What Determines Cash Holding of A Firm? Evidence from Euro-Zone Listed Firms

Finance Master Thesis

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Abstract

The average cash to assets ratio for US industrial firms more than doubled during the past decades. This paper investigates the empirical determinants of corporate cash holdings for a sample of 17653 observations for 1758 unique firms publicly traded in 11 Eurozone countries in the period from 1999 to 2011. Firstly, the increase of cash holdings of firm incorporated in Eurozone has been documented: the average cash ratios increased from 7.38% in 1999 to 12.47% in 2011. In addition, the empirical relevance of the transaction and precautionary motives are examined by analyzing the influence of firm characteristics on cash holdings. The results reveal that firms with quality investment opportunities tend to hold more cash. Furthermore, firms that have better access to capital markets and have access to more substitutes for cash, hold relatively lower cash to total assets ratios.

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1 Introduction

Cash is the most liquid and the least profitable asset. It plays an important role in corporate finance. Corporate cash holding is one of the most essential issues and strategies of corporate financial management, which not only relates to corporate operation and development, but also relates to the corporate governance and the institutional environment.

According to research by Opler, Pinkowitz, Stulz and Williamson (1997), the average cash-to-assets ratio for US industrial firms has increased dramatically over the past decades, which indicates that firms are holding more cash than before. Bates, Kahle and Stulz (2009) claim that main reasons for this increase are the increase of cash flow volatility and R&D expenditures, the decrease of capital expenditures, and the falling of inventories.

In a world of perfect capital markets, the optimal amount of cash is irrelevant. On account of the inexistence of a liquidity premium in such a world, the holdings of liquid assets have no opportunity costs. That is to say, even if the level of cash holding went unexpectedly low, a firm can still raise fund to keep investing and operating activities at zero cost. Therefore, the benefit of shareholders will not change with the liquid asset investing of the firm. However, because of the transaction cost, agency cost and information asymmetry, in the real world, it is costly for a firm to be short of liquid assets. Consequently, the management should decide the optimal amount of cash holdings to maximize the wealth of shareholders. There are two theoretical frames dominant in corporate cash holding theories: the trade-off theory and the financing hierarchy theory.

Cash is the most liquid assets. However, it is one of the least profitable assets. The marginal benefit of holding cash will decrease if the firm has too much cash on hand. Meanwhile, all kinds of normal activities of firms cannot be satisfied if the amount of cash holding is too small. The trade-off theory claims that management should decide the level of cash holdings by equalizing the marginal benefit of cash holdings with the marginal cost of those holdings. Opler, Pinkowitz, Stulz and

Williamson (1997) recite that there are two major benefits of holding liquid assets. First, firms can use their liquid assets to finance its operating and investing activities when other sources of financing are extremely expensive or not available. Second, a firm does not have to liquidate assets to finance and save the transaction costs to raise funds. Keynes (1936) defines the first benefit as the precautionary motive and the second as the transaction motive of holding cash. However, every coin has two sides. It is not always good to hold too much cash. Kim, Mauer and Sherman(1998) state that the investment in liquid assets is costly, since firms have to abstain from investing in less liquid but higher rate of return assets, and liquid assets lead to higher taxation. Furthermore, according to Jensen (1986), when the level of firm's cash holdings is really high, the agency problem between management and shareholders may become more severe. In conclusion, the trade-off theory states that there is optimal amount of cash holdings and it should be the equitation of the marginal benefit of cash holdings and the marginal cost of those holdings.

The financing hierarchy theory is derived from the pecking-order theory. Myers and Majluf (1984) focus on the methods that firms might use to raise cash when there is a valuable real investment opportunity. Based on the shareholder wealth maximization, they state that firms normally prefer to use internal funds to finance their investments. If internal funds are not enough for the payment, firms will still consider liquidating existence assets instead of raising outside funds. The reason is that when firms' managers know more about the value of the assets and opportunities than outside investors, financing for the investment opportunity will encounter adverse select problem, which leads to a higher cost for external financing. The financing hierarchy theory claims that there is no optimal amount of cash, because cash is recognized as negative debt.

According to Brealey and Myers (1996), identifying value of liquidity is one of the top 10 unsolved problems in the world of finance. Recently, there is a lot of research focusing on the determinants of cash holdings. Kim, Mauer and Sherman (1998) empirically test 915 industrial firms in the US. They find that the optimal amount of cash holding is positively related to the cost of external financing and the

volatility of future cash flow, and it is negatively related to the return on physical assets. Opler, Pinkowitz, Stulz and Williamson (1997) examine the sample of publicly traded US firms in the period 1971-1994, and find evidence to support the static trade-off model of cash holdings. They argue that firms with higher volatility of cash flows and stronger growth opportunities turn out to hold more cash than their opposite ones, and bigger firms with better credit ratings, which indicate better access to capital markets, hold less cash. Faulkender (2002) uses 2808 corporation in the 1993 National Survey of Small Business Finance conducted by the Federal Reserve as sample database, and he finds out that firms with higher cost of financial distress, greater leverage, greater information asymmetries or longer history tend to hold more cash. On the contrary, firms with difficulty in the past in financing have lower level of cash holding. Furthermore, because of the economies of scales, cash holdings decrease with size. John (1993) claims that firms prefer to hold more cash when they experience higher financial distress costs. By analysis the 223 major US corporations with an average annual liquidity ratio of 6.3% in the period 1979-1981, he finds out that firms with high market to book ratio and low liquidity ratio are inclined to greater cash holdings.

There are several reasons for which there might be differences in the level of cash holdings between European and U.S. corporations. On one hand, corporate governance of Europe and American firms are not identical. La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) find out that the legal origin of US has better protection of investors than European countries. They also suggest that agency problems are less severe in US than in Europe. On the other hand, according to Van Ark, O'Mahoney and Timmer (2008), there is the productivity gap between Europe and United States, which attribute to slower emergence of knowledge economy in Europe than in United States. That might lead to higher level of risk-averse of European investors. Nykvist (2008) claims that European countries have worse access to capital market than United States. In addition, Bottazzi and Da Rin (2003) argue that venture capital markets of United States are more developed than the ones in Europe.

In this paper, I investigate whether the rising trend of cash holdings also exists in Eurozone firms. The results prove that cash holdings of firm incorporated in Eurozone countries have increased significantly from 1999 to 2011. I also test the relations between cash holdings and some firm characteristics. Results are consistent with of the findings for the US, which indicates that those characteristics have the same effect on Eurozone firms as on US firms.

The remainder of the paper is structured as follows. Section 2 provides reviews of related empirical literature on this subject. Section 3 describes the dataset that is used. Section 4 overviews the change in cash holdings over time. Section 5 investigates the relationships between cash ratio and some important firm characteristics. Section 6 conducts the empirical analysis and presents the results. Section 7 concludes.

2 Empirical literature review and hypotheses

Previews economics and finance literature have pointed out four motives for firms to hold cash. This section contains the brief discussion of the existing empirical and theoretical literature on corporate cash holdings. The expectation of influence that caused by these motives on cash holdings will also be analyzed.

2.1 The transaction motive

Opler, Pinkowitz, Stulz and Williamson (1997) state that there are several options for a firm who is lack of liquid assets: it could sell existing assets, raise funds in the capital market, reduce dividends and investment, renegotiate existing financial contracts, or even make combinations of these actions. As mentioned before, in a perfect market, the transaction motive may not exist, since there is no opportunity cost to hold liquid asset. However, in reality, costs are generated at the time when companies buying and selling assets. Besides, Myers and Majluf (1984) argue that because of the information asymmetry, external financing is much costly than using

internal funds. Therefore, firms prefer to hold cash as buffer to avoid transaction costs. Since the 1930s, there have been some arguments about whether the optimal amount of cash holding exists or not. Keynes (1936) introduces transaction cost model based on the definition of marginal cost. He claims that the optimal amount of liquid assets is obtained by the intersection of the marginal cost of liquid asset shortage curve and the marginal cost of liquid assets curve. Opler, Pinkowitz, Stulz and Williamson (1997) identify the cost of holding liquid assets as their lower expected return, which will not vary with amounts. Hence, the marginal cost curve of holding liquid asset assumed to be horizontal. On the other hands, firms which are short of liquid assets may issue new equities or sell assets to finance. The greater the shortage, the greater the costs, because more outside funds need to be raised and more investment need to be abandoned to settle the shortage. Therefore, the marginal cost curve of liquid asset shortage is downward sloping.

The transaction motive for cash holdings has been discussed further in the later literatures. Classic finance model from Baumol (1952), who is more interested in the transaction motive of cash holdings, applies the classical "lot size" model of inventory management to cash holdings. He also derives the optimal demand for cash by dealing with the tradeoff between holding cash and giving up the return in form of interest, which is generated by remaining the assets on the balance sheet as noncash financial assets. Miller and Orr (1966) include the volatility of cash flow in the adaption of the Baumol's model and point up that the demand for money is increasing with the volatility of cash flow. They also show that brokerage cost could be one of the reasons of firms to hold more liquid assets. Mulligan (1997) uses evidence to support the existence of economies of scale theory, which states that large firms hold less cash than small firms.

Since difference options of raising funds are costly, according to the transaction motive, the firm that is more likely to trigger high transaction costs tends to hold more cash. The following variables affect the costs of being short of liquid asset:

2.1.1 Size

Under the assumption that big firms are better diversified than small firms, Bates, Kahle and Stulz (2009) state that big firms are more likely to be able to liquidate part of non-core assets to obtain cash, which reduces the possibility of encountering financial distress. Barclay and Smith (1995) state that there are scale economies resulting from the large fixed cost of public issuance. Big firms seem to have lower cost of raising money in the capital market than small firms owing to these scale economies. Therefore, small firms tend to hold more cash to avoid those costs. In a word, firm size is negative related to cash holdings.

2.1.2 Cash flow

Kim, Mauer and Sherman (1998) suggest that operating cash flow and especially free cash flow provide a ready source of liquidity to meet operating expenditures and maturing liabilities, and they also find evidence to prove the negative relation between cash flow and cash holdings.

2.1.3 Debt rating

Opler, Pinkowitz, Stulz and Williamson (1997) suggest that firms with a debt rating tend to hold less liquid assets, because firms that have already accessed capital markets are expected to have lower transaction costs. Moreover, firms with a debt rating are assumed have better access to the market, therefore, they might hold less cash than the counterparty.

2.1.4 Dividend

Bates, Kahle and Stulz (2009) state that firms who currently pay dividends are able to raise funds at lower cost by reducing their dividends payments when facing cash shortage. On the contrary, non-dividend payout firms have no choice but to use capital markets to raise funds. Therefore, they prefer to hold more cash to avoid the

higher cost.

2.1.5 Investment opportunity

The increasing of profitable investment opportunity indicates that firms might have to forgo better project when encountering financial difficulties. Firms with high quality investment project have higher opportunity cost of lost, because the NPV generated by investment project would nearly disappear when firms facing shortage of cash and have to give up. Therefore, firms with high quality investment opportunity tend to hold more cash. Investment opportunity is positively related to cash holdings

2.1.6 Leverage

When shortage of cash occurs, firms could borrow debts as a solution. As a result, debt is deemed as one substitution for cash. Leverage ratio is an indicator of firm's ability to take on debt. Baskin (1987) claims that the cost of investment on liquid assets is rising with the leverage ratio, which indicates that cash holding is decreasing with the debts in capital structure. Therefore, in the transaction motive point of view, leverage is negatively related to cash holding.

2.2 The precautionary motive

It is well-known that there are agency costs of debt and information asymmetries in reality. Firms without enough liquid assets tend to hold cash to prevent from cash flow shortfalls, which might lead to give up profitable projects or even financial distress. Opler, Pinkowitz, Stulz and Williamson (1997) define this as precautionary motive for holding cash. Almeida, Campello and Weisbach (2004) set a model to analyze the precautionary demand for cash. They find that cash holdings of firms that are financially constrained are positively related to cash flow, while the cash flow

sensitivity for holding cash is not found in financially unconstrained firms. Han and Qiu (2007) extend the theoretical model of Almeida, Campello and Weisbach (2004) to allow for a continuous distribution of cash flow. They suggest that cash holdings of financially constrained firms increased with cash flow volatility.

The followings are several variables deemed as proxy for the precautionary motive:

2.2.1 Firm size

In the view of precautionary motive, Rajan and Zingales (1995) state that big firms are more likely to reveal information to public than small ones. That is to say, public seems to know big firms better, so that the level of information asymmetries for those firms is lower. Furthermore, Myers (1977) mentions that because management is given less growth opportunity and free decision-making authority, the marginal bankruptcy cost of big firms is lower. Therefore, comparing to big companies, small ones are subject to more restrictions and bigger amount of transaction cost when raising money in capital market, and tend to hold more cash to prevent bankruptcy. In a word, size is negatively related to cash holdings.

2.2.2 Leverage

Generally speaking, the possibility of bankruptcy is increasing with the level of leverage of firms. Thus, in the precautionary motive point of view, firms with higher leverage tend to hold more cash in order to reduce the possibility of financial distress. In this respect, cash holdings are positively related to leverage. While in the transaction point of view, the leverage is negatively related to cash holdings. Therefore, in conclusion, though the influence of leverage on cash holding is significant, the sign is not clear.

2.2.3 Bank loan

According to Diamond (1984), bank loan is a better way to reduce the agency cost and information asymmetry than public debt, for the reason that banks have absolute advantages in supervising firms, and collecting and managing information. As a creditor, banks can utilize internal information, and evaluate and supervise debtors more effectively. Therefore, bank loan conveys positive information of firms to the public, which increases firms' reputation value. The capacity of raising debt in the capital is also increased. On the other hand, banks are more likely to renegotiate and provide additional loans comparing to other creditors when firms lacking of cash. In a word, bank loan is negatively related to cash holdings.

2.2.4 Dividend

Bates, Kahle and Stulz (2009) states that paying dividend is a positive signal of the firms to the public, therefore, dividend-paying firms usually have better access to the capital markets. As a result, they tend to hold less cash.

2.2.5 Market-to-book ratio

According to Opler, Pinkowitz, Stulz and Williamson (1997), market-to-book ratio is often used as a proxy for investment opportunity. As discussed before, firms with valuable investment opportunities and high cost of accessing external capital tend to hold more cash to avoid the higher cost of funds shortage. Ceteris paribus, one would expect firms with high market-to-book ratio to hold more cash. Therefore, market-to-book ratio is positively related to cash holdings.

2.2.6 R&D expenses

According to Opler and Titman (1994), R&D expenses are regarded as an indicator of the specialization of firms. As mentioned before, diversified firms tend to hold less cash than specified firms, because diversified firms could liquidate non-core

assets to finance their operating or investments when facing shortfalls of cash. Besides, Opler, Pinkowitz, Stulz and Williamson (1997) states when information asymmetries are most important, firms with high R&D expenses are expected to have larger cost of financial distress, because R&D expense are deemed as a form of investment. Consequently, firms with higher R&D expense will hold more cash.

2.2.7 Capital expenditures

According to Bates, Kahle and Stulz (2009), if the assets that created by capital expenditures could be used as collateral, then capital expenditure is negatively related to cash holdings because it could reduce the demand for cash and improve the debt capacity. On the other hand, capital expenditure can also be used as a proxy for financial distress costs or investment opportunities. From the precautionary point of view, firms with high capital expenditures may hold more cash, which means that capital expenditures and cash are negatively related.

2.2.8 Cash flow uncertainty

On account of uncertainty of market and other external financial elements, firms can hardly make accurate prediction on future cash outflows and inflows. The uncertainty of cash flow induces the possibility of shortage of cash. Therefore, firms with greater cash flow uncertainty are expected to hold more cash. Cash flow uncertainty is positively related to cash holdings.

2.3 The agency motive

The trade-off theory focuses on the trade off between benefits and costs of holding cash. It is under the assumption that to maximize the shareholders' wealth. However, managers and shareholders view the costs and benefits of holding cash differently. Agency problem might be the explanation for why the amount of the cash

holdings of firms is not always based on the maximization of shareholders' benefits in reality. Management has more incentives to hold cash, because it could reduce the risk and gain more control of firms. In return, these incentives lead management to put more weight on precautionary motives. Therefore, with the existence of agency cost, firms might hold more cash than shareholder expected.

Berle and Means (1932) suggest that the separation of ownership and control is an important characteristic of modern firms by analyzing the 200 non-financial firms in US. This separation forms an agent-principal relation between shareholders and management.

Jensen and Meckling (1976) bring about the principal-agent theory, which indicates that owing to information asymmetries and limited rationality, there is agency problem between shareholders and managers. Management would allocate resources of firms based on personal benefit, which lead to the damage of shareholders' benefits. Under the assumption of information asymmetry, the agency cost is emerged because agent may not manage the firm in the goal of maximizing the wealth of shareholders,

Based on agency cost, which is defined as the monitoring expenditures by the principal, the bonding expenditures by the agent and the residual loss, Jensen (1986) raises the free cash flow theory to explain the motives of management to hold cash. He thinks that high level of cash holdings of firms is in line with the benefit of management, but not with the shareholders'. With the free cash flow theory, Jensen (1986) analyzes the reason that management tend to hold large amount of cash. First, managements hold cash in order to ensure their bonus, non-pecuniary compensation and other personal benefits. Second, holding large amount of cash provides management more safeguards to pursue their goals. Even when there are errors in their decision making process, cash still can work as a buffer against the financial distress. Third, managements tend to enlarge the scale of business because incentive compensation mechanism of firms is always connected with scale and sales. With large amount of cash, managements could always make blind investments, sometimes even the bad ones, which are contradicted to the wealth of shareholders.

Dittmar, Mahrt-Smith, and Servaes (2003) also find cross-country evident suggesting that firms that in countries with greater agency problems hold more cash.

2.4 The tax motive

As mentioned by Foley, Hartzell, Titman and Twite (2007), tax burden creates motives for multinational firms to retain earnings abroad and hold them as cash. In US, firm's foreign income is taxed and these taxes can be deferred until firms repatriate their foreign income. As a result, multinational firms in US have an incentive to retain their earnings abroad and they hold these funds in cash to a large extent. Foley, Hartzell, Titman and Twite (2007) suggest that firm's cash holding is positively related to the repatriation tax costs. They also find that there are difference between incorporated affiliates and branch affiliates: branch affiliates tend to have less incentive to retain large amount of money because the earning of a foreign branch is taxed immediately.

Table 1
Theories of Variables and Expected Sign

The table contains the variables that mentioned in each theory and their expected sign indicated in each theory.

Variable	Theories	Expected Sign
Firm Size	Transaction motive	(-)
	Precautionary motive	(-)
	Agency motive	(+)
Market to book ratio	Transaction motive	(+)
	Precautionary motive	(+)
R&D to sales ratio	Precautionary motive	(+)
NWC	Precautionary motive	(-)
Cash Flow Ratio	Transaction motive	(-)
Capex	Precautionary motive	Not clear
Acqusitions	Precautionary motive	(-)
Leverage	Transaction motive	(-)
	Precautionary motive	(+)
Dividend Dummy	Transaction motive	(-)
	Precautionary motive	(-)
Industry Sigma	Precautionary motive	(+)

3 Data description

To investigate the hypotheses on determinants of cash holdings, I utilize a panel dataset that consists of annual fundamentals of Euro-zone firms for the year 1999 to 2011. The year 1999 is chosen for the reason that the Eurozone came into existence with the official launch of the euro (alongside national currencies) on 1 January 1999. The dataset is gathered from the WRDS Compustat Global database. I also decide to only include Greece and the initial 11 countries that joined in euro zone on January 1999 and exclude Ireland from the sample, because most of the listed companies of Ireland are traded in London Stock Exchange using pounds. Therefore, the sample contains firms that are incorporated in one of the 11 countries, namely Austria, Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal and Spain. Following the requirements that used in construction dataset by Bates, Kahle and Stulz (2009), I exclude firms with negative assets and sales for a given year. I also drop financial firms with Standard Industrial Classification (SIC) codes between 6000 and 6999, since those fields including marketable securities in their businesses, which involves cash, and they are obliged to meet statutory capital requirements. Besides, utilities, which SIC cods are between 4900 and 4999, are excluded, because their cash holdings are subject to regulatory supervision. For obtaining the market value of equity, I download the share prices and number of common shares outstanding for firms in the sample from Datastream. The sample consists of 17653 observations for 1758 unique firms. The details are presented in Table 2.

Table 2
Number of Observation and Unique Firms per Country

This table represents the number of observations and number of unique firms per country. The sample includes all Compustat Global firm-year observations from 1999 to 2011 for firms incorporated in the Eurozone. All firm-year observations are required to have positive values for the book value of total assets and sales revenue. Financial firms and utilities are dropped from the sample. The sample consists of 17653 observations for 1758 unique firms.

Country	Number of Observations	Number of unique firms
Austria	548	57
Belgium	826	77
Finland	1166	103
France	4731	476
Germany	5007	490
Greece	1407	157
Italy	1568	176
Luxembourg	89	10
Netherlands	1024	85
Portugal	403	39
Spain	884	88
Total	17653	1758

The followings are the definition and expectation of variables:

3.1 Dependent variable

The dependent variable used in regression is cash ratio. According to Opler, Pinkowitz, Stulz and Williamson (1997), they calculate this cash ratio as cash and marketable securities divide by total asset minus cash and marketable securities. Foley, Hartzell, Titman and Twite (2007) use the logarithm of the cash to net assets ratio to reduce the problem of outliers. In this research, I use both the cash to assets ratio and the logarithm of the cash to net assets ratio as depended variable.

3.2 Independent variable

3.2.1 Market-to-book ratio

The market-to-book ratio is calculated as book value of assets minus book value of equity plus market value of equity, and divided the results by book value of total assets. As a proxy for investment opportunity, market-to-book ratio is expected to have positive relation with cash ratio.

3.2.2 Cash flow to assets

Cash flow to assets is measures as earnings after interest, dividends, and taxes but before depreciation divided by the book value of assets. As a substitution for cash, a negative relation is expected between cash flow to assets and cash ratio.

3.2.3 Firm size

The firm size is measure as the logarithm of the book value of total assets in 2010 euros. As the economies of scale, we expected there is negative relation between size and cash ratio.

3.2.4 Net working capital

NWC is calculated as working capital minus cash and marketable securities, and then divide the book value of assets. Assets, which can substitute for cash, included in NWC. Therefore, negative relation is expected.

3.2.5 Capital expenditures to assets

I measure capital expenditures as the ratio of capital expenditures to book value of assets. According to Bates, Kahle and Stulz (2009), if the assets that created by capital expenditures could be used as collateral, then capital expenditure is negatively

related to cash holdings. On the other hand, capital expenditure can also be used as a proxy for financial distress costs or investment opportunities. From the precautionary point of view, firms with high capital expenditures may hold more cash, which means that capital expenditures and cash are negatively related. Therefore, the relation between capital expenditures to assets ratio and cash ratio is ambiguous.

3.2.6 Acquisitions to assets

Acquisitions to assets are measured as the ratio of acquisition expenditures to book value of total assets. Acquisitions to assets are expected to be negatively related to cash ratio.

3.2.7 Leverage

I measure leverage as long-term debt plus debt in current liabilities divided by book value of assets. Leverage is expected to be negatively related to cash ratio.

3.2.8 Dividend dummy

Dividend dummy is defined as a variable that equals to one in years in which a firm pays a common dividend. Otherwise the dummy equals to zero. Firms that paying dividend are expected to be less risky and have greater access to capital markets, so those firms tend to hold less cash.

3.2.9 R&D to sales

R&D is also treated as a proxy for investment opportunities. It is calculated as research and development expenses divided by sales, and is set equal to zero when R&D expense is missing. A positive relation between R&D to sales and cash ratio is expected.

3.2.10 Net equity issuance

Net equity issuance is calculated as sales of common and preferred stock minus purchases of common and preferred stock, and divided those by book value of assets. According to Bates, Kahle and Stulz (2009), firms tend to have more cash right after raising fund in capital market. Therefore the positive relation is expected.

3.2.11 Industry sigma

The industry sigma is measured as the following way: first, the standard deviation of cash flow to assets for the previous three years is calculated; then averages the firm volatilities each year across each industry using the two-digit SIC-codes. High industry sigma means that the cash flow volatility for the firm is high and that firm is riskier. Therefore, those firms with high industry sigma tend to hold more cash since they are more likely to encounter money shortfalls. The positive relation between industry sigma and cash ratio is expected.

4 Overview of the change in cash holdings over time

Before analysis the determinants of corporate cash holdings, an overview of change in cash holdings over sample period is given.

Table 3

Average and Median Cash and Leverage Ratio from 1999 to 2011

The sample includes all Compustat Global firm-year obesrvations from 1999 to 2011 for firms incorporated in the European Union. All firm-year observations are required to have positive values for the book value of total assets and sales revenue. Financial firms(SIC code 6000-6999) and utilities (SIC code 4900-4999) are excluded from the sample, forming a panel of 17653 observations for 1758 unique firms. Variable definitions can be found in the Appendix.

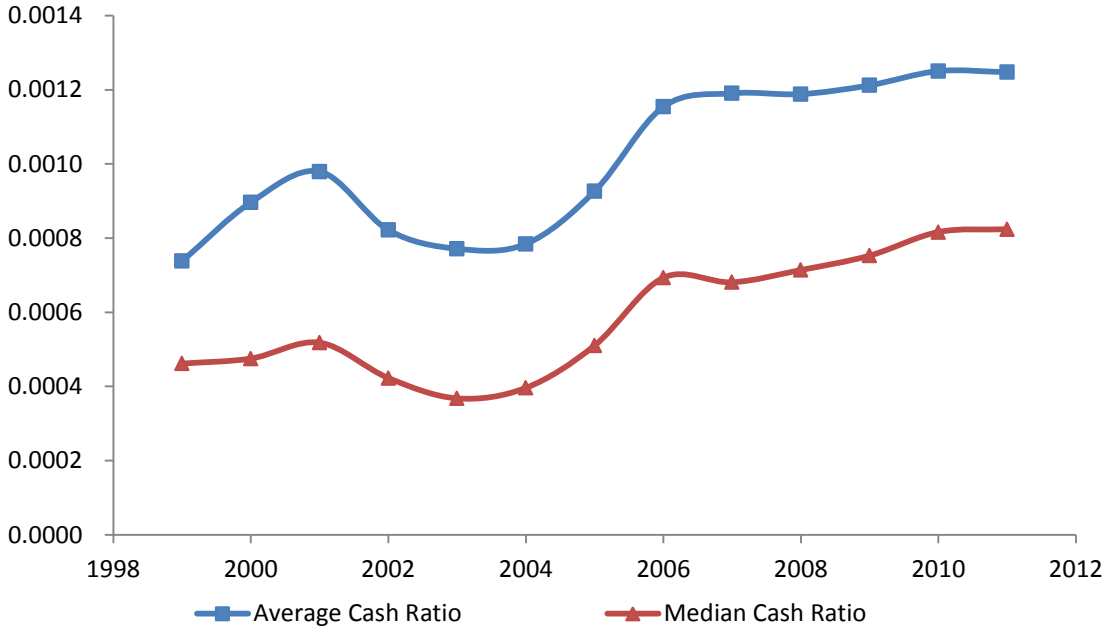
Year	N	Aggregate Cash Ratio	Average Cash Ratio	Median Cash Ratio	Avergae Leverage	Median Leverage	Average Net Leverage	Median Net Leverage
1999	259	0.0437	0.0738	0.0462	0.4720	0.2301	0.3982	0.1860
2000	538	0.0431	0.0896	0.0475	0.2325	0.2181	0.1429	0.1678
2001	1168	0.0491	0.0979	0.0518	0.2464	0.2100	0.1485	0.1461
2002	1345	0.0414	0.0822	0.0423	0.2442	0.1927	0.1625	0.1691
2003	1339	0.0410	0.0771	0.0368	0.2309	0.2214	0.1537	0.1638
2004	1397	0.0475	0.0784	0.0396	0.7507	0.2190	0.6723	0.1660
2005	1444	0.0632	0.0926	0.0510	0.7398	0.2071	0.6471	0.1405
2006	1554	0.0659	0.1154	0.0693	0.4739	0.1968	0.3585	0.1256
2007	1708	0.0702	0.1190	0.0681	0.5034	0.2022	0.3843	0.1258
2008	1754	0.0641	0.1188	0.0714	0.3638	0.2137	0.2449	0.1357
2009	1748	0.0759	0.1212	0.0753	0.2883	0.2264	0.1671	0.1481
2010	1758	0.0861	0.1250	0.0816	0.2454	0.2208	0.1204	0.1328
2011	1641	0.0794	0.1247	0.0824	0.2446	0.2115	0.1199	0.1224

Table 3 presents the overview of the change in cash holdings of Eurozone firms over time. The second column reports the number of observations in each year. Following Bates, Kahle and Stulz (2009), cash ratio is measured as cash and marketable securities divided by total assets. The aggregate cash ratio is presented in the third column, which is calculated as the sum of cash divided by the sum of total assets for all sample firms in a certain year. It is relatively stable but still increasing from 4.3% to 7.9% within the sample years, and it reaches the maximum of 8.6% in 2010. In the next column, the average cash ratio is reported, which increases from 7.38% in 1999 to 12.47% in 2011, peaking in 2010. The median cash ratio is also recorded. The trend chart of the mean and median cash ratio is graphed in Figure 1. As we can see, there is a steep decline from 9.70% in 2001 to 7.71% in 2003, followed by a substantial increase to 11.54% in 2006. After that, cash ratio trend remains gradual incline. In principle, the trend chart does prove the expectation that

the cash ratio increases during the sample period, which is 7.38% in 1999 and increased to 12.47% in 2011.

Figure 1
Trend Chart of the Mean and Median Cash Ratio from 1999 to 2011

The sample includes all Compustat Global firm-year obesrvations from 1999 to 2011 for firms incorporated in the European Union. All firm-year observations are required to have positive values for the book value of total assets and sales revenue. Financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999) are excluded from the sample, forming a panel of 17653 observations for 1758 unique firms. Variable definitions can be found in the Appendix. Cash ratio is calculated as the cash and marketable cash and marketable securities divided by total assets.



Next, the estimated regressions of the cash ratio on a constant and a time variable to analysis will be done to examine whether there is a statistically significant trend in cash ratio. The results are presented in Table 4. In model 1, the coefficient is 0.004 for average cash ratio, which means that the average cash ratio increases 0.4% per year. The coefficient of median cash ratio in model 2 is also 0.004. As we can see, the results of the coefficient on the time variable are statistically significant at the 1%. The adjusted R-squared for the two regressions is 75%. Table 3 provides an evidence for a positive time trend in cash holdings of Eurozone firms over the sample period from 1999 to 2011. Since the formation of Eurozone, cash holdings of firms who are

incorporated in member countries have increased by years.

Table 4

Regression Estimating a Time Trend in Cash and Net Leverage Ratios

The table shows the results from regression of the cash and the net leverage ratio on a constant and time measured in years. Variable definitions can be found in the Appendix. Absolute value of t statistics is in parentheses. * significant at 5%; ** significant at 1%.

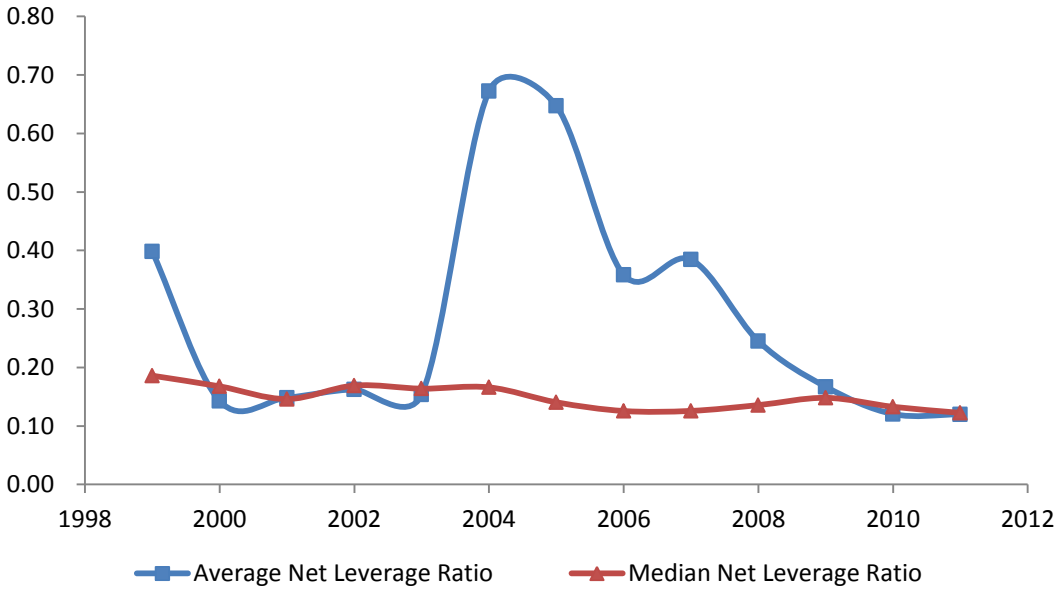
Model	1	2	3	4
Dependent Variable	Average cash ratio	Median Cash Ratio	Average Net Leverage	Median Net Leverage
Year	0.004	0.004	-0.007	-0.004
	(5.70)**	(5.67)**	-0.49	(4.52)**
Constant	-8.783	-7.229	14.749	8.572
	(5.64)**	(5.63)**	-0.5	(4.60)**
R-squared	75%	75%	2%	65%

Bates, Kahle and Stulz (2009) indicate that the increase of cash ratio have an influence on the leverage ratio. Column 6 of Table 3 presents the average ratio of sample firms by years. The leverage ratio is calculated as the sum of long-term debt and debt in current liabilities, divided by book value of assets. As we can see from the column 6 of Table 3, the average leverage ratio decreases from 47.2% in 1999 to 24.46% in 2011. However, the trend of decreasing is not stable: the leverage ratio increases dramatically during the year 2004 to 2007, and decreases after that. Comparing to average leverage ratio, the median leverage ratio, which is reported in column 7 of Table 3, is quite stable. The net leverage ratio is measured by subtracting cash and marketable from total assets and divided by total assets. The trends of average net leverage ratio and median net leverage ratio are similar to the ones of leverage ratio, which are presented in column 8 and 9 of Table 3. The trend chart of mean and median net leverage ratio is also given.

Figure 2

Trend Chart of the Mean and Median Net Leverage Ratio from 1999 to 2011

The sample includes all Compustat Global firm-year obesrvations from 1999 to 2011 for firms incorporated in the European Union. All firm-year observations are required to have positive values for the book value of total assets and sales revenue. Financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999) are excluded from the sample, forming a panel of 17653 observations for 1758 unique firms. Variable definitions can be found in the Appendix. Net Leverage ratio is calculated by subtracting cash and marketable from total assets and divided by total assets.



The regression results of the average net debt ratio on a constant and time variables are presented in Table 4. The coefficient of average net leverage ratio is -0.007, which indicates that the average net leverage ratio decreases 0.7% by years. However, it is not statistically significant. The result of median net leverage is statistically significant at 1% level. It suggests that the net leverage decrease 0.4% per year. The regression in Table 3 provides evidence for an approximate negative trend of net leverage in Eurozone over the sample period from 1999 to 2011.

5 Important firm characteristics and the cash ratio

In the previous section, the expectation that the cash ratio increases during the sample period is proved. In this section, several important firm characteristics that have influences on corporate cash holdings will be analyzed, which are size, dividend

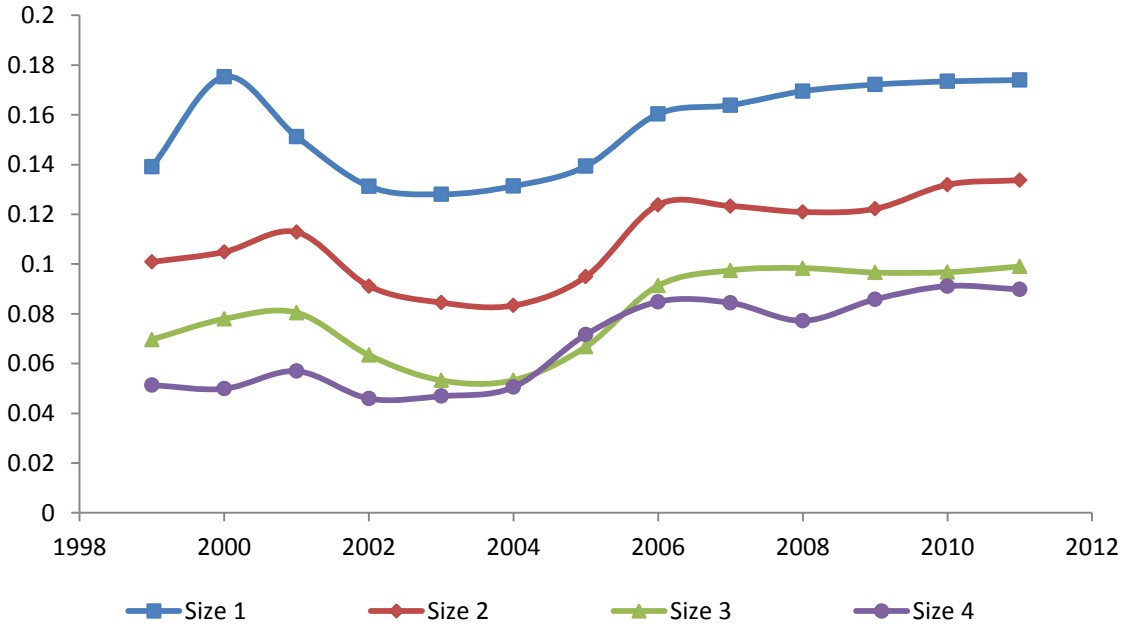
status, accounting performance and cash flow volatility of firms.

5.1 Cash ratio with firm size

The increasing of cash flow during the sample year from 19999 to 2011 has been proved. To examine whether this increase is driven by firm size, the whole dataset is divided into 4 quintiles based on book value of assets of previous fiscal year. The trend chart of average cash ratio by firm size quintile for the sample years is presented in Figure 3. Size 1 in the legend represents the smallest firm size quintiles and size 4 represents the largest.

Figure 3
Trend Chart of Average Cash Ratio by Firm Size Quintile from 1999 to 2011

The sample includes all Compustat Global firm-year obesrvations from 1999 to 2011 for firms incorporated in the European Union. All firm-year observations are required to have positive values for the book value of total assets and sales revenue. Financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999) are excluded from the sample, forming a panel of 17653 observations for 1758 unique firms. Cash ratio is calculated as the cash and marketable cash and marketable securities divided by total assets. Firms are divided into four size quintiles based on the book value of total assets of previous year.



According to theories and principles discussed in literature review section, big

firm tend to hold less cash than small firms. It is proved by Figure 3, which shows that the firms within the first two size quintiles obviously retain the higher cash ratio than the last two quintiles. However, the difference of cash ratio among firms within the third and the fourth size quintiles is not that big.

The next step is to test whether the time trends of cash ratio by size quintiles are the statistically significant. In Table 5, regressions of cash ratio for different size quintiles on a constant and time measured in years are estimated. The regression results show that the coefficients of time trends are all positive and statistically significant at the 5% level, which indicates that cash ratio of firms within each size quintiles increases about 0.4% each year.

Table 5
Regression Estimating a Time Trend in Cash Ratio per Size Quintile

The table shows the results from regression of the cash ratio on a constant and time measured in years for each size quintiles. The dataset is divided into four quintiles based on the book value of assets in the previous fiscal year. Variable definitions can be found in the Appendix. Absolute value of t statistics is in parentheses. * significant at 5%; ** significant at 1%.

Dependent Variable	Average Cash Ratio			
Size Quintile	(1)	(2)	(3)	(4)
Time	0.004	0.004	0.004	0.004
	(80.31)**	(80.29)**	(75.29)**	(130.75)**
Constant	-8.340	-8.343	-7.987	-8.808
	(78.82)**	(79.22)**	(74.52)**	(129.71)**
R-squared	60%	60%	57%	80%

5.2 Cash ratio with dividend payment and accounting performance

Besides size, dividend status also has a big effect on corporate cash holdings. Bates, Kahle and Stulz (2009) states that dividend- paying firms usually have better access to capital market. Those firms are also able to reduce or even suspend dividend payment to solve the funds shortage problems. Therefore, dividend-paying firms tend to hold less cash than ones without paying dividend. Table 6 presents the average cash ratio of firms with both dividend statuses. As can be seen, average cash ratio for both

subsamples increases over years. However, the average cash ratio for nondividend payer is always larger than the one for dividend payer, which indicates that firms without paying dividend hold more cash to prevent from financial distress.

Table 6
Average Cash Ratio for Dividend Status and Accounting Performance
Subsamples from 1999 to 2011

The sample includes all Compustat Global firm-year obesrvations from 1999 to 2011 for firms incorporated in the European Union. All firm-year observations are required to have positive values for the book value of total assets and sales revenue. Financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999) are excluded from the sample, forming a panel of 17653 observations for 1758 unique firms. Dividend payers are all firm-year observations that pay common dividends, otherwise is grouped into nondividend payer. Firm-year observations with zero or positive net income is classified as nonnegative net income subsample, otherwise is negative net income subsample.

Year	Dividend Status		Accounting Performance	
	Dividend Payer	Nondividend Payer	Negative Net Income	Nonnegative Net Income
1999	0.0611	0.0860	0.1119	0.0684
2000	0.0777	0.0949	0.1125	0.0851
2001	0.0735	0.0983	0.1162	0.0846
2002	0.0662	0.0838	0.1244	0.0668
2003	0.0601	0.0841	0.1219	0.0634
2004	0.0634	0.0838	0.1170	0.0677
2005	0.0786	0.1016	0.1295	0.0844
2006	0.1015	0.1262	0.1397	0.1092
2007	0.1062	0.1286	0.1456	0.1108
2008	0.1068	0.1277	0.1299	0.1151
2009	0.1121	0.1262	0.1261	0.1191
2010	0.1221	0.1266	0.1233	0.1263
2011	0.1188	0.1263	0.1207	0.1251

Table 7 shows the results of regressions of average cash ratio for both two subsamples on a constant and time measured in years. The coefficient of dividend paying firms is 0.006, which indicates that average cash ratio of those firms increases about 0.6% yearly. The average cash ratio of firms without paying dividend increases 0.5% per year. Both results are significant at 5% level even if the squared R is not so high.

Accounting performance is always treated as a proxy for financial constraints. Net income is calculated as operating income before depreciation minus depreciation, interest expenses and taxes. In the precautionary motive point of view, positive net income is regarded as substitution for cash. Firms with positive net income are less likely to suffer financial crisis, and tend to hold less cash. Column 5 and Column 6 of Table 6 shows average cash ratios of firms with negative net income and with nonnegative net income during the sample years. Those cash ratios increase by year. The cash ratios of firms with negative net income are higher than those with nonnegative net income. The statistical significance is also tested. The results are reported in Table 7. The coefficient of nonnegative net income is positive and significant at 5% level, which indicates that the average cash ratio of firms with nonnegative net income is increased by 0.6% per year. However, the result for negative net income seems really small and is not significant. This may indicate that cash holdings of negative net income firms remains in high level despite of the time.

Table 7
Regressions Estimating a Time Trend in Average Cash Ratio for Dividend Status and Accounting Performance

The table shows the results from regression of the average cash ratio for dividend status and accounting performance subsamples on a constant and time measured in years. The dependent variable is the cash ratio, which is calculated as cash and marketable securities divided by the book value of assets. Dividend payers are all firm-year observations that pay common dividends, otherwise is grouped into nondividend payer. Firm-year observations with zero or positive net income is classified as nonnegative net income subsample, otherwise is negative net income subsample. Variable definitions can be found in the Appendix. Absolute value of t statistics is in parentheses. * significant at 5%; ** significant at 1%.

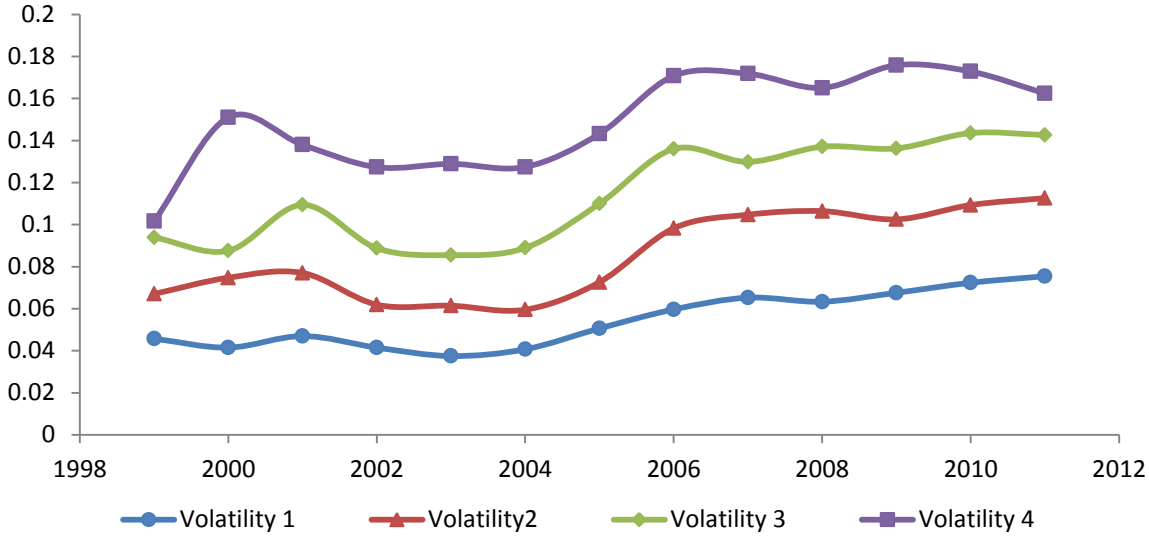
	Dividend Payers	Nondividend Payer	Negative Net Income	Nonnegative Net Income
Time	0.006	0.005	0.000	0.006
	(13.75)**	(11.91)**	-0.55	(19.98)**
Constant	-11.988	-9.378	-0.772	-12.114
	(13.64)**	(11.77)**	-0.47	(19.82)**
R-squared	3%	1%	0%	3%

5.3 Cash ratio with cash flow volatility

High cash flow volatility means that there are more uncertain elements within firms, and firms can hardly make accurate prediction on future cash outflows and inflows. Therefore, firms with greater cash flow uncertainty are more likely to encounter funds shortage, and then tend to hold more cash for precautionary purpose. The industry sigma is generated as following way: firstly, the standard deviation of cash flow to assets for the previous three years is calculated; then averages the firm volatilities each year across each industry using the two-digit SIC-codes. Based on the research of Bates, Kahle and Stulz (2009), the sample dataset is divided into four industry quintiles according to cash flow volatility. Figure 4 graphs the trend lines of average cash ratio for each volatility quintile. Volatility 1 in the legend represents the firms with the lowest cash flow volatility while Volatility 4 represents those with the highest cash flow volatility.

Figure 4
Trend Chart of Average Cash Ratio by Cash Flow Volatility Quintile

The sample includes all Compustat Global firm-year obesrvations from 1999 to 2011 for firms incorporated in the European Union. All firm-year observations are required to have positive values for the book value of total assets and sales revenue. Financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999) are excluded from the sample, forming a panel of 17653 observations for 1758 unique firms. Cash ratio is calculated as the cash and marketable cash and marketable securities divided by total assets. The sample dataset is divided into four industry quintiles based on cash flow volatility.



As can be seen in Figure 4, the average cash ratio of firms within the lowest cash flow volatility quintile is lower than those within the highest volatility quintile. The positive relation between cash flow volatility and cash ratio is proved. Furthermore, the average cash ratio for each volatility quintile increases by years, and the increase in lowest volatility quintile is lower than those in higher volatility quintiles.

As usual, the estimated regressions for the significance of time trend in cash ratios for different volatility quintiles are given. The regression results are reported in Table 8. Accordingly, cash ratio of firms within the lowest volatility quintile increases 0.4% by year, which is lower than the average increases 5.6% for the other three volatility quintiles. After all, all the coefficients of time variable are positive and statistically significant at 5% level, which indicates that there is a rising trend of cash ratios for each quintile. This finding also provides an evidence for precautionary motive for cash holdings.

Table 8
Regressions Estimating a Time Trend in Cash Ratios for Different Cash Flow Volatility Quintile

The table shows the results from regression of the average cash ratio for the four cash flow volatility quintiles. The dependent variable is the cash ratio, which is calculated as cash and marketable securities divided by the book value of assets. The sample dataset is divided into four industry quintiles based on cash flow volatility. Variable definitions can be found in the Appendix. Absolute value of t statistics is in parentheses. * significant at 5%; ** significant at 1%.

Volatility Quintile	(1)	(2)	(3)	(4)
Time	0.004	0.005	0.006	0.005
	(12.70)**	(11.93)**	(8.70)**	(5.76)**
Constant	-7.046	-10.407	-11.694	-9.167
	(12.60)**	(11.83)**	(8.61)**	(5.67)**
R-squared	43%	36%	25%	17%

The regression results in this section are in line with the hypotheses presented in previous research papers. In conclusion, cash holding of firms incorporated within Eurozone is negatively related to firm size and positively related to cash flow

volatility. Moreover, firms with good accounting performance or with dividend payment to shareholders tend to hold less cash than their counterparties.

6 Empirical analysis

After overviewing the trend of cash ratio, the determinants of cash ratio for the Eurozone firms are analyzed. Panel data analysis is chosen to investigate the determinants of leverage in this study. There are several advantages of panel data technique. First, it controls for individual heterogeneity. Second, panel data provides more informative data and have higher degrees of freedom and more efficiency. It can be used to test more complicated models than cross-sectional and time series data. Finally, panel data analysis can eliminate the biases resulting from aggregation over firms or individuals.

The estimated model is presented as follows:

$$\begin{aligned} Cash\ ratio_{i,t} = {} & \beta_0 + \beta_1 Size_{i,t} + \beta_2 Market\ to\ book_{i,t} + \beta_3 R\&D_{i,t} + \beta_4 NWC_{i,t} \\ & + \beta_5 Cash\ flow_{i,t} + \beta_6 Capex_{i,t} + \beta_7 Acquisition_{i,t} + \beta_8 Leverage_{i,t} \\ & + \beta_9 Net\ Equity\ Issue_{i,t} + \beta_{10} Dividend\ Dummy_{i,t} \\ & + \beta_{11} Industry\ Sigma_{i,t} + \varepsilon_{i,t} \end{aligned}$$

Where subscript i denotes the firm and subscript t denotes the fiscal year. The regression results are reported in Table 9.

Table 9
Regression Estimating the Determinants of Cash Holdings

The sample includes all Compustat firm-year observation from 1999 to 2011 with non-missing data for the book value of total assets and sales revenue for firms incorporated in the Eurozone countries. Financial fimrs (SIC code 6000-6999) and utilities (SIC code 4900-4999) are omitted from the sample, yielding a panel of 17653 observations for 1758 unique firms. Missing explanatory values reduce the panel to 9625 observations. Absolute value of t statistics is reported in parentheses. * stands for significant at 5% and ** stands for significant at 1%. Variable definitions are provided in the Appendix.

	1	2	3	4	5	6	7	8
Model	OLS	OLS	OLS	OLS	FM(1999-2007)	FM(2008-2011)	BE	FE
Dependent Variable	Cash/ Assets	Log(Cash/Net Assets)	Cash/ Assets	Log(Cash/ Net Assets)	Cash/ Assets	Cash/ Assets	Cash/ Assets	Cash/ Assets
Intercept	0.141	-2.761	0.150	-2.284	0.142	0.140	0.108	
	(19.80)**	(24.04)**	(21.94)**	(21.03)**	(12.42)**	(15.88)**	(10.06)**	
Indutsry Sigma	0.344	4.991	0.339	4.788	0.165	0.285	0.369	0.083
	(13.69)**	(10.84)**	(13.55)**	(10.64)**	(4.36)*	(7.49)**	(7.13)**	(10.49)**
Market to Book	0.008	0.096	0.008	0.110	0.020	0.011	0.017	0.003
	(2.80)**	(3.00)**	(2.85)**	(3.18)**	(3.60)*	(5.08)**	(7.00)**	(4.38)**
Size	-0.007	-0.051	-0.007	-0.057	-0.006	-0.007	-0.004	0.097
	(14.18)**	(6.46)**	(14.53)**	(7.43)**	(6.83)**	(10.83)**	(3.63)**	(1.99)*
Cash Flow Ratio	-0.009	0.014	0.008	0.012	0.072	-0.036	-0.080	0.009
	(2.06)*	-0.17	(2.37)*	(3.65)**	-1.720	-2.130	(5.13)**	(2.88)**

Table 9 ---- Continued

	1	2	3	4	5	6	7	8
Model	OLS	OLS	OLS	OLS	FM(1999-2007)	FM(2008-2011)	BE	FE
Dependent Variable	Cash/ Assets	Log(Cash/Net Assets)	Cash/ Assets	Log(Cash/ Net Assets)	Cash/ Assets	Cash/ Assets	Cash/ Assets	Cash/ Assets
NWC	-0.124	-1.967	-0.118	-1.688	-0.113	-0.123	-0.080	-0.174
	(17.77)**	(16.41)**	(16.64)**	(14.34)**	(8.61)**	(17.31)**	(6.56)**	(28.78)**
Capex	-0.159	-1.623	-0.147	-1.015	-0.175	-0.122	-0.155	-0.073
	(9.17)**	(4.80)**	(8.51)**	(3.06)**	(12.23)**	(6.85)**	(3.35)**	(4.34)**
Leverage	-0.181	-2.466	-0.181	-2.452	-0.168	-0.197	-0.171	-0.155
	(11.79)**	(10.19)**	(11.97)**	(10.72)**	(12.67)**	(10.31)**	(14.95)**	(20.25)**
R&D	0.000	0.001	0.000	0.001	0.018	0.044	0.000	0.000
	(9.10)**	(6.36)**	(9.18)**	(6.63)**	-1.450	-1.200	-1.890	(4.11)**
Dividend Dummy	-0.089	-0.086	-0.003	-0.080	-0.001	-0.001	0.000	-0.009
	(2.28)*	(2.26)*	-1.540	(2.14)*	-0.850	-0.660	-0.040	(4.96)**
Acquistions	-0.040	-0.036	-0.045	-0.059	-0.093	-0.030	-0.087	-0.028
	(2.33)*	(3.28)**	(2.59)**	(2.33)*	-3.010	-1.590	-1.700	(2.54)*
2008-2011 dummy			-0.014	-0.701				
			(6.87)**	(21.81)**				
R-squared	22%	13%	23%	16%	23%	29%	25%	12%

Model 1 is a basic Ordinary Least Square regression on the entire sample data. The cash to assets ratio is used as dependent variables in this case. As proxies for investment opportunities, R&D and market-to-book ratio have positive signs and are statistically significant in the regression results, which means cash ratio is increasing with R&D and market-to-book ratio. It confirms that firms with better investment opportunities tend to hold more cash to prevent from cash shortfalls. The industry sigma has positive and significant coefficient, as predicted by the theory. As seen in the table, the sign of coefficients of firm size, cash flow ratio, net working capital, capital expenditure, acquisitions, and dividend dummy are negative and significant, which is consistent with the expectation. Theory is ambiguous for deciding the sign of capital expenditure. In the first regression, the coefficient of capital expenditure is negative and significant. The best explanation for this result might be that capital expenditure increase the assets that can be used as collateral and improve the debt capacity of firms. In this regression, the coefficient of leverage is negative and significant, which is consistent with transaction motive. The R-squared is 22% for Model 1.

In Model 2, the logarithm of cash to net assets ratio is used as dependent variable. Comparing to Model 1, the sign of cash flow ratio is changed, but not significant. These two models confirm the transaction and precautionary motives of cash holdings.

The next step is to investigate whether the intercept changes over time. Model 3 and Model 4 are the re-estimation of the first two models by adding the 2008-2011 dummy, which allows for intercept shifts during the period 2008-2011.The purpose for this is to check if the intercept in the sample period 2008-2011 is different from the previous sample period 1999-2007. In both models, the 2008-2011 dummy has negative and significant sign, which indicates that changes in firm characteristics lead to higher cash ratios than those actually observed in the period 2008-2011.

There is a possibility that the slopes changes instead of the change of intercept, as would be the case if the relation between the cash ratio and firm characteristics changes over time. Model 5 estimates the Fama-MacBeth regression for the sample

period 1999-2007 and Model 6 for the period 2008-2011. Fama-Macbeth approach is an innovative two-stage approach meant to minimize within-portfolio variance while capturing the across-portfolio characteristics. The result of coefficients for other variables is consistent with those in Model 1. As same as the result of Bates, Kahle and Stulz (2009), the intercept is higher during the period 1999-2007 relative to the latter half of the sample period,

In Model 7, between effects model is used. According to Fujiki and Kitamura (1995), before running a cross-sectional regression, the between estimator uses time averages for both dependent and independent variables, which ignore the time variation within firms. The results of coefficient meet up with the Model 1.

The last model estimates fixed effects regression for cash ratio. The fixed effects model is equivalent to generate dummy variables for the individual cases and including them in a standard linear regression that controls for the fixed case effects. Each dummy removes one degree of freedom from the model, thus the fixed effects model functions best when there are numerous periods for fewer cases. Except for the sign of firm size, which turned to positive, the results of Model 8 are nearly the same as the ones in OLS regressions. The regression results are consistent with the agency motive, which indicates that big firms have more severe agency problems and entrenched management team tend to hold more cash.

Generally speaking, Table 8 suggests that more firm characteristics have the relation with cash holdings as predicted by theory, which indicates that those firm characteristics have the same effect on Eurozone firms as on firms that are incorporated in US.

7 Conclusion

The average cash to assets ratio for US industrial firms have increased dramatically during the past decades. This paper documented an increase of average cash to assets ratio from the year 1999 to 2011 by analyzing a sample of 17653 observations for 1758 unique firms publicly traded in 11 Eurozone countries.

Theory provides four motives of cash holdings, namely transaction motive, precautionary motive, taxation motive and agency motive. This paper pays special attention to the static tradeoff model, which focus on the transaction and precautionary motives. Transaction motive suggests that for the reason of avoiding transaction cost of liquidating assets or raising fund in the capital market to cope with the shortfalls of cash, firms prefer to hold more cash. In the precautionary point of view, firm tend to use cash to hedge for the risk of future cash shortfalls, especially when external financing is costly.

Although cash holdings of firms have increased both in Eurozone and US, there might be some differences evolving in cash holdings between two regions. On one hand, corporate governance of Europe and American firms are not identical, legal origin of US has better protection of investors than European countries. The agency problem is less severe in US than in Europe. On the other hand, there is the productivity gap between Europe and United States, which attribute to slower emergence of knowledge economy in Europe than in United States. That might lead to higher level of risk-averse of European investors. European countries seem to have worse access to capital market than United States.

The results of this paper confirm the transaction and precautionary motives mentioned by theories. As proxies for investment opportunities, market-to-book and R&D to assets ratio have positive relation with the cash holdings, which indicates that firms with better investment opportunities tend to hold more cash. As the substitutions of cash, net working capital and cash flow are predicted to have a negative relation with cash. The results confirm the prediction. Therefore, firms with more assets that can be treated as the substitution of cash tend to hold less cash. In the empirical test in this paper, the sign of coefficient of capital expenditure is always negative and significant, which suggests that capital expenditure increase the assets that can be used as collateral and improve the debt capacity of firms. That is to say, firms with better access to capital market tend to hold less cash.

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Appendix: Variable Definitions

Variable	Definition
Acquistion	The ratio of expenditures on acquistions relative to the book value of total assets
Capex	Ratio of capital expenditures to the book value of total assets
Cash flow ratio	Calculated as (Operating income before depreciation- Interest and related expense-income taxes-common dividends)/book value of assets
Cash ratio	The ratio of cash and marketable securities to the book value of total assets
Dividend dummy	Dummy variable equal to one if the firm paid a common dividend in that year, and zero otherwise.
Firm size	The natural log of the book value of total assets in 2010 Euros
Leverage	Calcuated as (long-term debt+debt in current lliabilities)/book value of assets
Market to book	Calculated as (book value of assets-book value of equity+share price*Number of common share outstanding)/book value of assets.
Net equity issuance	Calculated as (sales of common and preferred stock-purchasese of common and preferred stock)/book value of assets
Net leverage	Calculated as (total debt-cash and marketable securities)/book value of total assets
NWC	Calculated as (working capital-cash and marketable securities)/book value of total assets
R&D to assets	The ratio of research and development expense to sales