more long-term debt (Barclay and Smith, 1995). Therefore, considering that firms with superior credit ratings have better access to borrowing, it is expected that these firms hold less cash (Ferreira and Vilela, 2004). Summarizing, the association of debt maturity structure and cash holdings is uncertain.

2.2.2. Pecking Order Theory

The pecking order theory was proposed by Myers (1984) and is supported by the asymmetric information theory, developed by Myers and Majluf (1984). The pecking order theory states that there is an optimal hierarchy regarding firm's financing sources, with retained earnings first and foremost, followed by debt and finally equity. The major purpose of this financing order is to minimize asymmetric information costs and other funding costs, only using external sources when the first alternative is drained. Moreover, the pecking order theory suggests that firms do not have a specific target cash level, but frequently cash holdings are used as a buffer between investment needs and retained earnings. In the occasion of operational cash flows being sufficient to finance new projects, firms accumulate cash and repay debt. Opposingly, when current cash flows are scarce to finance investments, firms use accumulated cash holdings (Ferreira and Vilela, 2004). Thus, the pecking order theory proposes varied associations between cash holdings and specific company attributes, which will be examined in the subsequent sections.

Companies prefer to finance themselves with internal resources and therefore firms with large amounts of cash flow should maintain high levels of cash holdings, demonstrating a positive relation between cash flow and cash holdings. Regarding investment opportunities, Ferreira and Vilela (2004) argument that in the presence of a considerable investment opportunities set, firms should own high levels of cash holdings in order to not forego profitable

investments, unless companies engage in expensive external financing. Hence, a positive association between cash holdings and investment opportunities is predicted.

Opler et al. (1999) propose that larger firms tend to be more successful and consequently should have higher levels of cash holdings, after controlling for investment. Thus, firm's size and cash holdings relation is expected to be positive. Debt will increase when investment exceeds retained earnings and vice versa. Consequently, cash holdings follow an inverse pattern, growing when investment is less than retained earnings and decreasing when investment is superior to retained earnings (Ferreira and Vilela, 2004). Therefore, it is expected that cash holdings and leverage have a negative association.

2.2.3. Free Cash Flow Theory

The free cash flow theory (Jensen, 1986) suggests that managers have incentives to accumulate high amounts of cash holdings in a firm's balance sheet, implying a greater discretionary power over the company investment decisions and an increase in the value of assets under manager's control. Moreover, a large amount of cash holdings leads to a lower necessity for external financing in the surge of investment opportunities and therefore managers do not require to provide capital markets relevant detailed information about the firm's investment projects (Ferreira and Vilela, 2004). Furthermore, the presence of cash may reduce the pressure on the management team to obtain a good performance, leading to more self-interested decisions by managers. Hence, high levels of cash holdings develop incentives for managers to undertake investment opportunities that are prejudicial to shareholders' wealth but of the manager's personal interest. Regarding the free cash flow theory, it is relevant to consider various potential determinant characteristics for cash holdings, which will be examined in the following sections.

Entrenched managers of firms with scarce investment opportunities tend to accumulate greater amounts of cash holdings in order to have sufficient internal funds to invest in growth projects, even in projects with negative net present value (Drobetz and Grüninger, 2007). Then, the relation between investment opportunities and cash reserves is expected to be negative.

Large firms tend to have greater shareholder dispersion, which leads to difficulties in building consensus on strategic decisions, lack of engagement and communication challenges. Thus, managers should have superior discretionary power over financial policies and investment plans, leading to a bigger amount of cash reserves (Ferreira and Vilela, 2004). Therefore, this perspective predicts a positive association between size and cash holdings.

Additionally, the management team of highly leveraged firms is commonly restrained through requirements and debt covenants imposed by creditors. Hence, managers should have less discretionary power and not be able to accumulate considerable amounts of cash. On the other hand, a firm with low levels of debt is less subject to monitoring by the capital markets (Opler et al., 1999), increasing the discretionary power of managers. As a result, the association between leverage and cash holdings is predicted to be negative.

2.2.4. Outline of Theories Assumptions

Table 1 presents the relationships between firm characteristics and cash holdings across each foundational model. A major outcome of Table 1 is that the trade-off theory is the model that makes more assumptions regarding determinants of corporate cash holdings and the respective associations. Therefore, this conclusion suggests that the Trade-off theory is the one that is more capable in providing insights to answer the main research questions of this study. Moreover, Table 1 demonstrates that there is no unanimous agreement among the foundational theories regarding the manner in which a firm characteristic impacts decisions on cash holdings.

Table 1: Outline of Models Predictions

Variable	*Trade-off Theory*	*Pecking Order Theory*	*Free Cash Flow Theory*
Dividends	Negative	n.a.	n.a.
Investment Opportunities	Positive	Positive	Negative
Liquid Asset Substitutes	Negative	n.a.	n.a.
Leverage	Uncertain	Negative	Negative
Size	Negative	Positive	Positive
Cash Flow Volatility	Positive	n.a.	n.a.
Cash Flow	Negative	Positive	n.a.
Debt Maturity	Uncertain	n.a.	n.a.

Table 1 exhibits the numerous associations between firm characteristics and cash holdings across each foundational model. A "n.a." means that the theory in case does not make assumptions regarding the corresponding variable. Source: Ferreira and Vilela (2004).

2.3. Empirical Evidence on Cash Holdings

This section presents the major findings of former relevant empirical studies that investigated the impact of firms' characteristics on the level of corporate cash holdings. The main goal is to examine the convergence or divergence concerning studies' results in each relevant association and comprehend how hypothetical predictions from cash holdings theories differ from empirical outcomes.

Guney et al. (2007) investigate cash holdings behavior in various companies from the US, the UK, Germany, France and Japan in the late 20th century. The pooled regression yielded a negative relation between dividend payments and cash holdings, mainly due to the significance of this association in US firms. Nevertheless, Bigelli and Sánchez-Vidal (2012) study cash holdings in a wide sample of Italian private firms and conclude that dividend payments are connected with higher levels of cash holdings. The authors argue that the positive relation between payout policy and corporate cash holdings is natural since payment of dividends in private firms should be correlated with a superior generation of cash flows, in opposition with the same relation using a sample of public companies.

Regarding liquid asset substitutes, Gill and Shah (2012) examine the determinants of corporate cash holdings in Canadian listed firms during the peak years of the subprime crisis and discover a significant negative association between net working capital and cash holdings. Furthermore, Al-Najjar and Belghitar (2011) study the simultaneous relationship between dividend policy and corporate cash holdings using a sample of approximately 400 non-financial firms from 1991 to 2008 and find evidence of a negative relation among working capital and cash holdings, reinforcing the easiness in converting short-term liquid assets into cash.

Kim et al. (1998) provide an empirical and theoretical investigation regarding firm's decision on investing in liquid assets by using US industrial firms throughout 1975 and 1994. The study yields a strong negative relation between cash flow and cash holdings. Opposingly, Ferreira and Vilela (2004) investigate determinants of corporate cash holdings in EMU countries from 1987 to 2000 and find that cash flow has a positive impact in the level of cash holdings, as theorized in the pecking order theory.

Following, Riddick and Whited (2009) study the reasons that lead companies to accumulate liquid assets, using a sample of non-financial firms from several countries, such as the US and Japan. The authors find that companies with higher income uncertainty tend to hold greater precautionary levels of cash holdings. Moreover, Bates et al. (2009) investigate the increase in cash holdings in US firms from 1980 to 2004, concluding that a major cause for the

average cash ratio growth was the fact that American firm's cash flow had become considerably riskier throughout the timespan.

Opler et al. (1999) examine the determinants and implications of cash holdings in publicly traded US firm between 1971 and 1994, determining that companies with strong growth opportunities tend to hold relatively high ratios of cash to total assets. Additionally, Cunha and Pollet (2020) exploit variation in demand caused by demographics to provide significant evidence of the precautionary motive of cash holdings, demonstrating that companies increase their cash reserves in response to an exogenous rise of investment opportunities.

Drobetz and Grüninger (2007) explore the determinants of a large sample of Swiss non-financial firms' cash holdings from 1995 to 2004, showing that firm size is negatively related to liquidity holdings as it is relatively cheaper for large firms to raise funds in capital markets. Furthermore, Fernandes and Gonenc (2016) study the association between cash holdings and multinationals for a broad international sample of firms from 40 countries, finding significant evidence of size affecting cash holdings negatively, indicating that large firms have generally less need for cash.

Ozkan and Ozkan (2004) investigate the empirical drivers of liquidity holdings, focusing mainly on the importance of corporate governance characteristics such as managerial ownership. The paper's findings suggest that higher cash holdings are associated with lower levels of leverage. In concordance, Subramaniam et al. (2011) analyze the impact of organizational structure of firms in the levels of cash holdings from 1988 to 2006, finding a significant negative relation between leverage and cash reserves in several distinct regressions.

In a study examining the cash reserves of 860 small and medium-sized enterprises in Spain spanning the years 1996 to 2001, García-Teruel and Martínez-Solano (2008) find that firms with more short-term debt hold higher amounts of cash holdings, which reduces firm's financial distress and mitigates the risk of non-renewal of the lines of credit. Furthermore, Harford et al. (2014) hypothesize that short-maturity debt firms hold larger cash holdings to reduce the refinancing risk, employing a broad sample of US industrial firms from 1980 to 2008. The authors concluded that companies with shorter maturity debt hold more cash reserves, which implies that the refinancing risk had a considerable impact in the increase of cash holdings in US firms during that time horizon.

Harford et al. (2008) study the impact of corporate governance on US firms' cash holdings by using metrics based on inside ownership and antitakeover provisions. The paper suggests that companies with weaker governance structures have smaller cash reserves, since

entrenched managers decide to spend cash rapidly on capital expenditures and acquisitions. More recently, Chen et al. (2020) examine the impact of corporate governance on cash holdings in 41 countries, proposing that the adoption of board reforms improves governance and consequently leads to a reduction in cash reserves. Furthermore, the decrease in cash holdings is more salient for firms with weaker pre-reform corporate governance and with weaker institutional environments, demonstrating the relevance of the monitoring role of the board in enhancing internal governance and in reducing cash levels.

2.4. Hypotheses Development

This section introduces the research hypotheses of the dissertation, encompassing the predicted associations between cash holdings and several firm characteristics. Moreover, the hypothesis are based on the trade-off, pecking order and free cash flow theories assumptions and on the findings of previous relevant papers that investigated the determinants of corporate cash holdings. Table 2 summarizes the research hypotheses. The majority of the associations are expected to be negative, including dividend payments, liquid asset substitutes, leverage and debt maturity structure, whereas investment opportunity set and cash flow volatility are predicted to positively relate with cash holdings, mainly for precautionary motives. Cash flow and firm size have an ambiguous association with cash reserves since the key corporate finance theories do not have a consensus on that matter, similarly to the findings of previous works.

Table 2: Hypotheses Summary

Research Hypotheses
H1: There is a **negative** association between **dividend payments** and cash holdings.
H2: There is a **positive** association between **investment opportunities** and cash holdings.
H3: There is a **negative** association between **liquid asset substitutes** and cash holdings.
H4: There is a **negative** association between **leverage** and cash holdings.
H5: There is an **uncertain** association between **firm size** and cash holdings.
H6: There is a **positive** association between **cash flow volatility** and cash holdings.
H7: There is an **uncertain** association between **cash flow** and cash holdings.
H8: There is a **negative** association between **debt maturity structure** and cash holdings.

Table 2 presents the research hypotheses.

3. Research Methodology

This section presents the main methods and key variables used to test the research hypotheses. The first subsection describes in detail the data being applied to investigate the determinants of corporate cash holdings, evidencing the criteria employed to enhance the quality and exactitude of the information. Secondly, the dependent variable is defined and its evolution throughout the sample time horizon and respective descriptive statistics are explored. Thirdly, the explanatory variables are specified and described, including summary statistics, average differences by firm size, mean differences per cash ratio quartiles and correlation matrix. Finally, the last subsection addresses the methodology employed and its importance in the production of robust and precise findings.

3.1. Data Description

In order to investigate the research questions, the sample encompasses private Portuguese firms from 2006 to 2021, obtained from the Central Balance Sheet Harmonized Panel, which is a dataset constructed by Banco de Portugal Microdata Research Laboratory. Firstly, large private firms were excluded from the sample, as the main goal of the dissertation is to examine determinants of cash holdings in SMEs. Large firms are enterprises that have a staff headcount greater than 250 or a turnover and balance sheet total superior to 50 million euros and 43 million euros respectively. Moreover, observations with either negative sales, negative equity, negative assets or negative liabilities were eliminated. In addition, negative observations in explanatory variables such as leverage, size, debt maturity and cash holdings were disregarded. Besides, the independent variables investment opportunities, leverage and cash flow were winsorised at the 5% level on both tails of the distribution since several outliers were skewing the results. Missing firm-year observations were also discarded for any variable in the model. Furthermore, the initial sample did not include any financial industry company, which is relevant for accuracy purposes, as financial institutions' balance sheet is affected by specific factors like regulatory laws or industry rules. These conditions yielded a total sample of 3,348,872 firm-year observations.

3.2. Cash Holdings

The main goal of the research is to investigate the impact of firm characteristics on cash holdings and therefore the dependent variable is measured through a cash ratio. Several studies, such as Opler et al. (1999) and Ferreira and Vilela (2004), define cash ratio as the ratio of cash and cash equivalents to net assets, where net assets are calculated as book value of assets less cash and equivalents. Nevertheless, this research follows the empirical studies of Ozkan and Ozkan (2004) and Bates et al. (2009), which characterize the cash ratio as the ratio of cash and cash equivalents to total assets.

Figure 1 presents the evolution of the average cash holdings ratio throughout the examined timespan. In the first years of the sample, the cash holdings ratio remained fairly consistent, oscillating approximately between 0.190 and 0.195 and recording the lowest value in 2011. Afterwards, there is a clear growing trend in the average cash holdings ratio of Portuguese SMEs, with a noteworthy increase starting in 2019. A possible explanation for the sustained growth in the cash holdings ratio is the subprime mortgage crisis of 2008, that burst initially in the United States and impacted Portugal significantly (Pereira and Wemans, 2015). Due to the global crisis and other factors, Portugal entered in the beginning of the last decade in an economic recession cycle that lasted for several years, having a considerable effect in companies and individuals throughout 2011 and 2015. Therefore, the positive trend in the cash holdings ratio might be explained by precautionary motives, as Portuguese SMEs possibly decided to accumulate a superior level of cash to total assets in order to create a buffer for the economic downturn and uncertainty. Moreover, the worldwide covid crisis can also be a relevant factor to support the growth in the cash holdings ratio in the last years of the sample, with the ratio yielding the highest value of nearly 0.260 in 2021.

Figure 1: Average Cash Holdings Ratio Development

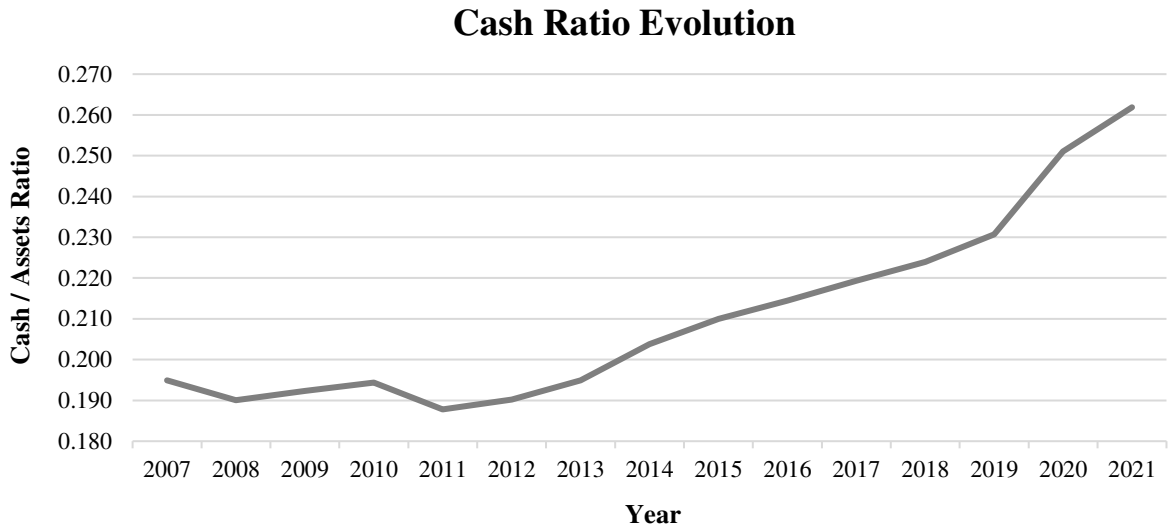

Figure 1 displays the average cash holdings ratio during the sample timespan. Cash ratio is measured as cash and cash equivalents to total assets. Firms that have missing year observations were discarded.

Table 3 exhibits descriptive statistics on the cash holdings ratio per firm size. Firstly, micro firms hold on average 0.227 of cash and cash equivalents to total assets, whereas small and medium firms hold 0.152 and 0.109 correspondingly. Hence, according to the findings outlined in Table 3, firm size and cash holdings association appears to be negative, aligning with the principles of the trade-off theory. Furthermore, the results show that the mean is superior to the median for all different firm sizes, suggesting that the distribution of the cash holdings ratio within each category is likely skewed to the right. Thus, the findings indicate that there are few firms with disproportionately high cash holdings ratios, that pull the means upwards. Additionally, the variability in the cash holdings ratio is the highest for micro firms, presenting 0.256, and the lowest for medium firms, yielding 0.150. Moreover, micro firms are the majority of the observations, with 0.825 of the total sample, whereas small firms and medium firms represent 0.150 and 0.025 respectively. Lastly, Table 18 in Annex B presents descriptive statistics on the cash ratio per firm size, with the cash holdings ratio being winsorised at the 5% level on both tails of the distribution. The findings of both tables are considerably similar, suggesting that Table 3 results are robust.

Table 3: Cash Ratio per Firm Size

Firm Size	*Mean*	*Median*	*P25*	*P75*	*STD*	*Max*	*Min*	*N*
Micro	0.227	0.120	0.029	0.348	0.256	0.999	0	2763080
Small	0.152	0.076	0.021	0.215	0.184	0.999	0	502257
Medium	0.109	0.045	0.012	0.145	0.150	0.999	0	83535
Total	0.213	0.109	0.026	0.319	0.246	0.999	0	3348872

Table 3 presents descriptive statistics on the cash holdings ratio by firm size from 2006 to 2021. Cash ratio is measured as cash and cash equivalents to total assets. P25 is the 25th percentile and P75 is the 75th percentile. STD denotes standard deviation. N is the number of observations in the sample for each firm size.

3.3. Explanatory Variables

In order to estimate the impact of dividend payments on cash holdings, a dummy variable was assembled and is set to one if the company pays dividends in each year and set to zero if it did not (Ferreira and Vilela, 2004). Regarding investment opportunities, market-to-book ratio is the most common proxy but, since the research focuses on private firms, it is not possible to employ this ratio. Therefore, based on previous studies that investigate determinants of corporate cash holdings in privately owned firms, such as Deloof (2001) and Pál and Ferrando (2010), firm's opportunities are measured as the yearly growth rate of sales.

Moreover, liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets (Ozkan and Ozkan, 2004). The proxy is measured by net current assets minus total cash and equivalents divided by the book value of assets. On the subject of leverage, total debt divided by total assets less cash and cash equivalents is the ratio applied (Opler et al., 1999). Similarly to Ferreira and Vilela (2004), the natural logarithm of total assets is the proxy for the real size of firms. Assets are adjusted at the 2021 price level using the Consumer Price Index.

Furthermore, cash flow volatility is measured by the standard deviation of cash flows over the average of total assets, as in Ozkan and Ozkan (2004) and as in Bigelli and Sánchez-Vidal (2012). For the purpose of measuring cash flow magnitude, the ratio used is cash flow to net assets (Ferreira and Vilela, 2004). In this case, cash flow is defined as after-tax profit plus depreciation expenses and is divided by total assets minus cash and equivalents. In the matter of debt maturity structure, the proxy is the ratio of long-term debt over the total debt of the company (García-Teruel and Martínez-Solano, 2008).

Table 4 presents summary statistics on the explanatory variables. Initially, the dividend dummy demonstrates that the great majority of Portuguese SMEs do not pay dividends to the owners, as the average is approximately 0.001. Regarding liquid asset substitutes, the net working capital minus cash and equivalents is on average 13.61% of the total assets, with several firms having negative net working capital. Moreover, investment opportunities and cash flow have some discrepancy between means and median, which implies that particular observations have considerably high values. The average firm size in the natural logarithm scale is 12.963 and the average cash flow volatility is nearly 0.116. Additionally, the average debt maturity is 0.274 and the median is 0.124, meaning that certain firms have a significant amount of long-term debt to total debt. Regarding leverage, the average total debt to total assets less cash and equivalents is around 0.717. Table 19 in Annex C exhibits descriptive statistics on the winsorised explanatory variables at the 5% level on both tails of the distribution. The results demonstrate that the original findings of Table 4 are minorly impacted by the winsorization technique.

Table 4: Explanatory Variables Description

Variable	*Mean*	*Median*	*P25*	*P75*	*STD*	*Max*	*Min*	*N*
Dividend Dummy	0.001	0	0	0	0.026	1	0	3348872
Investment Opportunities	0.090	0.008	-0.161	0.208	0.527	2.168	-0.873	3348872
Liquid Asset Substitutes	0.136	0.117	-0.070	0.365	0.379	222.618	-9.139	3348872
Leverage	0.717	0.721	0.429	0.939	0.397	2.101	0.071	3348872
Size	12.963	12.818	11.707	14.069	1.832	26.751	0	3348872
Cash Flow Volatility	0.116	0.084	0.047	0.144	0.125	52.953	0	3348872
Cash Flow	0.139	0.073	0.013	0.197	0.235	1.083	-0.346	3348872
Debt Maturity	0.274	0.124	0	0.510	0.682	860.027	0	3348872

Table 4 presents descriptive statistics on the explanatory variables from 2006 to 2021. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company. P25 is the 25th percentile and P75 is the 75th percentile. STD denotes standard deviation. N is the number of observations in the sample.

Table 5 exhibits averages of the exogenous variables per firm size. Firstly, all differences in means between firms are significant at the 1% level, except the difference between small and medium firms in the investment opportunities variable. Regarding payout policy, medium firms distribute on average more dividends than small and micro firms. Moreover, medium firms record the highest average on sales growth, with a total of 0.109, whereas small and micro firms had 0.107 and 0.087 respectively. These findings suggest that larger firms have more potential to grow. Opposingly, micro firms hold on average greater amounts of liquid asset substitutes to total assets in comparison with small and medium companies, possibly due to precautionary motives. In the matter of leverage and debt maturity, medium firms hold less debt to total assets minus cash and equivalents and the debt is more short-term. Additionally, micro firms are considerably more leveraged but the differences in the debt maturity ratio is not substantial between the different sizes, meaning Portuguese SMEs primarily finance themselves with short-duration liabilities. As expected, the size variable is greater for medium firms, with 16.638, and lower for micro businesses, with 12.551. Furthermore, the cash flow ratio is superior in micro firms and minor in medium companies, likewise in cash flow volatility, where micro firms have more uncertainty with cash streams.

Table 5: Explanatory Variables per Firm Size

Variable	*Micro*	*Small*	*Medium*	*t-statistic1*	*t-statistic2*	*t-statistic3*
Dividend Dummy	0.001	0.001	0.002	-11.129***	-18.728***	-9.416***
Investment Opportunities	0.087	0.107	0.109	-24.749***	-11.340***	-1.099
Liquid Asset Substitutes	0.145	0.096	0.081	84.630***	46.619***	13.546***
Leverage	0.716	0.731	0.699	-24.285***	11.395***	27.399***
Size	12.551	14.622	16.638	-860***	-740***	-360***
Cash Flow Volatility	0.123	0.083	0.073	207.263***	108.804***	37.319***
Cash Flow	0.145	0.112	0.102	90.039***	49.866***	17.152***
Debt Maturity	0.277	0.262	0.253	14.275***	9.422***	7.622***

Table 5 exhibits explanatory variables averages per firm size from 2006 to 2021. T-statistic1 tests the difference in means between micro firms and small firms. T-statistic2 tests the difference in means between micro firms and medium firms. T-statistic3 tests the difference in means between small firms and medium firms. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted

as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

Table 6 shows the averages of firm characteristics on each cash holdings ratio quartile. The t-statistic examines the premise that the fourth quartile firms are significantly different from the first quartile firms. A major conclusion is that all firm characteristics significantly differ between the first and fourth cash holdings ratio quartiles at the 1% level. Regarding payout policy, firms that pay more dividends tend to have higher amounts of cash holdings to total assets. Opposingly, size demonstrates a negative monotonic relationship with the cash ratio, which is in accordance with the trade-off theory. Furthermore, leverage exhibits a positive monotonic association with the cash ratio whereas debt maturity shows a negative monotonic relationship with the dependent variable. Moreover, cash flow volatility and cash flow present positive monotonic associations with the cash ratio of Portuguese SMEs. Lastly, investment opportunities and liquid asset substitutes do not evolve monotonically across the cash holdings ratio quartiles.

Table 6: Firm Characteristics per Cash Ratio Quartiles

Variable	*1st Quartile*	*2nd Quartile*	*3rd Quartile*	*4th Quartile*	*t-statistic*
Cash Holdings Ratio Range	0 to 0.03	0.03 to 0.11	0.11 to 0.32	0.32 to 1	
Cash Holdings Ratio	0.009	0.061	0.198	0.582	-2700***
Dividend Dummy	0.000	0.001	0.001	0.001	-15.854***
Investment Opportunities	0.025	0.099	0.125	0.111	-100***
Liquid Asset Substitutes	0.196	0.203	0.160	-0.015	348.370***
Leverage	0.642	0.643	0.667	0.918	-410***
Size	13.730	13.195	12.757	12.172	565.690***
Cash Flow Volatility	0.092	0.101	0.119	0.151	-300***
Cash Flow	0.042	0.072	0.125	0.316	-710***
Debt Maturity	0.312	0.296	0.273	0.216	112.023***

Table 6 exhibits firm characteristics averages per cash ratio quartile from 2006 to 2021. The t-statistic tests the difference in means from the first to the fourth quartile. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. Cash holdings ratio is measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined

as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

Table 7 displays the correlations between all variables from 2006 to 2021. Regarding the relationships between the explanatory variables and the dependent variable, dividend dummy, investment opportunities and debt maturity have a minor correlation with the cash holdings ratio. Furthermore, liquid asset substitutes and size evidence a negative relationship with cash holdings. In opposition, leverage and cash flow volatility demonstrate a positive association with the response variable, with 0.351 and 0.188 respectively. Cash flow is the independent variable that has a stronger relationship with cash holdings, yielding a moderate correlation of 0.523. In the matter of the associations between explanatory variables, the majority of the relationships are meaningless, suggesting that multicollinearity concerns are attenuated. Nevertheless, leverage and liquid asset substitutes, likewise cash flow volatility and size, exhibit considerable negative correlations, with -0.492 and -0.362 correspondingly.

Table 7: Correlation Matrix

Variable	*Cash*	*Div.*	*Invest.*	*Subst.*	*Lev.*	*Size*	*CF Vol.*	*CF*	*Maturity*
Cash Holdings	1.000								
Dividend Dummy	0.008***	1.000							
Investment Opportunities	0.031***	0.002***	1.000						
Liquid Asset Substitutes	-0.259***	-0.005***	-0.082***	1.000					
Leverage	0.351***	0.001	0.108***	-0.492***	1.000				
Size	-0.297***	0.012***	-0.028***	-0.033***	-0.062***	1.000			
Cash Flow Volatility	0.188***	0.026***	0.049***	-0.015***	0.009***	-0.362***	1.000		
Cash Flow	0.523***	0.032***	0.235***	-0.132***	0.117***	-0.177***	0.190***	1.000	
Debt Maturity	-0.058***	-0.003***	-0.000	0.205***	0.043***	0.018***	-0.036***	-0.040***	1.000

Table 7 presents all variables correlation matrix from 2006 to 2021. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. Cash holdings (*Cash*) is measured as cash and cash equivalents to total assets. Dividend Dummy (*Div.*) is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities (*Invest.*) are measured as the yearly growth rate of sales. Liquid asset substitutes (*Subst.*) are defined as the ratio of net working capital minus cash over total assets. Leverage (*Lev.*) is total debt divided by total assets less cash and cash equivalents. Size (*Size*) is denoted as the natural logarithm of

total assets adjusted at the 2021 price level. Cash flow volatility (*CF Vol.*) is measured by the standard deviation of cash flows over the average of total assets. Cash flow (*CF*) is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity (*Maturity*) is the ratio of long-term debt over the total debt of the company.

3.4. Methodology

The main goal of this study is to test and analyze several hypotheses regarding the determining factors of cash holdings for a sample of Portuguese SMEs over the period of 2006 to 2021. Hence, the general specification encompasses the cash holdings ratio and the explanatory variables described in previous sections, being characterized as it follows:

$$Cash_{i,t} = \alpha + \beta_1 DivDummy_{i,t} + \beta_2 InvOpp_{i,t} + \beta_3 LiqSubst_{i,t} + \beta_4 Leverage_{i,t} + \beta_5 Size_{i,t} + \beta_6 CFlowVol_{i,t} + \beta_7 CFlow_{i,t} + \beta_8 DebtMat_{i,t} + \mu_{i,t}$$

where *i* refers to the company and *t* to the year time frame. Cash holdings (*Cash*) is measured as cash and cash equivalents to total assets. The α is the constant term of the equation. Dividend Dummy (*DivDummy*) is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities (*InvOpp*) are measured as the yearly growth rate of sales. Liquid asset substitutes (*LiqSubst*) are defined as the ratio of net working capital minus cash over total assets. Leverage (*Leverage*) is total debt divided by total assets less cash and cash equivalents. Size (*Size*) is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility (*CFlowVol*) is measured by the standard deviation of cash flows over the average of total assets. Cash flow (*CFlow*) is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity (*DebtMat*) is the ratio of long-term debt over the total debt of the company. Lastly, μ is the error term of the regression.

Regarding regression methodologies, four distinct approaches will be applied. First, a random-effects methodology, accounting for variability and differences between firms. Following, the second methodology is a pooled time series cross-sectional regression, including yearly dummies to control for macroeconomic events. The third methodology is a pooled time series cross-sectional regression that includes yearly dummies and industry dummies to control for sector-specific effects. Lastly, the fourth methodology is a cross-sectional regression that is performed by using means of variables for each firm throughout time.

4. Empirical Results and Analysis

In this section, the main findings are presented and discussed. First and foremost, the results of the entire treated sample from 2006 to 2021 are analyzed. Then, several subsections evaluate the robustness of the original findings, including modified, lagged and alternative regression tests. Moreover, the results are compared among micro, small and medium firms. Lastly, differences in the findings between the financial crisis period and the post-crisis era are explored.

4.1. Regression Tests

This subsection presents the findings of several regressions of the cash holdings ratio on firm characteristics from 2006 to 2021, with the results being reported in Table 8. The dividend dummy is significant at the 1% level in all distinct approaches and the association with cash holdings is negative, similarly to the prediction of the trade-off theory. Regarding the investment opportunity set, the coefficients are significantly negative, being in accordance with the free cash flow theory and contradicting the trade-off and pecking order theories. Hence, it suggests that entrenched managers in Portuguese SMEs with poor investment opportunities tend to accumulate greater amounts of cash holdings.

Moreover, liquid asset substitutes findings are in accordance with the trade-off theory assumption and with the study hypothesis, being significant for the majority of the regressions. In the case of leverage, the results contradict the dissertation hypothesis and the pecking order and free cash flow theories, which suggests that Portuguese SMEs accumulate greater levels of cash holdings when levering up, possibly to create a buffer for future financial distress.

Firm size is in accordance with the trade-off theory, demonstrating that larger firms on average own lower cash holdings ratios. Cash flow and cash flow volatility both present significant positive relationships with the dependent variable, with cash flow displaying the most economically significant findings.

Debt maturity evidences a negative sign, except in the random-effects model, aligning with the study hypothesis and suggesting that firms with a greater proportion of long-term debt to total debt hold on average less cash holdings. Moreover, debt maturity is only significant in the cross-sectional methodology, at the 5% level.

A fixed-effects model is not included in the regression methodologies since cash flow volatility has no variation throughout time and solely differs by firm. Therefore, Table 20 in Annex D exhibits the findings of regressions of the cash holdings ratio on firm characteristics, excluding cash flow volatility, from 2006 to 2021 and the random-effects approach is substituted with a fixed-effects model. The findings of Table 20 demonstrate that the signs and the significance of the coefficients are considerably similar to the results presented in Table 8.

Table 8: Regressions of Cash Holdings on Firm Characteristics

Variable	***Random Effects***	***Year Dummies***	***Year and Industry Dummies***	***Cross-Sectional***
Constant	0.407	0.310	0.299	0.269
Dividend Dummy	-0.036***	-0.033***	-0.034***	-0.112***
Investment Opportunities	-0.030***	-0.029***	-0.028***	-0.088***
Liquid Asset Substitutes	-0.072***	-0.078***	-0.077***	-0.006
Leverage	0.218***	0.218***	0.220***	0.200***
Size	-0.032***	-0.026***	-0.024***	-0.022***
Cash Flow Volatility	0.063***	0.074***	0.068***	0.045***
Cash Flow	0.314***	0.315***	0.312***	0.579***
Debt Maturity	0.000	-0.001	-0.001	-0.024**
N	3348872	3348872	3348872	3348872
Adjusted R^2	0.381	0.379	0.405	0.343

Table 8 exhibits regressions of cash ratio on firm characteristics from 2006 to 2021. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

4.2. Modified Regression Tests

In order to test the robustness of the findings obtained in Table 8, liquid asset substitutes, firm size and cash flow are defined differently in this subsection. Regarding liquid asset

substitutes, these are specified as the ratio of net working capital minus cash over total assets minus cash and equivalents (Ferreira and Vilela, 2004). Firm size is denoted as the natural logarithm of total sales adjusted at the 2021 price level. Lastly, cash flow is defined as after-tax profit plus depreciation expenses divided by total assets.

Table 9 presents the findings of the modified regressions of cash holdings on firm characteristics from 2006 to 2021. The results demonstrate that the signs of the coefficients remained the same, except for debt maturity in the random-effects model, likewise for the level of significance, as solely the dividend dummy coefficients are less significant and liquid asset substitutes is now significant at the 1% level in the cross-sectional regression. Hence, this subsection suggests that the original findings are robust.

Table 9: Modified Regressions of Cash Holdings on Firm Characteristics

Variable	*Random Effects*	*Year Dummies*	*Year and Industry Dummies*	*Cross-Sectional*
Constant	0.255	0.095	0.070	0.310
Dividend Dummy	-0.012**	-0.011**	-0.012**	-0.021
Investment Opportunities	-0.011***	-0.013***	-0.013***	-0.065***
Liquid Asset Substitutes	-0.024***	-0.031***	-0.029***	-0.023***
Leverage	0.265***	0.263***	0.265***	0.250***
Size	-0.023***	-0.012***	-0.011***	-0.027***
Cash Flow Volatility	0.188***	0.198***	0.171***	0.146***
Cash Flow	0.318***	0.314***	0.303***	0.698***
Debt Maturity	-0.007	-0.007	-0.008	-0.048**
N	3256327	3256327	3256327	3256327
Adjusted R^2	0.227	0.221	0.275	0.191

Table 9 exhibits regressions of cash ratio on firm characteristics from 2006 to 2021. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets minus cash and equivalents. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total sales adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets. Debt maturity is the ratio of long-term debt over the total debt of the company.

4.3. Lagged Regression Tests

In the interest of mitigating the simultaneity bias and therefore improving the robustness of the major findings, a lagged cash holdings ratio variable is included in the models. This additional explanatory variable is specified as the cash ratio lagged one year.

Table 10 exhibits regressions of cash ratio on lagged cash holdings ratio and on firm characteristics from 2006 to 2021. The findings demonstrate that most of the coefficients have the same sign and the same level of significance in comparison with Table 8 results. Nevertheless, liquid asset substitutes becomes significant at the 1% level across all regression methodologies and the cash flow volatility coefficient in the cross-sectional regression yields a negative sign. To conclude, the findings of Table 10 suggest that the original results are robust.

Table 10: Regressions on Lagged Cash Ratio and on Firm Characteristics

Variable	*Random Effects*	*Year Dummies*	*Year and Industry Dummies*	*Cross-Sectional*
Constant	0.196	0.130	0.127	0.002
Lagged Cash Holdings	0.471***	0.468***	0.463***	0.889***
Dividend Dummy	-0.035***	-0.033***	-0.033***	-0.027***
Investment Opportunities	-0.016***	-0.016***	-0.016***	-0.012***
Liquid Asset Substitutes	-0.069***	-0.073***	-0.074***	-0.009***
Leverage	0.149***	0.150***	0.152***	0.035***
Size	-0.017***	-0.014***	-0.013***	-0.001***
Cash Flow Volatility	0.036***	0.049***	0.056***	-0.013***
Cash Flow	0.267***	0.268***	0.267***	0.125***
Debt Maturity	-0.000	-0.001	-0.001	-0.007***
N	2743028	2743028	2743028	2743028
Adjusted R^2	0.703	0.702	0.707	0.672

Table 10 exhibits regressions of cash ratio on lagged cash holdings ratio and on firm characteristics from 2006 to 2021. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Lagged Cash Holdings is the cash ratio lagged one year. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit

plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

4.4. Alternative Specifications

Assuming firm's decisions on cash holdings, leverage and investment strategy are decided simultaneously is a realistic and acceptable line of reasoning (Ferreira and Vilela, 2004). Therefore, to test the robustness and accuracy of the findings, alternative specifications that exclude the dividend dummy and leverage are presented in Table 11.

The main conclusion is that the signs of the coefficients remained unchanged, except for the debt maturity variable, that evidences positive signs for all different regression approaches. Furthermore, liquid asset substitutes is significant at the 1% level and debt maturity is non-significant, both across all regression approaches. Hence, the joint determination of cash holdings, leverage and investment policy seems to minorly impact the original findings.

Table 11: Alternative Regressions of Cash Holdings on Firm Characteristics

Variable	***Random Effects***	***Year Dummies***	***Year and Industry Dummies***	***Cross-Sectional***
Constant	0.570	0.482	0.450	0.489
Investment Opportunities	-0.026***	-0.024***	-0.024***	-0.074***
Liquid Asset Substitutes	-0.191***	-0.196***	-0.196***	-0.102***
Size	-0.030***	-0.025***	-0.024***	-0.027***
Cash Flow Volatility	0.060***	0.069***	0.065***	0.024***
Cash Flow	0.334***	0.336***	0.333***	0.589***
Debt Maturity	0.014	0.013	0.013	0.022
N	3348872	3348872	3348872	3348872
Adjusted R^2	0.345	0.343	0.362	0.324

Table 11 exhibits regressions of cash ratio on firm characteristics from 2006 to 2021, excluding dividend dummy and leverage. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation

expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

4.5. Regression Tests per Firm Size

In this subsection, the sample is divided by firm size in order to study the impact of firm characteristics on the cash holdings decisions of micro, small and medium companies and to explore the differences between them. Therefore, the three distinct groups of firms are examined separately and to conclude the subsection a comparison of the findings is made.

4.5.1. Regression Tests on Micro Firms

Concerning micro firms, Table 12 presents the results of the regression methodologies of cash ratio on firm characteristics from 2006 to 2021. First and foremost, the great majority of the coefficients are significant at the 1% level, with debt maturity in the cross-sectional regression being significant at the 5% level. Payout policy, investment opportunity set, liquid asset substitutes and firm size exhibit negative signs across the different regression approaches, with investment opportunities being contradictory to the study hypothesis and to a considerable previous literature.

On the other hand, leverage, cash flow volatility and cash flow present positive associations with the cash holdings ratio. In this case, leverage yields the most interesting results since a vast number of theoretical and empirical studies find a negative relationship between cash holdings and financial leverage. Debt maturity demonstrates irregular findings as the coefficient sign in the random-effects model is positive but negative in the other methodologies.

Table 12: Micro Firms Regressions

Variable	*Random Effects*	*Year Dummies*	*Year and Industry Dummies*	*Cross-Sectional*
Constant	0.430	0.339	0.328	0.286
Dividend Dummy	-0.046***	-0.043***	-0.043***	-0.118***
Investment Opportunities	-0.030***	-0.029***	-0.029***	-0.088***
Liquid Asset Substitutes	-0.076***	-0.081***	-0.080***	-0.009
Leverage	0.216***	0.216***	0.218***	0.201***
Size	-0.033***	-0.027***	-0.026***	-0.023***
Cash Flow Volatility	0.060***	0.069***	0.063***	0.045***
Cash Flow	0.311***	0.312***	0.308***	0.570***
Debt Maturity	0.001	-0.000	-0.000	-0.022**
N	2763080	2763080	2763080	2763080
Adjusted R^2	0.375	0.372	0.402	0.335

Table 12 exhibits regressions of cash ratio on firm characteristics in micro firms from 2006 to 2021. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

4.5.2. Regression Tests on Small Firms

Regarding small firms, Table 13 displays the findings of the different regression approaches of cash holdings ratio on firm characteristics from 2006 to 2021. In relation to the level of significance, liquid asset substitutes is significant at the 5% level in the cross-sectional regression and debt maturity is significant at the 5% level in the random-effects model. All the other remaining coefficients are significant at the 1% level. Dividend payments, investment opportunity set, firm size and debt maturity present negative associations with the cash holdings ratio for all methodologies, being the cross-sectional regression the methodology that on average presents more distinct findings in comparison with the other approaches.

Opposingly, a positive trend in coefficient signs is evidenced by leverage, cash flow volatility and cash flow. Thus, these findings suggest that Portuguese small firms hold greater amounts of cash as a precautionary motive for financial distress and future uncertainty. Lastly, liquid asset substitutes present a negative relationship with cash holdings for the majority of the regressions, except for the cross-sectional methodology, where the coefficient is slightly positive.

Table 13: Small Firms Regressions

Variable	*Random Effects*	*Year Dummies*	*Year and Industry Dummies*	*Cross-Sectional*
Constant	0.267	0.023	0.027	0.144
Dividend Dummy	-0.025***	-0.023***	-0.024***	-0.089***
Investment Opportunities	-0.029***	-0.026***	-0.026***	-0.054***
Liquid Asset Substitutes	-0.035***	-0.041***	-0.041***	0.004**
Leverage	0.243***	0.248***	0.248***	0.191***
Size	-0.024***	-0.010***	-0.009***	-0.013***
Cash Flow Volatility	0.136***	0.167***	0.167***	0.049***
Cash Flow	0.367***	0.367***	0.368***	0.626***
Debt Maturity	-0.005**	-0.012***	-0.012***	-0.078***
N	502257	502257	502257	502257
Adjusted R^2	0.365	0.372	0.389	0.347

Table 13 exhibits regressions of cash ratio on firm characteristics in small firms from 2006 to 2021. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

4.5.3. Regression Tests on Medium Firms

On the subject of medium firms, Table 14 exhibits regressions of cash holdings ratio on firm characteristics from 2006 to 2021 and its respective findings. With regards to coefficients significance, most of the coefficients are significant at the 1% level, with cash flow volatility presenting the only non-significant coefficient. Dividend dummy, investment opportunities, liquid asset substitutes, firm size and debt maturity show coefficients with negative signs across all regression methodologies, whereas leverage and cash flow present positive associations with the cash holdings ratio. Regarding cash flow volatility, the signs of the coefficients are positive for most of the approaches, except in the cross-sectional regression, which is negative.

Table 14: Medium Firms Regressions

Variable	*Random Effects*	*Year Dummies*	*Year and Industry Dummies*	*Cross-Sectional*
Constant	0.197	-0.062	0.017	0.106
Dividend Dummy	-0.030***	-0.028***	-0.027***	-0.075**
Investment Opportunities	-0.028***	-0.025***	-0.025***	-0.030***
Liquid Asset Substitutes	-0.037***	-0.030***	-0.032***	-0.010**
Leverage	0.210***	0.223***	0.223***	0.159***
Size	-0.017***	-0.004***	-0.002**	-0.009***
Cash Flow Volatility	0.098***	0.115***	0.114***	-0.007
Cash Flow	0.389***	0.389***	0.389***	0.600***
Debt Maturity	-0.007**	-0.027***	-0.025***	-0.066***
N	83535	83535	83535	83535
Adjusted R^2	0.321	0.330	0.368	0.313

Table 14 exhibits regressions of cash ratio on firm characteristics in medium firms from 2006 to 2021. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

4.5.4. Regression Findings per Firm Size Comparison

Firstly, micro firms present on average a greater impact on cash holdings in dividend dummy, investment opportunities, liquid asset substitutes and firm size, with all of the coefficient signs being negative and the majority being significant at the 1% level. Secondly, the positive and significant effects of leverage and cash flow volatility on the cash holdings ratio is more pronounced in small firms, which suggests that these group of companies hold on average higher levels of cash ratio when levering up or when there is more business uncertainty, comparing to micro and medium Portuguese firms.

Thirdly, medium companies' findings exhibit a greater positive influence of cash flow and a superior negative effect of debt maturity on cash holdings decisions, both being significant. Hence, the results suggest that medium firms accumulate more cash when there is an increase in cash flow than micro and small firms, possibly to create a buffer for financial instability or for future investment opportunities, and the rise of debt maturity influences medium firms to reduce the levels of cash holdings more noticeably, which might be due to the fact that larger companies tend to have more business complexity and with debt being more long-term, the need to allocate the cash to other endeavors is greater than in smaller firms.

Therefore, the findings per firm size demonstrate that the sign and the significance of the explanatory variables' coefficients are very similar between micro, small and medium companies, excluding the debt maturity variable that is considerably more significant in small and medium firms. Thus, the economic significance of the coefficients is the factor that is more notable in terms of differences.

Despite the core of this study being the investigation of the determinants of cash holdings in SMEs, Table 21 in Annex E presents regressions of the cash ratio on firm characteristics from 2006 to 2021 in Large Portuguese firms, in order to explore possible differences in the findings. The main conclusion is that the majority of the findings displayed in Table 21 are identical to the results exhibited in micro, small and medium companies, except for cash flow volatility that is significantly negative in the cross-sectional regression and non-significantly positive in the remaining approaches.

4.6. Regression Tests in Financial Crisis Period and Post-Crisis Era

This subsection divides the sample into two distinct time horizons with the goal of studying the differences in the impact of firm characteristics on cash holdings between periods.

Firstly, the findings in the financial crisis period are examined and secondly the results in a post-crisis era are analyzed. Lastly, the findings of both subsamples are compared in order to understand the influence of the macroeconomic cycle on the cash holdings decisions of Portuguese SMEs.

4.6.1. Regression Tests in Financial Crisis Period

Table 15 presents the findings of regressions of the cash holdings ratio on firm characteristics from 2006 to 2014. The coefficients of the crisis regressions are all significant at the 1% level, except for debt maturity that yields a non-significant coefficient and a significant coefficient at the 10% level.

In the matter of the impact on the cash holdings ratio, payout policy, investment opportunities, liquid asset substitutes and size exhibit negative associations with the dependent variable whereas leverage, cash flow volatility and cash flow demonstrate coefficients with positive significant signs. Debt maturity in the only explanatory variable in Table 13 that is not consistent across all regression methodologies in terms of the relationship with cash holdings, presenting positive signs in the first two approaches and negative signs in the remaining ones.

Table 15: Crisis Regressions

Variable	*Random Effects*	*Year Dummies*	*Year and Industry Dummies*	*Cross-Sectional*
Constant	0.385	0.369	0.382	0.298
Dividend Dummy	-0.036***	-0.035***	-0.035***	-0.127***
Investment Opportunities	-0.027***	-0.027***	-0.026***	-0.087***
Liquid Asset Substitutes	-0.077***	-0.079***	-0.076***	-0.007***
Leverage	0.233***	0.234***	0.238***	0.194***
Size	-0.031***	-0.030***	-0.029***	-0.023***
Cash Flow Volatility	0.092***	0.095***	0.088***	0.058***
Cash Flow	0.325***	0.325***	0.319***	0.656***
Debt Maturity	0.003***	0.001	-0.001*	-0.105***
N	1664478	1664478	1664478	1664478
Adjusted R^2	0.339	0.339	0.371	0.362

Table 15 exhibits regressions of cash ratio on firm characteristics from 2006 to 2014. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample.

The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

4.6.2. Regression Tests in Post-Crisis Era

Table 16 displays the results of regressions of the cash ratio on firm characteristics in a post-crisis era, from 2015 to 2021. Regarding significance, the coefficients of the post-crisis regressions are significant at the 1% level for most of the findings. Dividend dummy, investment opportunity set, liquid asset substitutes and firm size evidence negative signs across the different methodologies and, in opposition, leverage, cash flow volatility and cash flow show positive associations with the cash holdings ratio. In respect of debt maturity, it presents positive coefficients for the majority of the regressions apart from the cross-sectional approach, where the sign is significantly negative.

Furthermore, in order to investigate the impact of the Covid crisis on the findings of Table 16, regressions of cash holdings ratio on firm characteristics from 2015 to 2019 are exhibited in Table 22, Annex F. The exclusion of the Covid years demonstrate the resemblance in the results of both tables. Liquid asset substitutes is the firm characteristic that presents greater variations, evidencing a more significant negative influence on cash holdings in Table 22.

Table 16: Post-Crisis Regressions

Variable	*Random Effects*	*Year Dummies*	*Year and Industry Dummies*	*Cross-Sectional*
Constant	0.373	0.333	0.330	0.272
Dividend Dummy	-0.031***	-0.029***	-0.031***	-0.108***
Investment Opportunities	-0.028***	-0.024***	-0.024***	-0.078***
Liquid Asset Substitutes	-0.078***	-0.080***	-0.079***	-0.014
Leverage	0.226***	0.223***	0.225***	0.179***
Size	-0.028***	-0.026***	-0.025***	-0.020***
Cash Flow Volatility	0.059***	0.058***	0.051***	0.030***
Cash Flow	0.274***	0.279***	0.275***	0.539***
Debt Maturity	0.001	0.000	0.000	-0.012**
N	1684394	1684394	1684394	1684394
Adjusted R^2	0.396	0.397	0.423	0.386

Table 16 exhibits regressions of cash ratio on firm characteristics from 2015 to 2021. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

4.6.3. Regression Findings in Financial Crisis and Post-Crisis Comparison

The findings in the financial crisis period and in the post-crisis era are similar with regards to the significance and to the signs of the coefficients within the regression methodologies, exhibiting more noteworthy differences in terms of the economic significance. Following, the financial crisis subsample demonstrates stronger economic coefficients in payout policy, investment opportunities, financial leverage, firm size, cash flow volatility and cash flow. The post-crisis subsample only surpasses the financial crisis subsample in economic significance of the coefficients in the variable liquid asset substitutes, that are consistently more negative than those in the financial crisis interval. Moreover, debt maturity exhibits a considerable significant negative coefficient in the cross-sectional regression in the financial crisis period but most of the coefficients of this variable are inconsistent and economically non-significant in both time horizons.

Therefore, the results suggest that the negative economic cycle enhanced the impact of firm characteristics on cash holdings decisions, in both positive and negative effects, excluding liquid asset substitutes and debt maturity. Additionally, the greater influence of the majority of firm characteristics such as leverage, cash flow volatility and cash flow in the financial crisis period could be due to the increase in risk and uncertainty, causing cash holdings to be a vital resource for maintaining stability in the performance of businesses.

5. Conclusion

The dissertation investigates the determinants of corporate cash holdings for micro, small and medium enterprises in Portugal for the time period of 2006 to 2021. The main findings of the study suggest significant and negative associations between cash holdings and dividend payments, liquid asset substitutes and firm size, whereas cash flow volatility demonstrates a positive significant effect on cash levels. These results are mostly in line with Opler et al. (1999) and with the trade-off theory assumptions. Furthermore, the findings indicate that cash holdings in Portuguese SMEs are negatively affected by investment opportunities, which is consistent with the free cash flow theory, while cash flow displays a positive relationship with the amount of cash held by firms, being in accordance with the pecking order model. Similarly to García-Teruel and Martínez-Solano (2008) that study the determinants of cash balances for Spanish SMEs, leverage presents a positive effect on cash holdings while longer debt maturity impacts negatively the level of cash reserves.

Concerning differences by firm size, micro companies exhibit a higher cash holdings ratio in comparison to small and medium enterprises and demonstrate a stronger impact of payout policy, investment opportunity set, liquid asset substitutes and firm size on cash holdings decisions. Moreover, small firms reflect a more pronounced effect of leverage and cash flow volatility on cash holdings, while the influences of cash flow and debt maturity on cash reserves are more significant in medium-sized companies. With respect to the impact of the financial crisis of 2008 on the determinants of cash holdings, the findings suggest that the economic downturn exacerbated the majority of the associations between firm characteristics and corporate cash holdings. This intensified impact is likely related to the critical role of cash holdings during financial crisis, as risks and business uncertainty are more pronounced.

Regarding future research recommendations, the inclusion of corporate governance factors and macroeconomic variables might shed more light on the understanding of corporate cash holdings decisions. Furthermore, the comparison with SMEs from other economies, such as Greece, Italy and Spain, could be interesting in order to test differences in the impact of the financial crisis of 2008 in the determinants of cash holdings in an international scenario. Additionally, a more detailed analysis of the effect of the covid crisis on cash holdings decisions is suggested as the impact is recent and minorly explored. Finally, investigating the adoption of financial technologies and the influence of digitalization on liquidity management is recommended since it is a novel topic that has the potential to transform several decisions and practices in the corporate world.

References

Almeida, H., Campello, M., & Weisbach, M. S. (2004). The Cash Flow Sensitivity of Cash. *The Journal of Finance*, *59*(4), 1777–1804. https://doi.org/10.1111/j.1540-6261.2004.00679.x

Al-Najjar, B., & Belghitar, Y. (2011). Corporate cash holdings and dividend payments: Evidence from simultaneous analysis. *Managerial and Decision Economics*, *32*(4), 231–241. https://doi.org/10.1002/mde.1529

Barclay, M. J., & Smith Jr., C. W. (1996). On Financial Architecture: Leverage, Maturity, and Priority. *Journal of Applied Corporate Finance*, *8*(4), 4–17. https://doi.org/10.1111/j.1745-6622.1996.tb00679.x

Barclay, M., & Smith, C. (1995). The Maturity Structure of Corporate Debt. *Journal of Finance*, *50*, 609–631. https://doi.org/10.1111/j.1540-6261.1995.tb04797.x

Bates, T. W., Kahle, K. M., & Stulz, R. M. (2009). Why Do U.S. Firms Hold So Much More Cash than They Used To? *The Journal of Finance*, *64*(5), 1985–2021. https://doi.org/10.1111/j.1540-6261.2009.01492.x

Baumol, W. J. (1952). The Transactions Demand for Cash: An Inventory Theoretic Approach. *The Quarterly Journal of Economics*, *66*(4), 545–556. https://doi.org/10.2307/1882104

Bigelli, M., & Sánchez-Vidal, J. (2012). Cash holdings in private firms. *Journal of Banking & Finance*, *36*(1), 26–35. https://doi.org/10.1016/j.jbankfin.2011.06.004

Cardella, L., Fairhurst, D., & Klasa, S. (2021). What determines the composition of a firm's cash reserves? *Journal of Corporate Finance*, *68*, 101924. https://doi.org/10.1016/j.jcorpfin.2021.101924

Chen, R., Guedhami, O., Yang, Y., & Zaynutdinova, G. (2020). Corporate Governance and Cash Holdings: Evidence from Worldwide Board Reforms. *Journal of Corporate Finance*, *65*, 101771. https://doi.org/10.1016/j.jcorpfin.2020.101771

Cunha, I., & Pollet, J. (2020). Why Do Firms Hold Cash? Evidence from Demographic Demand Shifts. *The Review of Financial Studies*, *33*(9), 4102–4138. https://doi.org/10.1093/rfs/hhz124

Deloof, M. (2001). Belgian Intragroup Relations and the Determinants of Corporate Liquid Reserves. *European Financial Management*, *7*(3), 375–392. https://doi.org/10.1111/1468-036X.00161

Dittmar, A., & Mahrt-Smith, J. (2007). Corporate governance and the value of cash holdings. *Journal of Financial Economics*, *83*(3), 599–634. https://doi.org/10.1016/j.jfineco.2005.12.006

Dittmar, A., Mahrt-Smith, J., & Servaes, H. (2003). International Corporate Governance and Corporate Cash Holdings. *Journal of Financial and Quantitative Analysis*, *38*, 111–133. https://doi.org/10.2307/4126766

Drobetz, W., & Grüninger, M. C. (2007). Corporate cash holdings: Evidence from Switzerland. *Financial Markets and Portfolio Management*, *21*(3), 293–324. https://doi.org/10.1007/s11408-007-0052-8

Fernandes, N., & Gonenc, H. (2016). Multinationals and cash holdings. *Journal of Corporate Finance*, *39*, 139–154. https://doi.org/10.1016/j.jcorpfin.2016.06.003

Ferreira, M. A., & Vilela, A. S. (2004). Why Do Firms Hold Cash? Evidence from EMU Countries. *European Financial Management*, *10*(2), 295–319. https://doi.org/10.1111/j.1354-7798.2004.00251.x

Foley, C. F., Hartzell, J. C., Titman, S., & Twite, G. (2007). Why do firms hold so much cash? A tax-based explanation. *Journal of Financial Economics*, *86*(3), 579–607. https://doi.org/10.1016/j.jfineco.2006.11.006

García-Teruel, P. J., & Martínez-Solano, P. (2008). On the Determinants of SME Cash Holdings: Evidence from Spain. *Journal of Business Finance & Accounting*, *35*(1–2), 127–149. https://doi.org/10.1111/j.1468-5957.2007.02022.x

Gill, A., & Shah, C. (2012). Determinants of Corporate Cash Holdings: Evidence from Canada. *International Journal of Economics and Finance*, *4*(1). https://doi.org/10.5539/ijef.v4n1p70

Guney, Y., Ozkan, A., & Ozkan, N. (2007). International Evidence on the Non-Linear Impact of Leverage on Corporate Cash Holdings. *Journal of Multinational Financial Management*, *17*, 45–60. https://doi.org/10.1016/j.mulfin.2006.03.003

Harford, J., Klasa, S., & Maxwell, W. F. (2014). Refinancing Risk and Cash Holdings. *The Journal of Finance*, *69*(3), 975–1012. https://doi.org/10.1111/jofi.12133

Harford, J., Mansi, S. A., & Maxwell, W. F. (2008). Corporate governance and firm cash holdings in the US. *Journal of Financial Economics*, *87*(3), 535–555. https://doi.org/10.1016/j.jfineco.2007.04.002

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review*, *76*(2), 323–329. http://www.jstor.org/stable/1818789

Keynes. (1936). Mr. J. M. Keynes' General Theory of Employment, Interest and Money. *Economica*, *3*(10), 115–132. https://doi.org/10.2307/2549064

Kim, C.-S., Sherman, A., & Mauer, D. (1998). The Determinants of Corporate Liquidity: Theory and Evidence. *Journal of Financial and Quantitative Analysis*, *33*, 335–359. https://doi.org/10.2307/2331099

Martínez-Sola, García-Teruel, & Martínez-Solano. (2013). Corporate cash holding and firm value. *Applied Economics*, *45*(2), 161–170. https://doi.org/10.1080/00036846.2011.595696

Mikkelson, W. H., & Partch, M. M. (2003). Do Persistent Large Cash Reserves Hinder Performance? *The Journal of Financial and Quantitative Analysis*, *38*(2), 275. https://doi.org/10.2307/4126751

Miller, M. H., & Orr, D. (1966). A Model of the Demand for Money by Firms. *The Quarterly Journal of Economics*, *80*(3), 413–435. https://doi.org/10.2307/1880728

Modigliani, & Miller. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review*, *48*(3), 261–297. https://www.jstor.org/stable/1809766

Myers, S. (1984). The Capital Structure Puzzle. *The Journal of Finance*, *39*(3), 575–592. https://doi.org/10.2307/2327916

Myers, S., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, *13*(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

Opler, Pinkowitz, Stulz, & Williamson. (1999). The determinants and implications of corporate cash holdings. *Journal of Financial Economics*, *52*(1), 3–46. https://doi.org/10.1016/S0304-405X(99)00003-3

Ozkan, A., & Ozkan, N. (2004). Corporate cash holdings: An empirical investigation of UK companies. *Journal of Banking & Finance*, *28*(9), 2103–2134. https://doi.org/10.1016/j.jbankfin.2003.08.003

Pál, R., & Ferrando, A. (2010). Financing constraints and firms' cash policy in the euro area. *The European Journal of Finance*, *16*(2), 153–171. https://doi.org/10.1080/13518470903075748

Pereira, P. T., & Wemans, L. (2015). Portugal and the global financial crisis: Short-sighted politics, deteriorating public finances and the bailout imperative. In J. Wanna, E. A. Lindquist, & J. De Vries (Eds.), *The Global Financial Crisis and its Budget Impacts in OECD Nations* (pp. 231–254). Edward Elgar Publishing. https://doi.org/10.4337/9781784718961.00015

Rajan, R. G., & Zingales, L. (1995). What Do We Know about Capital Structure? Some Evidence from International Data. *The Journal of Finance*, *50*(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

Riddick, L. A., & Whited, T. M. (2009). The Corporate Propensity to Save. *The Journal of Finance*, *64*(4), 1729–1766. https://doi.org/10.1111/j.1540-6261.2009.01478.x

Subramaniam, V., Tang, T. T., Yue, H., & Zhou, X. (2011). Firm structure and corporate cash holdings. *Journal of Corporate Finance*, *17*(3), 759–773. https://doi.org/10.1016/j.jcorpfin.2010.06.002

Appendix

Annex A: Variables Description

Table 17: Definition of Variables

Variable	Variable Description
Cash Holdings	Cash and Cash Equivalents / Total Assets
Lagged Cash Holdings	Cash and Cash Equivalents / Total Assets (Lagged 1 Year)
Dividend Dummy	Equal to 1 if Dividends are # 0 and Equal to 0 if Dividends are = 0
Investment Opportunities	(Total Sales (t) - Total Sales (t-1)) / Total Sales (t-1)
Liquid Asset Substitutes	(Current Assets – Current Liabilities – Cash) / Total Assets
Liquid Asset Substitutes*	(Current Assets – Current Liabilities – Cash) / (Total Assets – Cash)
Leverage	Total Debt / (Total Assets – Cash and Cash Equivalents)
Size	Ln (Total Assets) / Consumer Price Index
Size*	Ln (Total Sales) / Consumer Price Index
Cash Flow Volatility	Cash Flow Standard Deviation / Total Assets Average
Cash Flow	(After-Tax Profit + Depreciation Expenses) / (Total Assets – Cash)
Cash Flow*	(After-Tax Profit + Depreciation Expenses) / Total Assets
Debt Maturity	Long-Term Debt / Total Debt

Table 17 exhibits the description of the variables applied on the study. Variables with * are the modified versions presented on Table 9.

Annex B: Descriptive Statistics on the Winsorised Cash Holdings Ratio

Table 18: Winsorised Cash Ratio per Firm Size

Firm Size	*Mean*	*Median*	*P25*	*P75*	*STD*	*Max*	*Min*	*N*
Micro	0.221	0.120	0.029	0.348	0.240	0.823	0.001	2763080
Small	0.151	0.076	0.021	0.215	0.180	0.823	0.001	502257
Medium	0.109	0.045	0.012	0.145	0.148	0.823	0.001	83535
Total	0.207	0.109	0.026	0.319	0.232	0.823	0.001	3348872

Table 18 presents descriptive statistics on the cash holdings ratio by firm size from 2006 to 2021. Cash ratio is measured as cash and cash equivalents to total assets and it is winsorised at the 5% level on both tails of the distribution. P25 is the 25th percentile and P75 is the 75th percentile. STD denotes standard deviation. N is the number of observations in the sample for each firm size.

Annex C: Descriptive Statistics on the Winsorised Explanatory Variables

Table 19: Winsorised Explanatory Variables Description

Variable	*Mean*	*Median*	*P25*	*P75*	*STD*	*Max*	*Min*	*N*
Dividend Dummy	0	0	0	0	0	0	0	3348872
Investment Opportunities	0.090	0.008	-0.161	0.208	0.527	2.168	-0.873	3348872
Liquid Asset Substitutes	0.139	0.117	-0.070	0.365	0.325	0.773	-0.583	3348872
Leverage	0.717	0.721	0.429	0.939	0.397	2.101	0.071	3348872
Size	12.945	12.818	11.707	14.069	1.660	17.477	9.775	3348872
Cash Flow Volatility	0.108	0.084	0.047	0.144	0.081	0.381	0.014	3348872
Cash Flow	0.139	0.073	0.013	0.197	0.235	1.083	-0.346	3348872
Debt Maturity	0.269	0.124	0	0.510	0.313	0.954	0	3348872

Table 19 presents descriptive statistics on the explanatory variables from 2006 to 2021. All explanatory variables are winsorised at the 5% level on both tails of the distribution. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company. P25 is the 25^{th} percentile and P75 is the 75^{th} percentile. STD denotes standard deviation. N is the number of observations in the sample.

Annex D: Regressions including a Fixed Effects Methodology

Table 20: Fixed Effects Regressions

Variable	*Fixed Effects*	*Year Dummies*	*Year and Industry Dummies*	*Cross-Sectional*
Constant	0.490	0.340	0.324	0.294
Dividend Dummy	-0.037***	-0.032***	-0.032***	-0.095***
Investment Opportunities	-0.025***	-0.029***	-0.028***	-0.088***
Liquid Asset Substitutes	-0.090***	-0.078***	-0.077***	-0.006
Leverage	0.220***	0.218***	0.220***	0.199***
Size	-0.036***	-0.027***	-0.026***	-0.023***
Cash Flow	0.288***	0.316***	0.313***	0.584***
Debt Maturity	0.001*	-0.001	-0.001	-0.025**
N	3348872	3348872	3348872	3348872
Adjusted R^2	0.366	0.377	0.403	0.344

Table 20 exhibits regressions of cash ratio on firm characteristics from 2006 to 2021. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

Annex E: Regressions of Cash Ratio on Firm Characteristics in Large Firms

Table 21: Large Firms Regressions

Variable	*Random Effects*	*Year Dummies*	*Year and Industry Dummies*	*Cross-Sectional*
Constant	0.070	-0.045	-0.105	0.047
Dividend Dummy	-0.030***	-0.030***	-0.031***	-0.166***
Investment Opportunities	-0.023***	-0.020***	-0.020***	-0.008
Liquid Asset Substitutes	-0.045***	-0.039***	-0.040***	-0.027***
Leverage	0.221***	0.226***	0.233***	0.146***
Size	-0.010***	-0.004***	-0.004*	-0.005***
Cash Flow Volatility	0.019	0.025	0.053	-0.094***
Cash Flow	0.389***	0.389***	0.390***	0.541***
Debt Maturity	-0.013*	-0.022***	-0.021**	-0.069
N	14992	14992	14992	14992
Adjusted R^2	0.287	0.290	0.430	0.232

Table 21 exhibits regressions of cash ratio on firm characteristics in large firms from 2006 to 2021. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

Annex F: Regressions of Cash Ratio on Firm Characteristics in the Post-Crisis Era except the Covid Period

Table 22: Post-Crisis Regressions Excluding the Covid Years

Variable	*Random Effects*	*Year Dummies*	*Year and Industry Dummies*	*Cross-Sectional*
Constant	0.376	0.348	0.335	0.297
Dividend Dummy	-0.030***	-0.030***	-0.031***	-0.109***
Investment Opportunities	-0.027***	-0.026***	-0.025***	-0.078***
Liquid Asset Substitutes	-0.106***	-0.106***	-0.105***	-0.051***
Leverage	0.211***	0.213***	0.215***	0.150***
Size	-0.028***	-0.027***	-0.025***	-0.020***
Cash Flow Volatility	0.067***	0.070***	0.065***	0.023***
Cash Flow	0.309***	0.310***	0.305***	0.566***
Debt Maturity	-0.000	-0.000	-0.000	-0.023**
N	1153902	1153902	1153902	1153902
Adjusted R^2	0.395	0.394	0.423	0.399

Table 22 exhibits regressions of cash ratio on firm characteristics from 2015 to 2019. Significance at the 1% level is represented by ***, at the 5% level by ** and at the 10% level by *. N is the number of observations in the sample. The dependent variable is the cash holdings ratio, measured as cash and cash equivalents to total assets. Dividend Dummy is a variable set to one if the company pays dividends in each year and set to zero if it did not. Firm's opportunities are measured as the yearly growth rate of sales. Liquid asset substitutes are defined as the ratio of net working capital minus cash over total assets. Leverage is total debt divided by total assets less cash and cash equivalents. Size is denoted as the natural logarithm of total assets adjusted at the 2021 price level. Cash flow volatility is measured by the standard deviation of cash flows over the average of total assets. Cash flow is defined as after-tax profit plus depreciation expenses divided by total assets minus cash and equivalents. Debt maturity is the ratio of long-term debt over the total debt of the company.

Annex G: Consumer Price Index

Table 23: Consumer Price Index Portugal

Year	CPI (Base Year = 2012)	CPI (Base Year = 2021)	CPI Conversion Factor
2006	88.819	84.471	1.051
2007	90.998	86.544	1.051
2008	93.354	88.784	1.051
2009	92.574	88.042	1.051
2010	93.872	89.277	1.051
2011	97.302	92.539	1.051
2012	100.000	95.105	1.051
2013	100.274	95.366	1.051
2014	99.996	95.101	1.051
2015	100.483	95.564	1.051
2016	101.094	96.145	1.051
2017	102.477	97.461	1.051
2018	103.496	98.430	1.051
2019	103.846	98.763	1.051
2020	103.833	98.750	1.051
2021	105.147	100.000	1.051

Table 23 exhibits the Consumer Price Index in Portugal with distinct base years. The Consumer Price Index with base year in 2012 is obtained from Instituto Nacional de Estatística (Statistics Portugal). The Consumer Price Index with base year in 2021 is achieved through a Conversion Factor that is equal to the last value of the CPI (Base Year = 2012) divided by the seventh value of the CPI (Base Year = 2012).

Annex H: Adjusted R^2

Table 24: Adjusted R^2 Computation

R^2	Observations	Predictors	Adjusted R^2
0.381	3348872	8	0.381
0.379	3348872	8	0.379
0.405	3348872	8	0.405
0.343	3348872	8	0.343
0.227	3256327	8	0.227
0.221	3256327	8	0.221
0.275	3256327	8	0.275
0.191	3256327	8	0.191
0.703	2743028	9	0.703
0.702	2743028	9	0.702
0.707	2743028	9	0.707
0.672	2743028	9	0.672
0.345	3348872	6	0.345
0.343	3348872	6	0.343
0.362	3348872	6	0.362
0.324	3348872	6	0.324
0.375	2763080	8	0.375
0.372	2763080	8	0.372
0.402	2763080	8	0.402
0.335	2763080	8	0.335
0.365	502257	8	0.365
0.372	502257	8	0.372
0.389	502257	8	0.389
0.347	502257	8	0.347
0.321	83535	8	0.321
0.330	83535	8	0.330
0.368	83535	8	0.368
0.313	83535	8	0.313
0.339	1664478	8	0.339
0.339	1664478	8	0.339
0.371	1664478	8	0.371
0.362	1664478	8	0.362
0.396	1684394	8	0.396
0.397	1684394	8	0.397
0.423	1684394	8	0.423
0.386	1684394	8	0.386
0.366	3348872	7	0.366
0.377	3348872	7	0.377
0.403	3348872	7	0.403
0.344	3348872	7	0.344

0.287	14992	8	0.287
0.290	14992	8	0.290
0.430	14992	8	0.430
0.232	14992	8	0.232
0.395	1153902	8	0.395
0.394	1153902	8	0.394
0.423	1153902	8	0.423
0.399	1153902	8	0.399

Table 24 exhibits the Adjusted R^2 for each regression of the study. The Adjusted R^2 is computed with the following formula: 1 - ((1 - R^2) * (Observations – 1) / (Observations – Predictors – 1)).