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CORPORATE CASH HOLDING AND FIRM VALUE

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Resumen

The aim of this paper is to contrast the effect of cash holding on firm value for a sample of US industrial firms over the period 2001-2007. In order to do this, we first empirically test the existence of an optimal cash level that maximizes firm value. Secondly, we analyze whether deviations from the optimum cash level reduce firm value. Our results show a concave relation between cash holding and firm value, verifying that there is an optimal level of cash holding. Additionally, and consistent with the initial analysis, we also find that deviations above and below optimal cash holding decrease firm value.

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1. INTRODUCTION

In the recent years there has been a growing interest in the finance literature in corporate cash holdings. This interest has been especially motivated by the fact that corporations hold significant amounts of cash in their balance sheets. Specifically, Dittmar and Mahrt-Smith (2007) state that in 2003, the sum of all cash and marketable securities represented more than 13% of the sum of all assets for large publicly traded US firms. From another perspective, the aggregate cash held by publicly traded US firms in 2003 represents approximately 10% of annual US GDP. Consequently, the cash reserves held by a firm are a relevant factor of study that can affect a firm's value

The first studies focus on this topic has studied the determinants of corporate cash holdings (Kim, Mauer, and Sherman, 1998, Opler, Pinkowitz, Stulz, and Williamson, 1999 Ozkan and Ozkan, 2004; García-Teruel and Martínez-Solano, 2008). Most of these papers have considered that a target cash level exists, providing that cash decisions follow a partial adjustment model, though there is no empirical evidence to justify why firms follow this partial adjustment model. Elsewhere in the finance literature the value of cash has been analysed, but there is no empirical evidence on the straight link between cash holdings and firm valuation. Specifically, Pinkowitz, Stulz and Williamson (2006) estimate the marginal value of cash and find that the relation between cash holdings and firm value is much weaker in countries with poor investor protection than in other countries. Dittmar and Marth-Smith (2007) investigate how corporate governance impacts firm value by comparing the value and use of cash holdings in poorly and well-governed firms. Another group of studies links the value of cash to firm's investment opportunities (Pinkowitz and Williamson, 2004) or to corporate financial policies (Faulkender and Wang, 2006). More recently, Drobetz, Grüninger and Hirschvogl (2009) have studied the marginal value of cash in connection with firm-specific and time varying information asymmetry, obtaining that indicating that information asymmetry decreases the marginal value of cash.

Despite the importance of corporate cash holdings, there are no studies focused on the effects of corporate cash holdings on firm value. In this sense, corporate cash holdings have benefits and cost for the firm and consequently may be an optimal cash level at which the value of the firm is maximized. The benefits of holding cash balances stem from several motives. First, for precautionary motives, firms maintain liquidity to meet unexpected contingencies. Second, for transactional motives, to meet the needs that come from the firm's normal activities. Third, the existence of information asymmetry could increase the cost of external finance (Myers and Majluf, 1984), so firms could retain internally-generated cash to take advantage of their investment opportunities. Additionally, since the existence of agency conflicts make it more expensive to obtain external funding, this could lead firms to pass up positive-NPV investment (Myers, 1984) and assets substitution (Jensen and Meckling, 1976). Hence, managers hold liquid assets in order to reduce the cost of relying on external finance. However investing in liquid assets also has its costs. On the one hand, large cash reserves can increase agency conflicts between managers and shareholders. In this way, the free cash flow might increase discretion by managers, which goes against shareholders' interest (Jensen, 1986). On the other hand, holding liquid assets implies opportunity cost, due to the lower return of these assets, especially if the firm gives up more profitable investments to hold that level of cash.

Thus, a firm's optimal cash holding can be viewed as determined by a trade-off between costs and benefits of having liquid assets to derive an optimal cash level, as is predicted by the model developed by Kim et al (1998). The firm balances the benefits of cash holdings against various costs of holding large cash reserves. The optimal cash level should be the point where marginal costs of cash just offset the marginal benefits.

This paper contributes to the literature by testing empirically if firms have an optimal cash level at which the firms maximize their value. In order to do this we employ two

approaches. The first approach is to set out a non-linear relationship (concave) between cash holdings and firm value. If a quadratic relation (concave) is confirmed, it can be expected that deviations from the inflexion point (maximum) will reduce firm value. So, secondly, we try to answer the following question: What will happen to firm value if we move away from firm's optimal cash holding? Following Tong´s methodology (2008), we describe a model which includes deviation and an interaction term. Finally, in order to get robust results, we use three different proxies for firm value.

This paper provides new evidence on how cash holding influences firm value. The results obtained show that there is a level of cash holding which maximizes firm value for a sample of 472 listed US industrial companies over the period 2001-2007. Specifically, we show empirically that the optimal level is around 14% of total assets. Moreover, deviations from the optimal level reduce firm value. This has important implications for researchers and managers, since it shows that firms can increase their market value merely by being around the optimal level of cash, which seems rational according to the trade-off between benefits and cost of cash holdings.

The remainder of this paper is organized as follows: in Section 2, we review corporate finance literature in depth, focusing on cash and firm value literature. In section 3, we give a general description of the sample and variables employed in this paper. In section 4, we explain the methodology employed. In section 5, we describe the quadratic model linking cash holding and firm value and we report the results and commentaries. Moreover, we analyse the effect on firm value of the deviation from optimal cash holding level. Finally, in Section 6 we present the main conclusions and implications of our study.

2. THEORETICAL FOUNDATIONS AND HYPOTHESIS

According to Stiglitz (1974), in the absence of market imperfections firms' financial decisions would not affect their value. The reason is that in this theoretical situation external finance can always be obtained without problem and at a reasonable price. Moreover, the absence of a premium for liquidity or taxes would mean that keeping cash would have neither an opportunity cost nor fiscal disadvantages. In this context, keeping liquid financial assets would be irrelevant and decisions about investment in liquid assets would not affect shareholders' wealth (Opler, Pinkowitz, Stulz and Williamson, 2001). However, in practice, the irrelevance of cash is not supported. The existence of market imperfections implies that there is an optimal cash level that balanced costs and benefits and maximizes the value of the firm.

With regard to the benefits, firms need cash to carry out their normal activities, to take advantage of profitable future investment opportunities, and to meet unforeseen events (transactional and precautionary motives). Moreover, from holding cash include a reduction of the firm's dependence on costly external financing. Due to the presence of information asymmetry between creditors and debtors, it is more difficult and expensive for firms to obtain external funding because of problems related with adverse selection. In this situation, firms establish a hierarchy in their financing and prefer finances with resources generated internally before issuing in the market, following the Pecking order theory. (Myers and Majluf, 1984). Furthermore, this can generate underinvestment problems because it creates the possibility that the firm will choose not to issue, and will therefore pass up a positive-NPV investment (Myers, 1977). However, this cost can be avoided if the firm can retain enough internally-generated cash to cover its positive-NPV opportunities (Myers, 1984). In other words, managers can avoid this problem by building up the firm's cash reserves. For this reason, cash holding may be beneficial (or financial slack is valuable) so as not to limit firm's investment opportunities, especially for firms with difficulties in accessing external financing. Additionally, corporate liquidity reduces the likelihood of incurring financial distress costs if the firm's operations do not

generate sufficient cash flow to meet obligatory debt payments (Faulkender and Wang, 2006).

However, following previous literature we can highlight the lower rate of return of corporate cash holdings (opportunity cost) and tax disadvantages as the costs of holding liquid assets. Furthermore, corporate liquidity can raise agency problems between managers and shareholders, since cash may provide funds for managers to invest in projects which offer non-pecuniary benefits but which destroy shareholder value (Jensen and Meckling, 1976). Thus the existence of large free cash flow can generate discretional behaviors in the managers that are harmful to shareholders' interests (Jensen, 1986).

Consequently, in finance literature there are two confronting positions regarding cash balances. Myers and Majluf (1984) argue that firms optimally carry large cash balances to avoid having to raise outside capital because cash balances confer financial flexibility benefits but entail no agency costs. Meanwhile, Jensen (1986) proposes that firms optimally carry only minimal cash balances because excess cash balances entail agency costs but provide no flexibility benefits. For this reason, DeAngelo and DeAngelo (2007) consider that cash balances both entail agency costs and confer flexibility benefits, and thus cash accumulation is no longer uniformly beneficial (as in Myers and Majluf, 1984) and investors will pressure firms to limit cash balances to mitigate agency costs while also encouraging managers to maintain a cash cushion that is sufficient to fund moderate unanticipated capital needs that may arise.

A firm's optimal cash holding can be viewed therefore as being determined by a trade-off between costs and benefits of having liquid assets to derive optimal cash level. Actually, previous studies analysing cash holdings determinants implicitly assume the existence of optimal cash holding (Opler et al., 1999; Kim et al., 1998) and demonstrates that cash holding can be viewed as a target-adjustment model where

corporate cash holdings are periodically adjusted to the target level (Ozkan and Ozkan, 2004, and Garcia-Teruel and Martinez-Solano, 2008).

However, the direct effect of cash holding on firm value has not been studied yet. There are some papers analyzing the value and use of cash holdings under different situations. Pinkowitz, Stulz and Williamson (2006) find that the relation between cash holdings and firm value is much weaker in countries with poor investor protection than in other countries. They find that in countries with high investor protection, a dollar of liquid assets is worth roughly a dollar to minority investors. In contrast, in countries with poor investor protection, a dollar of liquid assets is worth much less. These authors identify a discount for liquid asset holdings in countries with poor investor protection. In particular, they show that a source of value loss in these countries is that outside shareholders do not receive the full value of liquid assets owned by the firm. Faulkender and Wang (2006) examine the marginal value of corporate cash holdings under different corporate financial policies. Their results show that the marginal value of cash declines with larger cash holdings, higher leverage, better access to capital markets, and to the extant that firms choose greater cash distribution via dividends rather than repurchases. More recently, Dittmar and Mahrt-Smith (2007) investigate how corporate governance impacts on firm value by comparing the value and use of cash holdings in poorly governed and well-governed firms.

In this context, there is no evidence that contrasts how a firm's cash holdings affect its value. Optimal cash holdings will be determined as the equilibrium between advantages and disadvantages of holding cash. According to the transactional motive and precautionary motive, cash is beneficial for firms. Firms need cash to carry out their normal activities, to take advantage of profitable future investment opportunities, and to meet unforeseen events. In contrast, we have the free cash flow theory, which postulates that cash holdings are detrimental for firms, since cash holdings imply

agency costs (because managers have a large amount of funds under their control and they have more power). Thus, we test for two different effects of cash holding on firm value. On the one hand, at lower levels of cash, transaction and precautionary motives will predominate, and so an increase in cash levels is followed by increases in firm value. On the other hand, at higher levels of cash, the free cash flow and opportunity cost will predominate, and then an increase on cash levels is followed by reductions in firm value. Thus, we expect a non linear relationship (concave) between cash holdings and value of the firm. The inflexion point (maximum of the quadratic function) will represent the maximum value of the company. The main hypothesis of this paper is that there is an optimal cash level that maximises the value of firm. We also predict that deviations both above-optimal and below-optimal cash holding will reduce firm value.

This argument is consistent with Faulkender and Wang (2006). They contrast the hypothesis that the value of cash is decreasing in the level of firms' cash position. That is, firms with a low level of cash reserves are more likely to need to access the external capital market to fund their short-term liabilities and investments than firms with high cash reserves. Due to the existence of transaction costs incurred by accessing the capital markets, the value of additional dollar of cash for such firms is greater than one. In contrast, as cash holdings increase, firms are less likely to access capital markets in the near future and are instead more likely to return cash to shareholders. In this case, the value of an additional dollar of cash could be lower than one, because of higher corporate tax rates relative to investor tax rates and the free cash flow theory problem. Therefore, these authors argue that, for firms that are not near to bankruptcy, the marginal value of cash should be a decreasing function of the cash level.

3. DATA AND VARIABLES

Data

We obtain information from the OSIRIS database about data from Balance sheets, and Profit and Loss accounts. Data for US interest rates (short and long term debt), capital goods prices, and wholesale index were taken from Eurostat.

We use a sample of industrial publicly traded US firms from 2001 to 2007. Industrial firms, SIC Code from 3000 to 5999, are considered in this study due to the high homogeneity between them. Thus, it is common to employ samples made up of industrial firms, such as Kim et al. (1998), Pinkowitz, Stulz, and Williamson (2001) who employed a panel of US industrial firms to study determinants of cash holding, and Opler, Pinkowitz and Willianson (2004) who used a sample of industrial firms from US, Germany, and Japan to study the effect of bank power on cash holdings.

The information obtained was screened, eliminating cases with errors in the accounting data or lost values for some of the variables from the sample. Firms with fewer than five consecutive observations were also dropped from the sample. It is a necessary requisite to perform the Hansen test. As results, we have an unbalanced panel comprising 472 companies for which information is available for at least five consecutive years from 2001 to 2007. It represents 3,055 firm-year observations. We do not use a sample of balanced panel data in the analysis in order to avoid surveillance bias.

Variables

The dependent variable in our study is firm value. We use Tobin's Q as a proxy for firm value. This is the ratio of the firm's market value to the replacement cost of its assets. Tobin´s Q is often used in corporate finance studies to measure firm valuation (Tong, 2008; McConnell, Servaes and Lins, 2008; Lin and Su, 2008; De Miguel, Pindado and De la Torre, 2004). Also Tobin´s Q is employed as a proxy for corporate performance

(Demsetz and Villalonga, 2001). We have also constructed other two additional proxies for firm value in order to test the robustness of the results. These are BOOK-TO-MARKET ratio, defined as the ratio of market value equity to total assets, and EQUITY is the ratio between market capitalisation to equity book value.

The key independent variable is CASH. We measure CASH as cash and cash equivalent to total assets. We include CASH and $CASH^2$ (Cash square) to test the existence of a non linear model. We expect a positive relationship between cash and value when we are below the optimal cash holding level, in other words, in those situations where firms are in the left side of the quadratic function. Similarly, we expect a negative association between the cash and value when we are above the optimal cash holding level. For this reason, we expect CASH to take a positive sign, and $CASH^2$ a negative one.

We also include control variables in the model, in particular, Intangibles, Size, and Leverage. Intangible is the ratio of intangible assets to total assets. We try to capture the firm's growth opportunities, we do not include other more common proxies like for example Tobin´s Q or Market to book because of the multicoleallinity problems. To measure firm size we use the natural logarithm of gross sales. Finally, leverage is total liabilities and debt divided by shareholder equity.

Table 1 presents descriptive statistics for the variables used in our study. It reveals that the mean cash ratio is 7.9% and the median is 4.48%. These values are in line with the median values reported by Kim et al. (1998) 8.1%, in the same market (USA), Ozkan and Ozkan (2004) 9.9% in the UK, and García-Teruel and Martínez-Solano 6.57% in Spain.

INSERT TABLE 1 HERE

It is important to note that ten per cent of firms in our sample have a very small ratio of cash. They hold less than one per cent of cash over total assets. Ten percent of firms hold more than twenty per cent of cash.

INSERT TABLE 2 HERE

In table 2 we present the correlation matrix. The correlations that should be noted are the 0.9613 correlation between Q and BOMK, the two alternative measures of firm value. There are no high correlations between independent variables which could lead to multicolineality problems, and consequently inconsistent estimations.

4. METHOD OF ESTIMATION

We employ two different methodologies to test the existence of an optimal cash holding level which maximizes firm value. In the first phase we test the existence of a non-linear relationship (concave) between firm value and cash. In the second phase we study the relation between deviations on either side of optimal cash level and firm value, following the methodology developed by Tong (2008) for studying the relation between deviations from the optimal CEO ownership and firm value. If a non-linear cash-value relationship is confirmed, where an optimal point which maximizes firm value exists, it is expected that deviations from this optimal cash level will reduce firm value.

Following Arellano and Bond (1991) we employed the GMM method of estimation on the model in first differences, because it controls for unobservable heterogeneity and prevents potential endogeneity problems. First, since firms are heterogeneous, there are always factors influencing firm value that are difficult to measure or hard to obtain (see Himmmelberg, Hubbard, and Palia, 1999). Second, the potential endogeneity of cash holdings and firm value can influence the cash-value relation.

This estimation assumes that there is no second-order serial correlation in the errors in first differences. For this reason, in order to test the consistency of the estimations, we used the test for the absence of second-order serial correlation proposed by Arellano and Bond (1991). Likewise, we employed the Hansen test for over-identifying restrictions, which tests for the absence of correlation between the instruments and the error term.

5. RESULTS

5.1 Quadratic model

In order to study if there is a optimum level of cash holding we estimate Model 1, where the market value in firm i at time t depends on cash holdings and its square, as well as on control variables.

Model 1:

$$V_{it} = \beta_0 + \beta_1 (CASH_{it}) + \beta_2 (CASH^2_{it}) + \beta_3 (GROWP_{it}) + \beta_4 (SIZE_{it}) + \beta_5 (LEV_{it}) + \eta_i + \lambda_t + \varepsilon_{it}$$

where V_{it} is the firm value, proxy as Tobin's Q, BOMK, and EQUITY. The independent variables are CASH, which measures cash and cash equivalent to total assets holding by firm i at time t, and $CASH^2$ (cash squared) in order to test a non-linear relation cash-value. $GROWP_{it,}$ $SIZE_{it,}$ and LEV_{it} are control variables; $GROWP_{it}$, proxy for growth opportunities is intangible to total assets; $SIZE_{it}$ is the natural logarithm of gross sales; and LEV is total liabilities and debt divided by shareholder equity. η_i is the unobservable heterogeneity. It measures both firms' particular characteristics and the characteristics of the sector in which they operate. λ_t are dummy variables that change in time but are equal for all firms in each of the periods considered. In this way we try to capture the

economic variables that firms cannot control and which may affect their value. ε_{it} is the error term.

Table 3 shows the results of the estimation of model 1 using three different proxies for firm value. In the first column we proxy firm value as Q (Tobin´s Q). In the second column we use a different proxy for firm value, BOMK (book-to-market ratio). Finally, the third column presents the results using EQUITY as proxy for firm value. Consistent with our expectations, CASH is positive and statistically significant, while $CASH^2$ is negative and significant at better than 1% level for the three different specifications of dependent variables. This means that cash holding increases the value of the firm up to the breakpoint, after which maximum, increases in the cash holding by a firm reduces its value. We can easily determine the cut-off point of a quadratic function. It is β_1 /-2*β_2. Therefore, we can say that the optimal point, as one that maximizes firm value is 13.81% per cent of cash over total assets (in column 2, 19.98% and in column 3, 14.82%). From the point of view of cash, and considering that the mean value for cash holding is around 8%, it could be considered that, on average, US industrial firms could increase their value by increasing their cash balances.

INSERT TABLE 3 HERE.

The stability of the estimated coefficients for three different specifications of dependent variable demonstrates the robustness of our findings regarding the non-linear relationship between cash holdings and firm value.

Consistent with previous empirical studies, control variables employed in our study are in line with other papers which study firm value. LEV is positively related to firm value, proxy as Tobin´s Q, BOMK (Book-to-market ratio) and EQUITY. De Miguel, et al. (2004) found a similar relation between debt and firm value. The coefficient of the variable SIZE is negative, but not always significant. There is a negative relationship

between firm size and firm value when we proxy value as BOMK and EQUITY, at 5% level and 10% level respectively. Contrary to what might be expected, growth opportunities have a negative and significant impact on firm value. This is in line with Lin and Su (2008), who find a negative relation between growth opportunities (Proxy as the ratio of intangibles to total assets).

5.2 Deviation from the optimal cash level

We have shown above that there is a quadratic relation (concave) between firm cash holdings and firm value, as a consequence of two contrary effects. Our aim in this section is to provide evidence to support the fact that if firms move away from this optimum, firm value will be reduced.

Because of the costs associated with holding cash in excess (such as agency costs, tax effect or opportunity cost), the market might not place a high value on such cash holdings above the optimal level. However, the market will place a higher value on liquidity for those firms that are below optimal cash holding level.

Tong (2008) develops a methodology to study the relation between deviations on either side of optimal CEO ownership and firm value. We follow his methodology to analyze the relation between deviations from optimal cash holdings and firm value.

Next regression is benchmark specification for the determinants of cash holdings based on relevant previous studies (Opler et al., 1999; Kim et al., 1998; Ozkan and Ozkan, 2004; and García-Teruel and Martínez-Solano, 2008).

Model 2:

$$CASH_{it} = \beta_0 + \beta_1 (CFLOW_{it}) + \beta_2 (LIQ_{it}) + \beta_3 (LEV_{it}) + \beta_4 (SIZE_{it}) + \beta_5 (BANKD_{it}) + \beta_6 (GROWP_{it}) + \eta_i + \lambda_t + \varepsilon_{it}$$

Where $CASH_{it}$ is cash and cash equivalent to total assets; $CFLOW_{it}$ is earnings after tax minus depreciation/amortization divided by gross sales; LIQ_{it}, proxy for liquid assets is defined as working capital less total cash and short term investment to total assets; LEV_{it}, leverage is total liabilities and debt divided by shareholders ´equity; $BANKD_{it}$ is the ratio of bank loans (long term) to total debt; $GROWP_{it}$, proxy for growth opportunities is intangible to total assets; and $SIZE_{it}$ is the natural logarithm of gross sales. η_i is the unobservable heterogeneity. λ_t are dummy variables that change in time but are equal for all firms in each of the periods considered and ε_{it} is the error term.

Next, we obtain residuals from Model 2 and we include these residuals in Model 3 after transform them. In this way, we define DEVIATION as the absolute value of these residuals. The aim is to find if deviations from the optimal cash level affects a firm's value. In order to do this we estimate the following model:

Model 3:

$$V_{it} = \beta_0 + \beta_1 (DEVIATION_{it}) + \beta_2 (GROWP_{it}) + \beta_3 (SIZE_{it}) + \beta_4 (LEV_{it}) + \eta_i + \lambda_t + \varepsilon_{it}$$

where V_{it} is firm value, proxied as Tobin's Q, BOMK, and EQUITY. The dependent variable is $DEVIATION_{it,}$ defined as the absolute value of residuals. $GROWP_{it,}$ $SIZE_{it,}$ and LEV_{it} are control variables. LEV_{it}, leverage is total liabilities and debt divided by shareholders ´equity; $BANKD_{it}$ is the ratio of bank loans (long term) to total debt; $GROWP_{it}$, proxy for growth opportunities is intangible to total assets; and $SIZE_{it}$ is the natural logarithm of gross sales. η_i is the unobservable heterogeneity. λ_t are dummy variables that change in time but are equal for all firms in each of the period considered and ε_{it} is the error term.

We expect $b_1<0$ in the Model 3, implying a negative relation between deviations from optimal cash holding level and firm value.

INSERT TABLE 4 HERE.

In Table 4 we present panel data regressions to explain whether deviations from optimal cash holding influence firm value (model 3) for three alternative measures of the firm value.

In accordance with our expectations, DEVIATION is inversely related to firm value, since its coefficient is negative and significant at better than 1%. It confirms the existence of a point at which firm value is maximized, and as we move away from this point, firm value decreases. As before, we proxy value as Q (Tobin´s Q), BOMK (Book-to-Market ratio) and EQUITY, and we obtain the same results. But we are not distimguishing whether these deviations are positive or negative.

Additionally, to analyze the way of which both deviations, above and below optimal cash level, affect firm value, we include an interaction term in model 4. So, we define variable INTERACT as Above-optimal*deviations. Above-Optimal is a dummy variable that takes 1 for positive residuals and 0 otherwise. We try to investigate how variables deviation and deviation + interact (b_1+b_2) affect firm value. With this, we also estimate model 4, which is defined as follows:

Model 4:

$$V_{it} = \beta_0 + \beta_1 (DEVIATION_{it}) + \beta_2 (INTERACT_{it}) + \beta_3 (GROWP_{it}) + \beta_4 (SIZE_{it}) + \beta_5 (LEV_{it}) + \eta_i + \lambda_t + \varepsilon_{it}$$

where V_{it} is firm value, proxied as Tobin's Q, BOMK, and EQUITY. The dependent variables are $DEVIATION_{it,}$ defined as the absolute value of residuals, and $INTERACT_{it}$. It is an interaction term: Above-optimal*deviations. Above-Optimal is a

dummy variable that takes 1 for positive residuals and 0 otherwise. Control variables are $GROWP_{it,}$ $SIZE_{it,}$ and LEV_{it}. LEV_{it}, leverage is total liabilities and debt divided by shareholders ´equity; $BANKD_{it}$ is the ratio of bank loans (long term) to total debt; $GROWP_{it}$, proxy for growth opportunities is intangible to total assets; and $SIZE_{it}$ is the natural logarithm of gross sales.η_i is the unobservable heterogeneity. λ_t are dummy variables that change in time but are equal for all firms in each of the periods considered and ε_{it} is the error term.

We expect $b_1<0$ and $b_1+b_2<0$. This means a negative effect of both above-optimal and below optimal deviations on firm value.

INSERT TABLE 5

As displayed in table 5, DEVIATION is negative and statistically significant in all three cases. On the other hand, INTERACT is positively related to firm value in columns 1 and 2. Interact could be positive due to the fact that positive and negative residuals offset each other. Because of this, we perform an F test, to prove that $\beta_1 + \beta_2$ remains negative and statistically significant. Effectively, the F-test reveals that the sum of these two coefficients is significant at better than 10% level. These results support the hypothesis that deviations on either side of optimal cash holding reduce firm value.

In column 3 Table 5, DEVIATION and INTERACT are once again both negative and significant. This means that firms can increase their value both by increasing their cash balances in those situations when they are below-optimal cash level and by reducing their investment in liquid assets if they are above-optimal.

Using all three proxies for firm value, the results are strongly consistent with our hypothesis. We find that the relationship between cash holdings and firm value is quadratic and, moreover, deviations from optimal cash holdings (above and below the optimal level) significantly reduce firm value.

6. CONCLUSION

The aim of this paper is to contrast the effect of cash holding on firm value. With this in mind, we use a sample of 472 US industrial firms to conduct a study with panel data during the period 2001-2007. In order to do this, we first empirically test the existence of an optimal cash level that maximizes firm value. Secondly, we analyze whether deviations from the optimum cash level reduce firm value.

The results obtained show that there is a level of cash holding which maximizes firm value. Specifically, we show empirically that the optimal level is around 14% for a sample of listed US industrial companies over the period from 2001 to 2007. Moreover, deviations from the optimal level reduce firm value. Our results imply a positive marginal value of cash in those situations in which we are below optimal cash level, and a negative marginal value of cash when we are above optimal cash level.

It is worthwhile pointing out the implications of our study for researchers and managers, since it shows that firms can increase their market value merely by being around the optimal level of cash, which seems rational according to the trade-off between benefits and cost of cash holdings.

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Table 1

Descriptive Statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Median*	*perc 10*	*perc 90*
Q	3055	1.2550	0.8019	1.0262	0.6908	2.0418
BOMK	3055	1.5730	0.9327	1.3023	0.9070	2.4941
EQUITY	3055	2.6527	12.3742	1.7406	0.7697	4.2151
CASH	3055	0.0790	0.0925	0.0448	0.0067	0.2031
GROWP	3055	0.1764	0.1583	0.1294	0.0152	0.4028
SIZE	3055	13.2897	2.1075	13.3636	10.4510	15.9889
LEV	3055	1.8885	4.0427	1.1970	0.3566	3.4623
CFLOW	3055	-0.0728	0.5054	0.0011	-0.1566	0.0626
LIQ	3055	0.1198	0.1590	0.1119	-0.0665	0.3237
BANKD	3055	0.3978	0.2024	0.4079	0.1036	0.6636

This table provides descriptive statistics for the data employed in the analysis. The data is from 2001 to 2007. The variables are the followings: ratio of the firm's market value to the replacement cost of its assets (Q), ratio of market value equity to total assets (BOMK), ratio between market capitalisation to equity book value (EQUITY), ratio of cash and cash equivalents to total assets (CASH), ratio of intangibles to total assets, (GROWP), natural logarithm of gross sales (SIZE), ratio of total liabilities and debt to shareholders ´equity (LEV), earnings after tax minus depreciation/amortization divided by gross sales (CFLOW), ratio of working capital less total cash and short term investment to total assets (LIQ), and ratio of bank loans (long term) to total debt (BANKD).

Table 2

Correlation Matrix

	Q	BOMK	CASH	GROWP	SIZE	LEV	CFLOW	LIQ	BANKD
Q	1.0000								
BOMK	0.9613***	1.0000							
CASH	0.2923***	0.2769***	1.0000						
GROWP	-0.0216	-0.0561***	-0.1214***	1.0000					
SIZE	-0.0814***	-0.0648***	-0.2395***	-0.1054***	1.0000				
LEV	-0.0053	-0.0006	-0.0984***	-0.0380**	0.0821***	1.0000			
CFLOW	-0.1089***	-0.0707***	-0.1428***	0.0286	-0.2257***	-0.0470***	1.0000		
LIQ	-0.0031	-0.0276	-0.0325*	-0.1183***	0.2077***	0.2141***	0.1500***	1.0000	
BANKD	-0.1977***	-0.1951***	-0.2040***	-0.1634***	0.0250	-0.1336***	0.0208	-0.1259***	1.0000

The variables are the following: Q, BOMK, EQUITY, CASH, GROWP, SIZE, LEV, CFLOW,LIQ and BANKD. Variable definition is provided in section 3, variables.

***significant at 1%, **significant at 5%, *significant at 10% level

Table 3

Corporate cash holdings and firm value

	TOBIN´S Q (1)	BOOK-TO-MARKET (2)	EQUITY (3)
CASH	0.8201***	2.0894***	16.6872***
	2.78	6.3	4.92
$CASH^2$	-2.9694***	-5.2281***	-56.3101***
	-7.33	-10.64	-9.97
GROWP	-2.5613***	-0.2019	-12.4402**
	-5.43	-0.43	-1.97
SIZE	-0.0019	-0.2669**	-2.0171*
	-0.02	-2.31	-1.84
LEV	0.0118***	0.0133***	2.7802***
	5.55	5.51	13.2
m_2	0.962	0.795	0.197
Hansen test (df)	76.57 (58)	69.42 (58)	54.42 (58)

All models estimated by GMM. All variables are treated as endogenous and the lagged independent variables are used as instrument. In column (1) the dependent variable is Tobin´s Q, proxy for firm value. In column (2) the dependent variable employed to proxy firm valuation is Book-to-market ratio, which is market value equity to total assets. In column (3) the dependent variable is Equity, which is the ratio of market capitalisation to equity book value. Independent variables are CASH and $CASH^2$. Control variables are GROWP, SIZE, and LEV. Time dummies are included in all regressions

m_2 is test statistic for second order autocorrelations in residuals, distributed as standard normal N(0,1) under the null hypothesis of no serial correlation. Hansen test is a test of overidentifying restrictions, distributed as chi-square under the null of instrument validity.

***significant at 1%, **significant at 5%, *significant at 10% level

Table 4

Deviation from the optimal cash level and firm value (I)

	TOBIN´S Q (1)	BOOK-TO-MARKET (2)	EQUITY (3)
DEVIATION	-0.7256***	-1.0229***	-15.7288***
	-2.60	-3.49	-7.93
GROWP	-3.1915***	-1.2565**	-21.9361***
	-7.09	-2.48	-3.98
SIZE	-0.0592	-0.2529***	-2.4682***
	-0.74	-2.93	-2.99
LEV	0.0163***	0.0196***	2.9055***
	8.24	8.29	16.69
m_2	0.928	0.687	0.326
Hansen test (df)	93.52 (81)	92.26 (81)	78.26 (81)

All models estimated by GMM. All variables are treated as endogenous and the lagged independent variables are used as instrument. In column (1) the dependent variable is Tobin´s Q, proxy for firm value. In column (2) the dependent variable employed to proxy firm valuation is Book-to-market ratio, which is market value equity to total assets. In column (3) the dependent variable is Equity, which is the ratio of market capitalisation to equity book value. The Independent variable is DEVIATION. Control variables are GROWP, SIZE, and LEV.

m_2 is test statistic for second order autocorrelations in residuals, distributed as standard normal N(0,1) under the null hypothesis of no serial correlation. Hansen test is a test of overidentifying restrictions, distributed as chi-square under the null of instrument validity.

***significant at 1%, **significant at 5%, *significant at 10% level

Table 5

Deviation from the optimal cash level and firm value (II)

	TOBIN´S Q (1)	BOOK-TO-MARKET (2)	EQUITY (3)
DEVIATION	-1.2754***	-2.8190***	-13.5508***
	-2.96	-6.4	-3.13
INTERACT	0.8228**	2.3083***	-4.1597
	2.03	4.74	-0.79
GROWP	-3.1352***	-1.6044***	-20.1820***
	-8.31	-3.67	-5.66
SIZE	-0.1123	-0.3720***	-2.6427***
	-1.59	-4.84	-4.45
LEV	0.0168***	0.0192***	2.7967***
	6.65	5.95	19.18
m_2	0.871	0.601	0.293
Hansen test (df)	122.49 (101)	122.01 (101)	106.19 (101)
F-test (p-value)	3.22 (0.0727)	3.27 (0.0707)	

All models estimated by GMM. All variables are treated as endogenous and the lagged independent variables are used as instrument. In column (1) the dependent variable is Tobin´s Q, proxy for firm value. In column (2) the dependent variable employed to proxy firm valuation is Book-to-market ratio, which is market value equity to total assets. In column (3) the dependent variable is Equity, which is the ratio of market capitalisation to equity book value. Independent variables are DEVIATION and INTERACT. Control variables are GROWP, SIZE, and LEV.

m_2 is test statistic for second order autocorrelations in residuals, distributed as standard normal N(0,1) under the null hypothesis of no serial correlation. Hansen test is a test of overidentifying restrictions, distributed as chi-square under the null of instrument validity.

F-test refers to an F test on the null hypothesis that the sum of the coefficients of deviation and interact is zero. The p-value is noted in the brackets.

***significant at 1%, **significant at 5%, *significant at 10% level