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Determinants of corporate cash holding: Evidence from UK listed firms

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Abstract: Our paper revisits the determinants of company cash holding. It attempts to explain the cash holding behavior of firms' managers by investigating non-financial companies listed on the London Stock Exchange from 2011 to 2016. Our results indicate that firm size, leverage, cash flow, cash flow volatility, and investment opportunity exert influence on such cash holding behavior. It can be explained by the trade-off theory, the pecking-order theory and free cash flow theory. Our results may shed light on the decrease in the cash holding level for the post-crisis period.

JEL Classifications: G30

Keywords: Cash holding, trade-off theory, pecking order theory, free cash flow theory

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1. Introduction

One of the most vital assets for companies is cash. Holding a great amount of cash helps managers run an organization smoothly: the firm does not suffer from a cash-shortage and may not need to raise expensive capital from the external market. However, in some circumstances, such as an imperfect market, managers can take advantage of cash holding and benefit at the shareholders' expense.

There are three theories accounting for cash holding: the trade-off theories (Myers, 1977), the pecking order theory (Myers & Majluf, 1984), and the free cash flow theory (Jensen, 1986). With respect to the trade-off theory, cash and debt share similar features: holding cash can bring benefits and generate costs for shareholders. Under this theory, the firm should have an optimal level of cash ratio, which balances the marginal benefits and marginal cost of holding cash. In contrast to the trade-off theory, Myers & Majluf (1984) imply that there is no optimal cash holding level. Based on this theory, the purpose of holding cash is to lower asymmetric information costs. Finally, according to Jensen (1986), a manager requires a great amount of cash in his hand because this will bring him power to control the firm. In addition, when the firm has enough cash for future investment, the manager does not need to raise external funds and thus does not need to provide outside investors with information about the firm's investment projects.

There are a number of studies examining cash holding empirically in different countries. For example, Opler, Pinkowitz, Stulz, & Williamson (1999) and Bates, Kahle, & Stulz (2009) examine the determinants of cash holding of listed companies in the US market. Other related researches have been conducted in Europe, such as in the UK (Ozkan & Ozkan, 2004) and Italy (Bigelli & Sanchez-Vidal, 2010). In addition, this topic has also been investigated in countries such as the US, Germany and Japan (Pinkowitz &

Williamson, 2001) or in a group of international countries in the Economic and Monetary Union of the European Union (Ferreira & Vilela, 2004). On the whole, these studies have found the evidence which strongly or partially supports the above three theories.

The purpose of this paper is to revisit the determinants of cash holding, which include firm size, leverage, cash flow, cash flow volatility, liquid assets, investment opportunity and dividend dummy, in the UK market for the post-crisis period from 2011 to 2016. This period is characterized by the gradual decrease of cash ratio, measured by cash and cash equivalent to total assets, from 2011 to 2016*. We show that the level of cash can be clearly explained by the trade-off theory (negative relationship with firm size and positive relationship with investment opportunity) and partially by the pecking order and free cash flow theory (negative relationship with leverage and positive relationship with cash flow).

The remainder of the paper is organized as follows. Section 2 reviews the cash holding theory. The next section illustrates data and methodology. Section 4 provides empirical results. Section 5 concludes.

2. Literature review

Cash can be considered as one of a company's most vital assets since money is needed to pay expenses, as well as to fund future investment. Moreover, holding enormous amounts of cash helps companies survive through crisis periods. Holding cash can give firms some advantages, such as minimizing transaction costs (Opler et al., 1999; Ozkan & Ozkan, 2004; and Ferreira & Vilela, 2004), avoiding underinvestment problems (Chang & Noorbakhsh, 2009), efficiently supporting firms' daily activities, and protecting them from the adverse impacts of recession periods (Bates et al., 2009). Almost all of the extant studies investigating the determinants of firm cash holding are based on three theories: the trade-off theory (Myers, 1977), the pecking-order theory (Myers & Majluf, 1984), and the free cash flow theory (Jensen, 1986).

2.1. Trade-off theory

The trade-off theory, also known as the transaction cost theory (Opler et al., 1999), suggests that each firm has an optimal cash level that balances the marginal benefits with the marginal costs of holding cash. The marginal benefits of holding cash lower the probability of financial distress and avoid the costs of external financing sources. In contrast, the marginal costs include the opportunity cost of holding cash when the firm gives up high returns from other investments.

According to this theory, and due to the economy of scale, the demand for holding cash and the firm size have a negative relationship. Besides, it is arguable that small firms with higher developing potential, which can make them more risky, are likely to hold cash as it is more costly for them to raise funds in the external market (Ferreira & Vilela, 2004). This result is empirically supported by Faulkender (2002) and Kim, Mauer, & Sherman (1998) for the US market, Bover & Watson (2005) for Spain, Pinkowitz & Williamson (2001), and Ferreira & Vilela (2004) for other international countries.

* The average cash ratios are 0.083, 0.078, 0.082, 0.075, 0.077, and 0.076 for year of 2011, 2012, 2013, 2014, 2015, and 2016, respectively.

In contrast to the relationship between firm size and cash holdings, the relationship between leverage and cash holding is not clear. On the one hand, there can be a negative relationship because high leverage can be a signal that the company can access the debt market (Ferreira & Vilela, 2004): thus, the company has no need to hold much cash. In addition, it can be argued that the costs of holding cash are greater for high leverage companies than for low leverage companies (Ozkan & Ozkan, 2004). On the other hand, high leverage firms are considered to have higher financial risk. The firms, therefore, need to hold more cash to decrease the risk, implying a positive relationship between leverage and cash holdings.

Cash flow, which is measured as profit after tax plus depreciation, provides a ready source of liquidity, implying that it can be regarded as substitutes (Kim et al., 1998). This suggests a negative relationship between cash flow and cash holding. In contrast, the trade-off theory predicts the positive relationship between cash flow volatility and cash holding (Ozkan & Ozkan, 2004, and Bigelli & Sanchez-Vidal, 2010). During a crisis, a larger amount of cash should be maintained as a safeguard for a firm whose cash flow volatility is high, to improve the probability of survival. Some studies, such as Bigelli & Sanchez-Vidal (2010), Ferreira & Vilela (2004), and Opler et al. (1999) document the positive relationship between cash flow volatility and cash holding.

Similar to cash flow, liquid assets are substitutes for cash holdings since these assets can be easily converted into cash and with low costs (Bigelli & Sanchez-Vidal, 2010; Ferreira & Vilela, 2004; and Ozkan & Ozkan, 2004). This suggests the negative impact of liquid assets on cash holdings.

In terms of investment opportunities, according to Ferreira & Vilela (2004), a firm with greater investment opportunities will have higher costs if the firm experiences bankruptcy: it cannot turn these opportunities into reality. This provokes a positive investment opportunity impact on cash holding, since the firm will hold more cash to operate smoothly and reduce bankruptcy costs.

Based on the trade-off theory, dividend payments and cash holdings are predicted to have a negative relationship. It is arguable that firms that pay dividends can afford to hold less cash when they are more capable of raising funds (Ozkan & Ozkan, 2004). Ferreira & Vilela (2004), Ozkan & Ozkan (2004), and Pinkowitz & Williamson (2001) have found evidence supporting this prediction.

2.2. Pecking-order theory

According to the pecking-order theory, a firm manager attempts to lower the cost of information asymmetries and other financing expenses. The first source of funding future investment for the company comes from retained earnings (internal funds). The firm can then decide to use debt instruments and finally, equity instruments. Ferreira & Vilela (2004) argue that cash can be seen as a buffer between retained earnings and investment needs.

The pecking-order theory implies that firm size and cash holding have a positive relationship because larger firms are considered to be more successful and therefore maintain more cash for future investment. Nevertheless, neither Opler et al. (1999) nor Ferreira & Vilela (2004) found evidence supporting this prediction.

When retained earnings are less than investment, debt instruments are issued. Moreover, when retained earnings are not sufficient to invest in future projects, cash holding will fall, suggesting that there is a negative relationship between the holding of cash and leverage (Ferreira & Vilela, 2004).

With regard to cash flow and investment opportunity, the pecking order theory predicts a positive impact of cash flow and investment opportunity on cash holding. High cash-flow firms are considered to have outstanding operating performance and hence can have many investment opportunities. As a result, the firms have to hold more cash (Ferreira & Vilela, 2004) because they prefer an internal, rather than an external, financing source (Ozkan & Ozkan, 2004).

2.3. Free cash flow theory

Under the free cash flow theory, firms' managers can increase their power by holding more cash because the manager can make a discretionary decision. Managers with a large amount of cash do not need to go to an external financing market and provide detailed information about the firm's investment project to outside investors.

The free cash flow theory suggests a positive impact of firm size on cash holdings. In bigger firms, which usually have more diversified shareholders, managers can make decisions at their discretion. This leads to the increase of company cash holding because doing so can help managers increase the power of investing and financing decisions (Ferreira & Vilela, 2004).

Investors may not monitor companies with low leverage so much, making more room for company managers to benefit themselves by holding a large amount of cash. Consequently, companies with less leverage tend to hold more cash, implying a negative relationship between leverage and cash holding.

TABLE 1. SUMMARY OF PREDICTIONS ACCORDING TO THE THEORY

VARIABLES	TRADE-OFF THEORY	PECKING-ORDER THEORY	FREE CASH FLOW THEORY
Firm size	-	+	+
Leverage	+/-	-	-
Cash flow	-	+	n/a
Cash flow volatility	+	n/a	n/a
Liquid assets	-	n/a	n/a
Investment opportunity	+	+	-
Dividend payment	-	n/a	n/a

Note: This table summarizes the predictions of determinants of cash holding in relation to the trade-off theory, pecking-order theory, and free cash flow theory. "+" - indicates a positive relationship, "-" - indicates a negative relationship, and "n/a" indicates no prediction.

Managers of companies with poor investment opportunities want to hold more cash to ensure that they can invest in as many projects as they wish, even though these may have negative net present value that can decrease the market value of the company. Nonetheless, a firm's book value may increase because the company invests in more projects. Consequently, the investment opportunity, calculated by the market-to-book

ratio, can decline. This suggests investment opportunities' negative impact on cash holding.

The relationship between firm size, leverage, cash flow, cash flow volatility, liquid assets, investment opportunity and dividend payment with cash holding will be summarized in Table 1. The outcomes of this study are analyzed on the basis of theory assumption and the results of previous authors.

3. Data and methodology

3.1. Data

Our sample includes non-financial companies listed on the London Stock Exchange that are components of the FTSE 100 Index from 2011 to 2016. The financial data is collected from the Bloomberg database. We exclude firms in the financial sector as they have a different motivation for holding cash than firms in the non-financial sector. Our final sample has 456 firm-year observations.

3.2. Methodology

To investigate the determinants of cash holding, the following regression model is employed:

$$CASH_{it} = \alpha + \beta_1 SIZE + \beta_2 LEV + \beta_3 CF_{it} + \beta_4 CFV_{it} + \beta_5 LIQ + \beta_6 IO_{it} + \beta_7 DIV_{it} + \varepsilon_{it}$$

We have applied pooled OLS regression, fixed effects regression, random effects regression and Fama-MacBeth (1973) regression for the equation above. The dependent variable is *CASH*, measured by the ratio of cash and cash equivalent over total assets. *SIZE* equals the natural logarithm of total assets. *LEV* is calculated as the total debt divided to total assets. *CF* measures the firm's cash flow and is computed by the ratio of EBITDA (earnings before interest, tax, depreciation and amortization), minus interest and tax expenses and dividend paid over the total assets. *CFV* is cash flow volatility, measured by the standard deviation of the cash flow over a 4-year period over the total assets. Liquidity assets, *LIQ*, is calculated as the net working capital over the total assets, in which net working capital equals total current assets minus total current liabilities and minus total cash and cash equivalents. *IO* (investment opportunity) is the ratio of the market value of assets over the market value of equity. *DIV* takes the value 1 if firms pay dividend and 0, otherwise. Finally, ε is the error term. The index *i* and *t* are the company *i* and year *t*, respectively.

To control for the difference between industries in our sample, we have included the industry dummies in our regression. In addition, to control for the impact of different

years, we also have included the year dummies in our regression. To control for the effect of outliers, all the variables are winsorized at the 1st and 99th percentile.

4. Empirical results

4.1. Univariate analysis

Table 2 provides summary statistics for our sample. The mean of cash ratio is 0.0782 with the minimum of 0.0027 and the maximum of 0.3396, implying that the cash level varies significantly among firms. The variety in the independent variables is also observed. For example, the firm leverage has a mean of 0.2685 and ranges from 0 to 0.6565.

TABLE 2. SUMMARY STATISTICS

VARIABLE	OBS.	MEAN	STD. DEV.	MIN	MAX
Cash ratio	456	0.0782	0.0678	0.0027	0.3396
Firm size	456	3.9410	0.5724	2.4802	5.3341
Leverage	456	0.2685	0.1507	0.000	0.6565
Cash flow	456	0.0709	0.0591	-0.1166	0.2563
Cash flow volatility	456	0.0314	0.0354	0.0017	0.2243
Liquid assets	456	-0.0253	0.1597	-0.3866	0.5817
Investment opportunity	456	4.0861	5.6046	-13.8308	32.6484
Dividend dummy	456	0.9211	0.2700	0.0000	1.0000

Note: This table provides the summary statistics of variables used in our regressions. All the variables are winsorized at the 1th and 99th percentile.

To further investigate the firms' characteristics, we have divided the sample into two groups based on the median of the cash ratio. The firm with a higher or equal cash ratio to the median will be in the high cash ratio group. The other firms are considered as low cash ratio firms and are included in low cash ratio group. Table 3 compares the firms' characteristics of the high cash ratio with the lower group.

TABLE 3. UNIVARIATE RESULTS

VARIABLE	HIGH CASH RATIO		LOW CASH RATIO		MEAN DIFFERENCE (1) - (3)	MEDIAN DIFFERENCE (2) - (4)
	MEAN (1)	MEDIAN (2)	MEAN (3)	MEDIAN (4)		
Firm size	3.922	3.851	3.960	3.885	-0.038	-0.034
Leverage	0.249	0.244	0.288	0.269	-0.039***	-0.025***
Cash flow	0.073	0.061	0.069	0.064	0.004	-0.003
Cash flow volatility	0.036	0.025	0.027	0.018	0.009***	0.007***
Liquid assets	-0.032	-0.046	-0.018	-0.026	-0.014	-0.020
Investment opportunity	4.763	3.115	3.410	2.682	1.353***	0.433*
Dividend dummy	0.895	1.000	0.947	1.000	-0.053**	0.000

Note: This table compares the firms' characteristics of the high cash ratio group with the corresponding low cash ratio group. The firm is classified as high cash ratio if its cash ratio is higher than or equal to the median of cash ratio. The other firms are considered as low cash ratio firms and are included in the low cash ratio group. Mean and median differences are based on t-test equality of means and Wilcoxon rank-sum test. All the variables are winsorized at the 1th and 99th percentile. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

The results in Table 3 show that the level of cash holding can be explained by three above theories. The high cash flow group has higher cash flow volatility and higher investment opportunity and pays fewer dividends than the low group, suggesting that the trade-off theory has a role in influencing the firms' cash holding behavior. In addition, the lower leverage in the high cash flow group indicates that the pecking-order theory and free cash flow theory can also account for the cash holding behavior.

Table 4 provides the correlation among the variables employed in our model. All values in Table 4 are below 0.7, suggesting that our regression models are not likely to have a multicollinearity problem.

TABLE 4. CORRELATION MATRIX

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Cash ratio	1.000							
(2) Firm size	-0.270	1.000						
(3) Leverage	-0.261	0.012	1.000					
(4) Cash flow	0.239	-0.319	-0.139	1.000				
(5) Cash flow volatility	0.164	-0.124	-0.092	0.120	1.000			
(6) Liquid assets	-0.051	-0.157	-0.227	-0.036	0.147	1.000		
(7) Investment opportunity	0.146	-0.169	0.093	0.303	-0.044	-0.052	1.000	
(8) Dividend dummy	-0.012	0.052	-0.128	0.088	-0.104	-0.065	0.156	1.000

Note: This table provides correlation among variables used in our model. All variables are winsorized at 1th and 99th percentile.

4.2. Multivariate analysis

Table 5 presents the results of the multivariate analysis. Column 1 applies pooled OLS regression to examine the determinants of cash holding. The coefficient of firm size is negative and significant at 5 per cent level. This result is consistent with Opler et al. (1999), Ferreira & Vilela (2004), Kim et al. (1998) and supports the trade-off theory. In addition, the significantly positive coefficient of investment opportunity supports not only the trade-off theory but also the pecking-order theory. These results are similar to those in Opler et al. (1999), Ozkan & Ozkan (2004), Ferreira & Vilela (2004), and Kim et al. (1998). With regard to leverage coefficient, the significantly negative coefficient of leverage confirms the explanation of the pecking-order theory and free cash flow theory for the company managers' cash holding behavior.

Column 2 of Table 5 shows the results when using Fama-MacBeth regression. The results of column 2 are consistent with the results of column 1, except that the coefficient of cash flow volatility is significantly positive at 10 per cent level, suggesting that the trade-off theory is supported. Opler et al. (1999) and Harford, Mansi, & Maxwell (2012) also find that cash flow volatility has a positive impact on cash holding.

The results of column 3, employing the fixed effects model, and column 4, using the random effects model, are rather similar to each other. The negative impact of firm size on cash holding in columns 3 and 4 supports the evidence found in columns 1 and 2, suggesting that the trade-off theory can explain the impact of firm size on cash holding. In contrast to columns 1 and 2, columns 3 and 4 show that the coefficient of cash flow is positive and significant at 1 per cent level, consistent with the explanation of the pecking-order theory. This confirms the results in Opler et al. (1999), Ferreira & Vilela (2004) and Ozkan & Ozkan (2004).

TABLE 5. MULTIVARIATE RESULTS

VARIABLES	Pooled OLS (1)	Fama-MacBeth (2)	Fixed Effects (3)	Random Effects (4)
Firm size	-0.030** (0.012)	-0.027*** (0.003)	-0.113** (0.050)	-0.060** (0.025)
Leverage	-0.101*** (0.033)	-0.101*** (0.013)	0.016 (0.051)	-0.026 (0.037)
Cash flow	0.144 (0.093)	0.095 (0.055)	0.191*** (0.069)	0.191*** (0.070)
Cash flow volatility	0.223 (0.146)	0.348* (0.136)	-0.090 (0.132)	-0.010 (0.126)
Liquid assets	-0.007 (0.040)	-0.012 (0.021)	-0.079 (0.113)	-0.040 (0.068)
Investment opportunity	0.001* (0.0005)	0.001* (0.0005)	0.0002 (0.0006)	0.0004 (0.0004)
Dividend dummy	0.004 (0.014)	-0.002 (0.014)	0.006 (0.009)	0.004 (0.010)
Constant	0.230*** (0.048)	0.218*** (0.008)	0.513** (0.210)	0.328*** (0.101)
Observations	456	456	456	456
R-squared	0.276	0.343	0.213	0.215

Note: This table provides the results from multivariate analysis. The results in column 1 are based on pooled OLS regression. Column 2 employs the Fama-MacBeth regression. The results in column 3 and 4 are from the fixed effects model and random effects model, respectively. Industry dummies and year dummies are included in our regressions but not reported. All the variables are winsorized at the 1th and 99th percentile. Standard errors adjusted for heteroscedasticity and autocorrelation are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

Overall, we find strong evidence supporting the trade-off theory and weak evidence for the pecking-order theory and free cash flow theory.

5. Conclusion

Our paper revisits the determinants of company cash holding and attempts to explain the cash holding behavior of firms' managers. Our sample includes non-financial companies listed on the London Stock Exchange that are components of the FTSE 100 Index from 2011 to 2016. We employ different methods, including pooled OLS regression, Fama-MacBeth regression, fixed effects regression, and random effects regression, to examine the determinants of cash holding.

Consistent with previous studies (Opler et al. (1999); Ferreira & Vilela (2004); Ozkan & Ozkan (2004); Harford et al. (2012); and Kim et al. (1998)), we show that firm size, leverage, cash flow, cash flow volatility, and investment opportunity exert influence on such cash holding behavior by firms' managers. This behavior can be explained by the trade-off theory, the pecking-order theory and free cash flow theory.

Our results may shed light on the decrease in the cash holding level for the post-crisis period. The coefficient of firm size is significantly negative in all regression models, suggesting that the main reason for the decline in cash holding levels is because of the

increase in firm size. After the financial crisis in 2008-2009, the UK economy grew more strongly than expected (Chan, 2015), provoking the development of UK firms.

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