CASH HOLDINGS, FIRM SIZE AND ACCESS TO EXTERNAL FINANCE. EVIDENCE FOR THE EURO AREA

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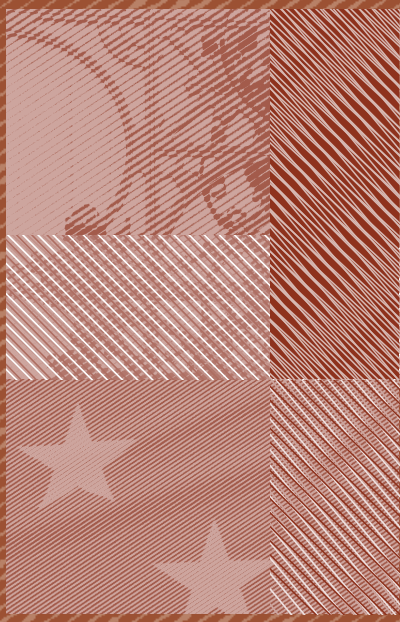

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Abstract

This paper investigates the empirical determinants of corporate cash holdings in the euro area as a function of firm size. The results show that there are significant differences in investment in liquid assets for firms of different size. More specifically, liquid assets for smaller firms in the euro area are more strongly linked to firm cash flow and its variability than cash holdings for larger firms, possibly as a result of their more restricted access to external funds and the need to provide for future investment needs. Likewise, results show that the link between cash holdings and tangible assets, which facilitate access to external finance, is stronger for small and medium-sized firms than for large firms. In contrast, cash holding sensitivity to variations in the spread between the return on liquid assets and alternative uses of these funds (debt repayment, in the empirical specification presented in this paper) is higher for larger firms, something that might be linked to their better access to capital markets and their lower need to keep a cash buffer for precautionary reasons.

Keywords: cash holdings, financing constraints, panel data.

JEL classification: C23, E41, G31, G32.

1 Introduction

This paper looks at the empirical determinants of firms' cash holdings in the euro area, focussing on those aspects that might result from precautionary reasons and, specifically, from limited access to external finance. For this purpose, the paper analyses to what extent there are differences in the relative importance of the factors conditioning firms' cash holdings by firm size, a variable which is usually considered a reasonably good proxy for the degree of financial constraints faced by the company (smaller firms are usually younger, more opaque and less well known and thus potentially more vulnerable to capital market imperfections).

Some recent studies stress the relevance of cash policies in the context of imperfect capital markets, in which firms' access to external finance is limited. They argue that the existence of financing constraints can be tested by analysing the sensitivity of cash holdings to cash flow and its variability, which avoids the main criticism of the interpretation of positive sensitivity of investment to cash flow as a sign of the existence of financial constraints [see Alti (2003), amongst others]: if current cash flow is correlated with firms' investment opportunities, and the latter are not properly measured, the positive investment sensitivity to cash flow could simply be reflecting the link between investment and investment opportunities. This problem does not arise when the existence of financing constraints is tested by measuring the sensitivity of cash holdings to cash flow and its variability: if a firm does not face financing constraints it has no need to provide for future investment needs, and hence its cash holdings should not depend either on cash flow or on cash flow variability. However, if firms do face financing constraints, they can decide to hold more cash to hedge against the possibility of falling short of cash in the future and hence not being able to carry out valuable investment projects. Thus, differences in the sensitivity of cash holdings to cash flow, and its variability across different groups of firms, could be signalling differences in access to external finance. Almeida, Campello and Weisbach (2004) and Han and Qiu (2007) exploit this idea and analyse the sensitivity of cash holdings to, respectively, cash flow and cash flow variations. However, with regard to the sensitivity of cash holdings to cash flow, two recent papers by Almeida, Campello and Weisbach (2009) and Riddick and Whited (2009) question the use of a positive sensitivity to cash flow as a tool to obtain evidence of restricted access to external finance for certain groups of firms.

The analysis presented here supplements previous studies on the impact of financing constraints on cash holding policies, which have mainly focussed on US firms and on the analysis of the sensitivity of cash holdings to cash flow and its variations (see Section 2 for a review of such studies). For the euro area, only Pál and Ferrando (2010) have addressed this issue previously, focussing on the analysis of liquid asset saving policies (that is, on cash holding *changes)* and, specifically, on the link between cash flow and cash savings. The analysis presented here differs from that study in two main aspects: first, it looks at cash holding *levels* (relative to assets), rather than at their change; second, it looks not only at the link between cash holdings and cash flow, but also at the impact on cash policies of other variables linked to firms' access to external finance, such as cash flow variability and the collateral available. There is also an important difference between the analysis here presented and previous papers that analyse the link between cash holdings and size: the analysis is not restricted to listed or (mainly) large firms, as in these previous papers. Instead, in the sample used here unlisted and small and medium-sized firms, which are those expected to have a more difficult access to external finance, prevail. In particular, the sample used for the analysis

contains around 0.5 million firm-year observations, more than 95% of them being for small or medium-sized firms (SMEs).

The rest of the paper is organised as follows: after reviewing the existing literature on this field in Section 2, Section 3 presents a descriptive analysis of the relationship between cash holdings and their potential determinants, Section 4 sets out the results of the econometric analysis and Section 5 concludes.

2 Literature review

According to the trade-off theory, firms choose their cash holding levels by balancing the marginal costs and the marginal benefits of holding cash. The main cost is the opportunity cost of capital invested in liquid assets instead of in other assets with a higher return. The benefits related to higher cash holdings are the lower transaction costs (associated with using cash for payments without having to liquidate assets), a lower likelihood of suffering financial distress and the possibility of executing investment projects that could not be carried out without these funds owing to the existence of financial constraints.

The link between financial constraints and firms' demand for liquid assets can help to identify to what extent firms of different size face different degrees of financial restrictions.[1] As has been mentioned in the introduction, Almeida, Campello and Weisbach (2004) and Han and Qiu (2007) have focussed on the estimation of cash holding equations as a tool to assess the existence of financing constraints using data for US companies. In the first of these papers, the authors claim that a positive sensitivity of cash holdings to cash flow indicates the existence of financing constraints: if firms are financially unconstrained, their cash holdings should not respond to either current cash flow or investment opportunities and hence they should not display a systematic propensity to save cash out of their cash flows; if instead firms anticipate financing restrictions in the future, they can respond to these potential constraints by hoarding cash today as a way of providing for future investment needs, something that is not necessary for unconstrained firms. Using a sample of publicly traded manufacturing firms, they test empirically whether the propensity to save cash out of cash flows is positive for a group of constrained firms (which they define using a function of alternative variables that proxy for the likelihood that firms face financing constraints) and non-significant for financially unconstrained firms, and they obtain results in line with their priors.[2]

Han and Qiu (2007) extend the model of Almeida, Campello and Weisbach (2004) and analyse the role of financial constraints in the link between corporate cash holdings and cash flow variability. They argue that if a firm has unrestricted access to external funds, it has no need to provide for future investment needs and hence its cash policies should not depend on cash flow variability. They find, using a sample of US publicly traded companies, that the link between these two variables depends on the degree of financing constraints faced by the firm, being positive and significant for constrained firms only. When they use the size of the firm as a proxy for the degree of financing constraints faced by the firm, they find that the cash holdings of smaller firms respond positively to cash flow variability, while for large companies liquid assets do not react to changes in this variable.

The results in Almeida, Campello and Weisbach (2004) contrast with those in Riddick and Whited (2009), who find that, after controlling for Tobin's q (and for errors in its

1. In parallel to this strand of the literature that studies the impact of financing constraints on cash holding policies, there is a vast one which focuses on studying the existence of economies of scale in money demand, hence emphasising the transaction motive for holding cash [see Lotti and Marcucci (2007) for a review of this literature].

2. Viral, Almeida and Campello (2005) model the interplay between cash and debt policies in the presence of financial constraints. Their empirical analysis is carried out using a sample of US publicly traded (manufacturing) firms, and their results suggest that financially constrained firms with high hedging needs have a strong propensity to save cash out of cash flows, while showing no propensity to reduce outstanding debt. In contrast, constrained firms with low hedging needs systematically channel free cash flows towards debt reduction, as opposed to cash savings. The authors conclude from their evidence that cash should not be viewed as negative debt.

measurement), cash holding accumulation and cash flow are negatively related. They argue that this negative propensity to save occurs because a positive (and positively correlated) productivity shock causes both cash flow and the marginal product of capital to increase. Nonetheless, their model show a positive relationship between a firm's risk and its level of cash, in line with the results in Han and Qiu (2007). More recently, Almeida, Campello and Weisbach (2009) extend and refine the analysis presented in Almeida, Campello and Weisbach (2004) and find, in contrast with their previous results, that the cash flow sensitivity of cash can be positive or negative for financially constrained firms. The different conclusion they reach is explained by the fact that in Almeida, Campello and Weisbach (2004) it is assumed that all fixed investment is illiquid, while Almeida, Campello and Weisbach (2009) introduce the possibility of investing in liquid assets other than cash, and under this scenario the cash flow sensitivity of cash is not necessarily positive even for constrained firms. Acharya, Almeida and Campello (2007) find that the cash flow sensitivity of cash depends on constrained firms' hedging needs. If hedging needs are high (that is, if future cash flows and investment opportunities are not highly correlated), then constrained firms tend to save cash out of cash flows.

More generally, Opler, Pinkowitz, Stulz and Williamson (1999) examine the determinants and implications of holdings of cash and marketable securities. As in the previous two papers, they use a sample of US publicly traded firms, for the period 1971 to 1994. They find that firms with strong growth opportunities and riskier cash flows hold relatively high ratios of cash to total non-cash assets, while firms that have greater access to the capital markets, such as large firms and those with high credit ratings, tend to have lower cash ratios.

For the euro area, the studies on corporate cash holding policies at micro level are scarce and focus on large firms.[3] An exception is Martínez-Carrascal and von Landesberger (2010), who analyse cash holdings from a macro and micro perspective and use the same database used in this paper. However, this paper does not report results by size (or by any other firm characteristic that might be linked to the degree of financing constraints). Ferreira and Vilela (2004) analyse the determinants of corporate cash holdings in euro area countries, but only for publicly traded firms, while Pál and Ferrando (2010) analyse the changes in firms' cash holding ratios from the standpoint of identifying financing constraints using a sample in which large firms prevail. In the first of these papers, cash holdings of publicly traded firms are found to be positively linked to investment opportunities and to cash flow, and negatively linked to leverage and size, findings that are also in line with the results in Martínez-Carrascal and von Landesberger (2008). The paper by Pál and Ferrando (2010) extends the analysis in Almeida, Campello and Weisbach (2004) to euro area firms. They use the same database used in this paper, but, since their analysis relies on firms with consolidated accounts, which are usually not available for small firms, large companies and large corporate groups prevail in their sample. Their results are not in line with those of Almeida, Campello and Weisbach (2004) for US firms, since they find that all types of euro area firm, regardless of their financing conditions, display a positive sensitivity of cash holdings to cash flow, and in fact they estimate the highest sensitivity for firms operating under the best financing conditions (those classified as unconstrained firms). They explain this puzzling result by arguing that the higher sensitivity estimated for unconstrained firms simply reflects the high growth opportunities of this group of firms.

3. There are numerous papers focused on the estimation of the elasticity of cash holdings to sales at a country level [see for example Adao and Mata (1999) or Bover and Watson (2005)].

3 A preliminary look at the links between size, cash holdings and the determinants of cash holdings

This section presents, primarily in graphical form, a preliminary analysis of firms' cash holdings in the euro area. First, it illustrates the variability in the cross-sectional distribution of the variable of interest, the cash holding ratio (defined as the ratio of cash and cash equivalent to total assets), for different firm size classes over time.[4] Then, it presents a bivariate analysis of the relationship between cash holdings and some of their potential determinants, for different firm size classes.

The data used for the analysis were obtained from the AMADEUS database of the Bureau van Dijk, which contains profit and loss account and balance sheet data on private and publicly owned firms across eleven euro area countries for the period 1990-2005. For the purpose of the analysis, euro area listed and unlisted private non-financial enterprises are considered. Whenever available, consolidated annual accounts are used as these are considered to be more suitable for providing information about the financial situation of a company with subsidiaries. When consolidated data are not available, unconsolidated data are used. Thus, since many small and medium-sized (SMEs) firms provide only unconsolidated accounts, a large number of SMEs are included in the sample, which would have been excluded otherwise.

The first two years are excluded because of the poor coverage across countries and some additional years are not used for the construction of the variables for the econometric analysis. After some filtering to eliminate inconsistent observations, an unbalanced panel of around 85,000 firms with about 500,000 observations for the period 1998-2005 is obtained. Around 82% of the observations correspond to small firms, while 14% correspond to medium-sized firms and just 4% to large companies.[5] With regard to the country composition, French, Italian and Spanish companies account for a large proportion of the total sample; for all size classes companies from each of these countries account for at least one fifth of all enterprises in the sample.

Table 1 presents some descriptive statistics (the mean, median and standard deviation) for the firm-level variables used in the analysis for the sample period (1998-2005) for each size group. The distribution for the cash holding ratio (cash and cash equivalent to total assets) appears to be strongly positively skewed for all size classes and there seems to be an inverse relationship between size and cash holdings, as the mean and median cash holding ratios of smaller firms are higher; smaller firms hold not only higher levels of cash holdings but also of other types of short-term assets (net working capital) in their balance sheets. In contrast, tangible assets make up a lower proportion of their total assets. These descriptive statistics do not show a clear link between cash flow and firm size,

4. In applied work, the variables used to capture the transaction motive are sales, under the inventory approach, or, in a portfolio framework as here, total assets. See Vogel and Maddala (1967) for a comparison of the patterns observed in both ratios.

5. For the size class definitions, I use the classification adopted by the European Commission that relies on the number of employees and on a joint condition on either total assets or turnover. The thresholds for assets and turnover which define different size classes are adjusted over time, using the gross value added deflator.

or between size and cash flow variability, which is measured by means of the coefficient of variation of firms' cash flow over the previous five years.[6]

Charts 1.1-1.3 illustrate the variability in the cross-sectional distribution of cash holding ratios for different firm size classes over time. More specifically, they show the 25th, 50th and 75th percentiles of the cash holding ratio for large, medium and small firms, respectively. A comparison of these three charts reveals that the distribution of this ratio has much higher values for smaller firms; for example, the median cash holding ratio for small firms is on average almost 2.5 times higher than the median value of this ratio for large firms. Also the dispersion of the distribution is larger for smaller firms (although not if the dispersion is normalised by the median cash holding ratio in the corresponding size class). The charts also show that there has been a slight upward shift in the upper part of the distribution for all size classes from the year 2000. This shift is not observed in the lower percentiles, which are very stable over time for all size classes.

The rest of the charts compare, for each size class, the median cash holding ratio in different corporate groupings defined on the basis of alternative variables that may influence cash holding levels. Each chart presents the median cash holding ratio for firms with high, medium and low levels, respectively, of that indicator. For example, Charts 2.1, 2.2 and 2.3 depict the median cash holding ratio for firms belonging to the top, median and bottom deciles of the cash flow distribution. The median decile (which includes firms between percentiles 45 and 55) can be regarded as representative of the behaviour of the typical or average firm in terms of cash flow, while the top (bottom) decile includes the 10% of firms with the highest (lowest) value of this ratio. These charts show noticeable differences in the link between cash holdings and cash flow for different size classes: while these two variables are positively linked for smaller firms, there is no clear relationship between them for large firms, according to this bivariate analysis. As cash flow is correlated with growth opportunities, this could partly reflect a higher impact of growth opportunities on cash holdings for smaller firms, which may have more restricted access to external finance, although a genuinely higher impact of cash flow on cash holdings for smaller firms might also be behind this pattern [see for example Ferreira and Vilela (2004) or Han and Qiu (2007)]. As for the link between cash holdings and cash flow variability, this descriptive analysis does not point towards a positive relationship between these two variables: as can be seen in Charts 3.1, 3.2 and 3.3, firms with more uncertain cash flows are in fact those holding lower levels of cash holdings, especially in the case of smaller firms.

Charts 4.1, 4.2 and 4.3 show a negative relationship between cash holdings and the proportion of tangible assets in firms' balance sheets, which might be linked to the easier and less costly access to external finance afforded by collateral. Again, the link appears to be stronger for SMEs than for large firms. This relationship seems to be non-linear, especially for SMEs, as the difference in cash holding ratios for firms with low and medium levels of tangible assets is much smaller than the difference in cash holding ratios for firms with medium and high levels of tangible assets.

Charts 5.1, 5.2 and 5.3 show the link between indebtedness and cash holdings. A priori, the link between these two variables is ambiguous: on the one hand, more indebted firms have a higher opportunity cost of holding cash; on the other, higher leverage increases the probability of bankruptcy and firms might try to reduce the probability of experiencing

6. That is, the standard deviation divided by the mean (in absolute value) of the cash flows.

financial distress by holding more cash. The descriptive evidence shown in these charts seems to indicate that the first effect dominates for the companies in the sample, as there seems to be a negative relationship between these variables. Finally, as expected, there is also a negative relationship between cash holdings and the ratio of net working capital to assets (short-term assets other than cash and its equivalents), in line with the fact that cash and working capital are substitutes (liquid assets other than cash can be more easily liquidated than other assets in the event of a cash shortage).

To sum up, this descriptive analysis shows that there is significant heterogeneity in cash holdings for firms of different size, and also, at least according to this simple bivariate analysis, in the relationship between cash holdings and several balance sheet and profit and loss account indicators for SMEs and for large firms.

4 Estimation results

The equation to be estimated is:

$$Cash_{it} = \beta_1 Cash_{it-1} + \beta_2 Cash_{it-2} + \beta_3 spread_{ct} + \beta_4 CF_{it} + \beta_5 CFV_{it-1} + \\ + \beta_6 NWC_{it-1} + \beta_7 TA_{it-1} + \beta_8 L_{it-1} + \alpha_i + \theta_t + S_i + \varepsilon_{it}$$

where i indexes companies *i*=1, 2...N, *t* indexes the year t=1, 2...T, and *c* indexes the country c = 1, 2…*C* in which firm I operates. Cash is the cash holding ratio and, as mentioned above, is constructed as the ratio of cash and cash equivalent to total assets, *spread*, which captures the opportunity cost of holding cash, is the difference between the long-term interest rate on bank lending to non-financial corporations and the M3 rate,[7] *CF* is the cash flow to total assets ratio, *CV* is the cash flow volatility, *NWC* is the net working capital (short-term assets minus cash and its equivalents divided by total assets), *TA* is the ratio of tangible assets to total assets, *L* is the leverage ratio (debt to assets), α_i are company-specific fixed effects, θ_t are time effects that control for macroeconomic influences on cash holdings that are common across companies, S_i control for sectoral effects that are constant over time and ε is a serially-uncorrelated, but possibly heteroskedastic error.[8]

As mentioned in the previous section, a positive coefficient is expected for cash flow variability in the context of credit market imperfections, while negative ones are expected for the spread between the long-term interest rate on bank lending to non-financial corporations and the M3 rate, net working capital (the closest substitute in firms' balance sheets for cash holdings) and the ratio of tangible assets to total assets. As for cash flow, a positive sign might be expected, even for non-financially constrained firms, as growth opportunities, which are correlated with cash flow and empirically have been found to have a positive impact on cash holdings, are not controlled for.[9] Finally, there are no clear predictions about the impact of leverage on liquid asset holdings. Two lags of the endogenous variable are also included to control, as usual in the literature, for potential persistence in cash holdings.

The estimation method consists of the GMM system estimator proposed by Arellano and Bover (1995) and examined in detail in Blundell and Bond (1998). These models control for unobservable firm-specific fixed effects, the estimator being an extension of the GMM estimator of Arellano and Bond (1991) that estimates equations not only in first differences but also in levels.[10] Apart from the biases that would arise if fixed effects were not controlled

7. That is, the rate associated with banknotes and coins, short-term deposits and short-term marketable instruments issued by monetary and financial institutions in the euro area.

8. Country dummies were excluded from the specification because they turned out to be non-significant.

9. Most companies in the sample are unlisted and hence the Tobin's q cannot be calculated as a proxy for growth opportunities.

10. The use of the GMM system estimator is especially justified in the case of autoregressive models with high persistence in the data, so that the lagged levels of a variable are not highly correlated with the first difference, which results in finite sample biases associated with weak instruments in the first-difference estimator [see Blundell and Bond (1998)]. Blundell and Bond (1998) show that in these circumstances also including the levels equations in the system estimator offers significant gains, countering the bias. They also show that in autoregressive distributed lag models, first differences of the variables can be used as instruments in the levels equations provided that they are mean stationary. The high levels of serial correlation displayed by several variables included in the models and the fact that they can be regarded as mean stationary favour the use of a GMM system estimator rather than the first-difference estimator.

for, it is also necessary to take into account that most current firm-specific variables are endogenous (it is likely that shocks affecting firm cash holdings also affect other firm-specific characteristics such as cash flow). Likewise, it is possible that the observed relationship between cash holding ratios and other balance sheet characteristics reflects the effects of cash on the latter or vice versa. In order to avoid the bias associated with this endogeneity and reverse causality problem, a GMM estimator is used, taking lags of the dependent and explanatory variables as instruments, and including all balance sheet right hand side variables lagged one period.

The estimation method requires the absence of second order serial correlation in the first-differenced residuals for which the test of Arellano and Bond (1991) is presented (labelled M_2). If the underlying model's residuals are white noise then first-order serial correlation should be expected in the first-differenced residuals for which the test of Arellano and Bond (1991), labelled M_1, is also presented. The results of the Sargan test of overidentifying restrictions as a test for instrument validity is also reported. Table 2 show the results obtained when the equation is estimated separately for large, medium and small firms. The expected first-order serial correlation in the first-differenced residuals is found while there is no evidence of second order serial correlation, the key requirement for validity of our instrumentation strategy, and the Sargan test statistics are insignificant at conventional 5% significance levels.[11] For each regressor, the table presents the p-value associated with the null hypothesis that the estimated coefficient for small and large firms is not statistically significant.

As can be seen in the table, the first lag of the endogenous variable (and the second one, for large and medium firms) is found to be clearly significant, indicating, in line with previous studies, persistence in firms' cash holdings. This persistence is, according to the magnitude of the estimated coefficients, quite large.

The signs obtained for the rest of the regressors are also in line with expectations, and point towards significant differences in cash holding policies across firm size groups. As for cash flow, unlike the results in Pál and Ferrando (2010), this variable seems to have a stronger bearing on the cash holding policies of smaller firms, for which larger coefficients are estimated. Since cash flow is correlated with growth opportunities, the higher sensitivity estimated for smaller firms might indicate that cash holdings of large firms respond less to growth opportunities than those of smaller firms, who, anticipating a more restrictive access to external finance, might respond by hoarding more cash today to avoid the risk of being unable to fund profitable investment projects, while large firms do not need to do so.[12] Apart from the effect of growth opportunities on cash holdings, there could also be a genuinely higher impact of cash flow on cash holdings for smaller firms [see for example

11. See the bottom part of the table for a list of the instruments used for each size class. When common instruments were used across all size groups, the M_2 and Sargan tests in some cases reported values above standard critical values. Accordingly, different sets of instruments where used for each of the size groups. The main results presented here remain valid when common instruments are used (see Table A.1 in the Appendix), although in this case the p-value associated with the M_2 and Sargan tests for the estimation for small firms is rather low.

12. It is possible that the significant and higher sensitivity of cash holdings to cash flow could simply be reflecting the larger information content of cash holdings about future investment opportunities for SMEs. The data do not seem to point in this direction, as the cash flow information content on future investment opportunities seems to be similar for all size groups. To check the predictive power of cash flow for investment opportunities across size groups, sales growth (or cash flow) was regressed on past cash flows. The estimated coefficients do not point towards significant differences in the predictive power of cash flow across size groups which, at most, would be lower for smaller firms. When trying to control for growth opportunities through the inclusion of the growth rate of sales in the specification, the existing correlation between cash flow and growth rate of sales resulted in collinearity problems, and a larger coefficient was estimated for cash flow while a negative one was obtained for the growth rate of sales.

Ferreira and Vilela (2004) or Han and Qiu (2007)], which is difficult to estimate here as the usual Tobin's q cannot be constructed to proxy for growth opportunities as most of the companies are unlisted.

In addition, and consistent with the results reported in Han and Qiu (2007), evidence is found that cash flow volatility positively affects cash holdings, in line with the precautionary motive for holding cash; as in the results for US firms reported in Han and Qiu (2007), the coefficient is only significant (and quantitatively larger) for small firms, which, again, could be linked to their comparatively more limited access to external finance. More specifically, the estimated coefficient for this variable implies that for an increase of one standard deviation in cash flow volatility, the cash holding ratio increases by 0.8 pp (9.5% of the median cash holding ratio in the sample). The positive link between cash holdings and cash flow volatility for firms with a limited access to external finance could result, as Han and Qiu (2007) indicate, in a negative relationship between current investment and cash flow volatility for financially constrained firms, in contrast to unconstrained firms, that can carry out all their positive net present value investment projects. The estimated coefficient is higher than that found in Han and Qiu (2007) for constrained firms, which does not necessarily reflect a more restricted access to external finance for (constrained) European firms than for US ones, but could rather be the result of the existing differences in the sample composition used in both studies [in the sample used here small and unlisted firms prevail, while the analysis in Han and Qiu (2007) is based on a sample of listed firms)].

Likewise, as expected, the cash holding ratio depends negatively on the opportunity cost of holding cash. For all size classes, this variable is found to be the one exerting the highest impact on firms' cash holding ratio, but this sensitivity seems to vary significantly across size groups, being higher for larger firms. More specifically, the estimated coefficient for large companies is more than twice as high as that estimated for smaller companies (that estimated for medium-sized companies lies in the middle, although it is somewhat closer to the one found for the smallest firms). This result could be driven by the possibly lower need of large companies to save cash for precautionary reasons.

As for leverage, a negative coefficient is estimated for all size groups. However, it is found to be significant only for smaller firms; the magnitude of the estimated coefficient is similar for small and medium firms, but for this latter group the coefficient is rather imprecisely estimated and hence not significant. In contrast, the estimated coefficient for large firms is close to zero. Similarly, the estimated coefficient for the ratio of tangible assets to total assets is larger for SMEs, and only significant for these companies. This might be signalling that the access to external finance for smaller firms is more strongly linked to collateral availability than for large firms, in line with the evidence found in Coluzzi, Ferrando and Martínez-Carrascal (2008). Finally, firms holding higher levels of assets that can be considered as cash substitutes (higher net working capital) hold less cash. The link is stronger for larger companies, while for small companies the coefficient is much smaller than for large firms and falls short of significance.

Overall, these results indicate that there are significant differences in firms' cash holding policies across size groups; the cash holdings of larger firms tend to respond more to the spread between the return on cash holdings and that on alternative uses of these funds, while for smaller firms cash holding policies seem to be more conditioned by their cash flow and its volatility and the share of tangible assets in their balance sheets, potentially as a result of their more limited access to external finance. Also leverage seems to condition more

importantly cash holdings of smaller firms. The difference between the estimated coefficients for large and small firms is statistically significant at conventional significance levels for all the regressors, except the second lag of the cash holding ratio and leverage (see the last column of Table 2).

5 Conclusions

This paper investigates the empirical determinants of corporate cash holdings in the euro area as a function of firm size. It supplements previous analysis on the impact of financing constraints on cash holdings policies, which has been mainly based on US firms and on the analysis of the link between cash holdings and cash flows and their variation. For the euro area, only Pál and Ferrando (2010) have addressed this issue previously, focussing on the analysis of liquid asset saving policies (or cash holding *changes)* and, specifically, on the link between cash holdings and cash flow. Instead, the analysis presented here looks at the differences in the link between cash holding *levels* and their determinants for firms of different size; not only the impact of cash flow on cash holdings is analysed but also that of other variables such as cash flow variability and the collateral available, which are also linked to the access to external finance and hence may also affect cash policies. The prevalence of small firms in the database used for the analysis is also an important difference with respect to previous papers in this literature, which have based their analysis on listed or (mainly) large firms.

The descriptive and econometric evidence set out in this paper indicates that cash policies differ significantly across firms of different size, something that could be linked to differences in their access to external finance. The cash holdings of smaller firms seem to be more conditioned by precautionary reasons than those of large firms, since the cash holding ratios of smaller firms respond more to cash flow variability; likewise, the cash holdings of smaller firms are more strongly linked to cash flow than those of large firms, which may reflect the fact that the cash holdings of smaller firms are more affected by growth opportunities than those of large firms, but also a genuinely higher impact of cash flow on cash holdings. This could suggest that the investment decisions of smaller firms might be suboptimal due to their more restricted access to external finance, which forces them to hold more liquid assets, in response to higher cash flow variability (and, potentially, also when they have more growth opportunities), than larger firms do. Likewise, the negative link between cash holdings and tangible assets, which can be used as collateral when asking for a loan and hence give easier access to external finance, is stronger for SMEs. In contrast, cash holdings for larger firms, with better access to capital markets, might be less influenced by precautionary reasons and this might explain why their cash policies are more sensitive to variations in the opportunity cost of holding cash (the spread between the return on liquid assets and that on alternative uses of these funds, such as debt repayment). Finally, the level of short-term assets other than cash seems to be more strongly linked to cash holding ratios for larger than for smaller firms, while leverage seems to be a more important factor in the determination of the cash holdings of smaller firms.

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TABLES

Table 1. Descriptive statistics

	Large firms			Medium firms			Small firms		
	Mean	Median	Std Dev	Mean	Median	Std Dev	Mean	Median	Std Dev
Cash	0.074	0.033	0.105	0.084	0.041	0.109	0.139	0.084	0.153
CF	0.081	0.075	0.086	0.077	0.067	0.079	0.085	0.071	0.090
CFV	1.054	0.349	2.863	0.947	0.358	2.585	1.042	0.428	2.615
NWC	0.342	0.340	0.216	0.371	0.375	0.209	0.417	0.413	0.264
TA	0.252	0.198	0.214	0.218	0.170	0.185	0.205	0.144	0.193
L	0.691	0.709	0.213	0.692	0.719	0.208	0.692	0.709	0.242

Note : Cash is the ratio of cash and cash equivalents divided by total assets, CF is the cash flow to total assets ratio, CV is the cash flow volatility, defined as the coefficient of variation of firms' cash flow over the past five years, NWC is the net working capital (short tem assets minus cash and its equivalents divided by total assets), TA is the ratio of tangible assets to total assets, L is the leverage ratio (debt divided by assets).

Table 2. Cash holding determinants. Estimation results

	Large firms		Medium firms		Small firms		Statistical difference: small vs.
	coefficient	std error	coefficient	std error	coefficient	std error	p-value
$Cash_{it-1}$	0.624	0.048	0.570	0.109	0.809	0.095	0.04
$Cash_{it-2}$	0.087	0.020	0.188	0.090	0.025	0.080	0.77
CF_{it}	0.082	0.049	0.183	0.066	0.235	0.051	0.02
Spread	-0.844	0.238	-0.455	0.230	-0.375	0.179	0.02
CFV_{it}	0.001	0.001	0.002	0.001	0.003	0.001	0.05
NWC_{it-1}	-0.069	0.041	-0.041	0.025	-0.012	0.008	0.09
(TA/A)it-1	0.009	0.030	-0.049	0.025	-0.046	0.015	0.03
L_{it-1}	-0.008	0.016	-0.012	0.016	-0.013	0.008	0.39
M_1	0.00		0.00		0.00		
M_2	0.11		0.46		0.16		
Sargan	0.39		0.11		0.16		
Number of firms	3382		11255		69459		
Number of observations	21477		71853		421200		

Note: All equations include time and sectoral dummies. Estimated coefficients and asymptotic robust standard errors reported. Estimation by GMM-SYSTEM estimator using the robust one step method (Blundell and Bond,1998; Arellano and Bond, 1998).Sargan is a Sargan Test of over-identifying restrictions (p-value reported).Mj is a test of jth-order serial correlation in the first differenced residuals (p-values reported). Instruments: in first-differences equation, following lagged values of the regressors: Large firms: Cash (t-2, t-3),CF (t-2, t-3)CFV(t-3 to t-5), TA (t-4,t-5); Medium firms: Cash (t-5),CF (t-5) CFV (t-4 to t-6), NWC (t-5,t-6) TA (t-5, t-6),L (t-5);Small firms: Cash (t-6),CFV(t-4 to t-6),TA (t-5). In levels equations, first differences of the regressors dated as follows: Large firms: Cash (t-4), CF (t-4),NWC (t-5), TA (t-5), L (t-1); Medium firms: Cash (t-4), CF (t-4),NWC (t-4),TA (t-3),L (t-3);Small firms: Cash (t-4),CF (t-4),NWC (t-4), TA (t-5), L (t-3)*,**,*** indicate significance at 10%, 5% and 1% significance level, respectively. Last column shows the p-value associated with the null hypothesis that the corresponding coefficient is statistically different for small and large firms.

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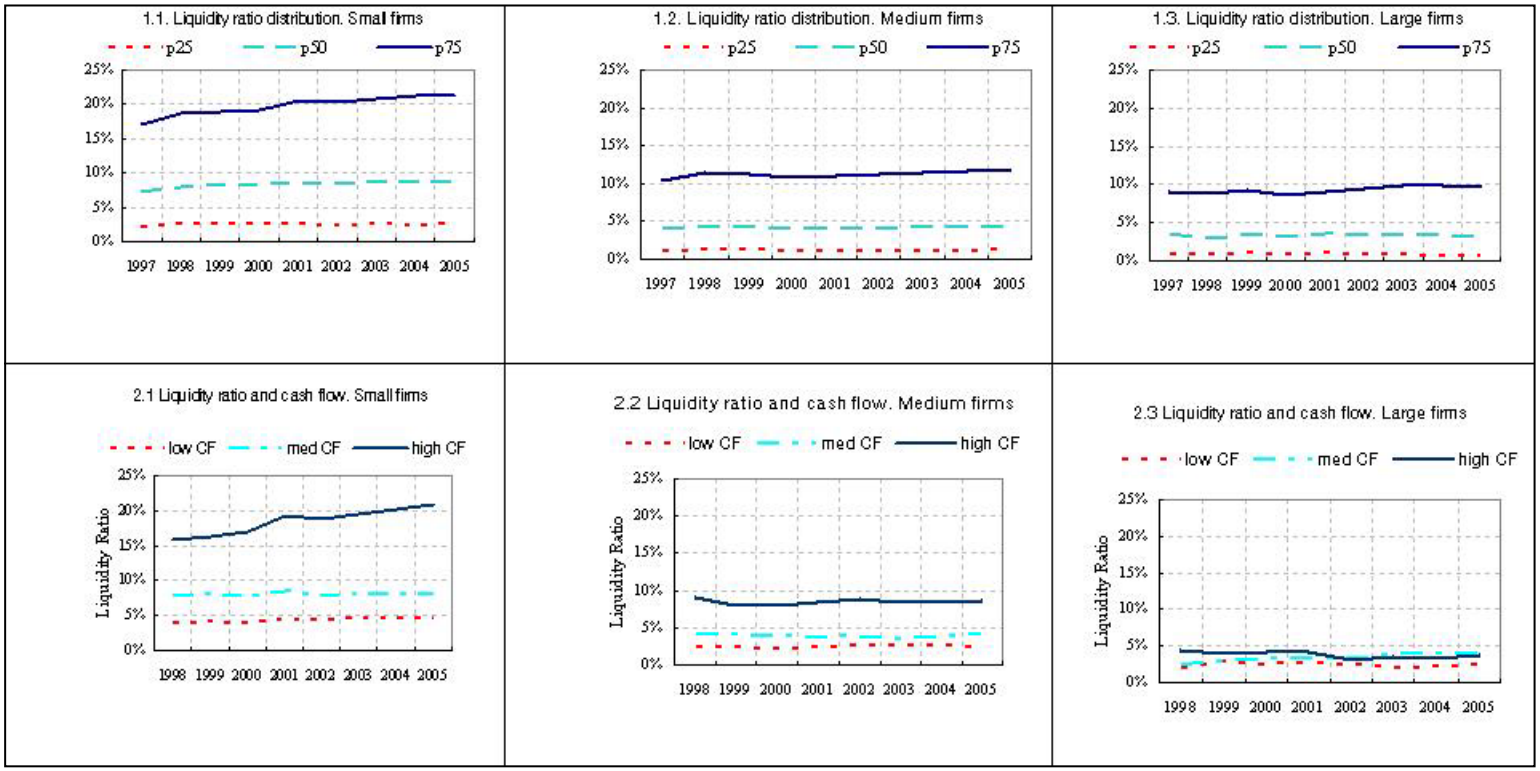
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1.3. Liquidity ratio distribution. Large firms
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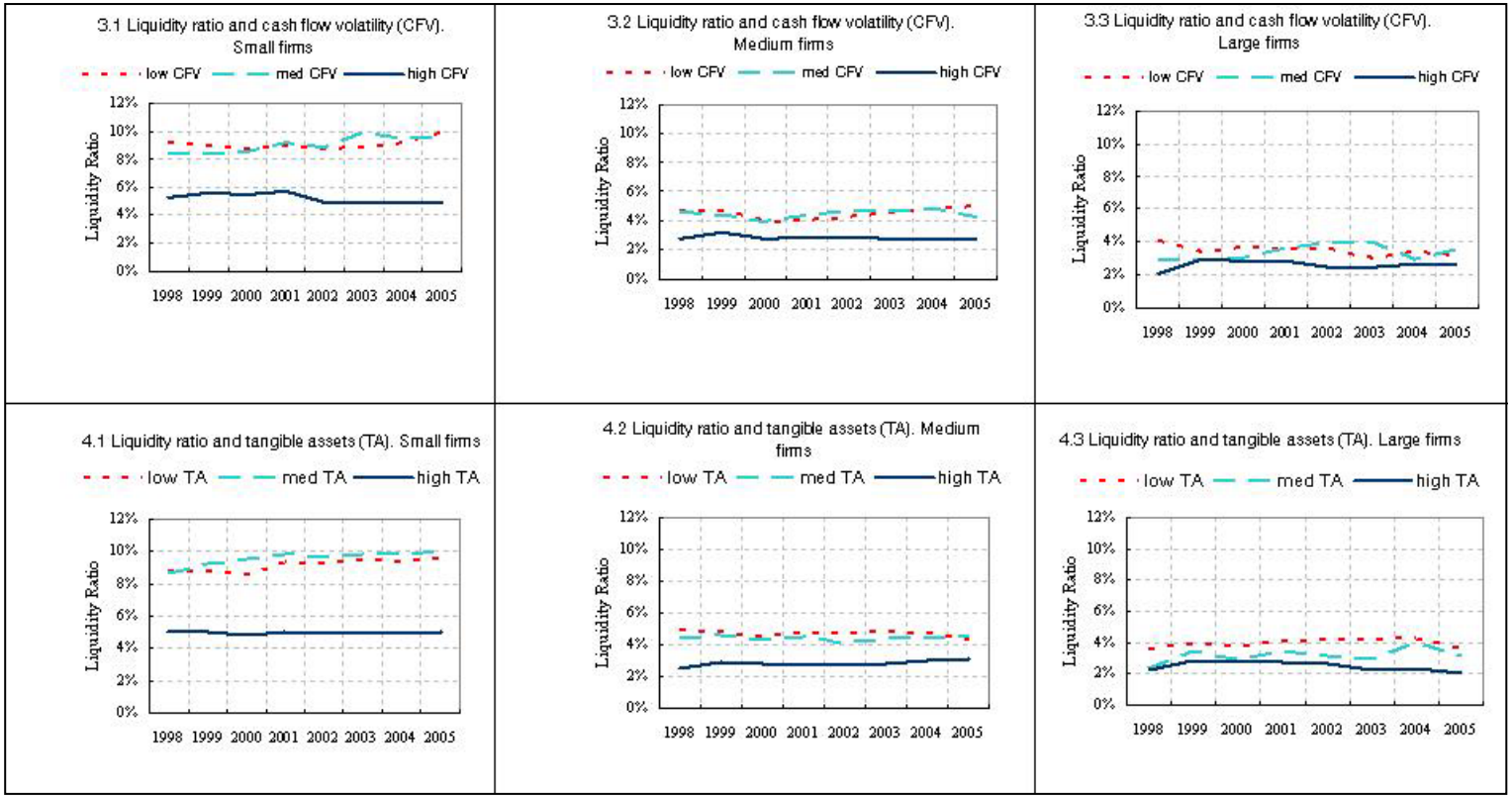
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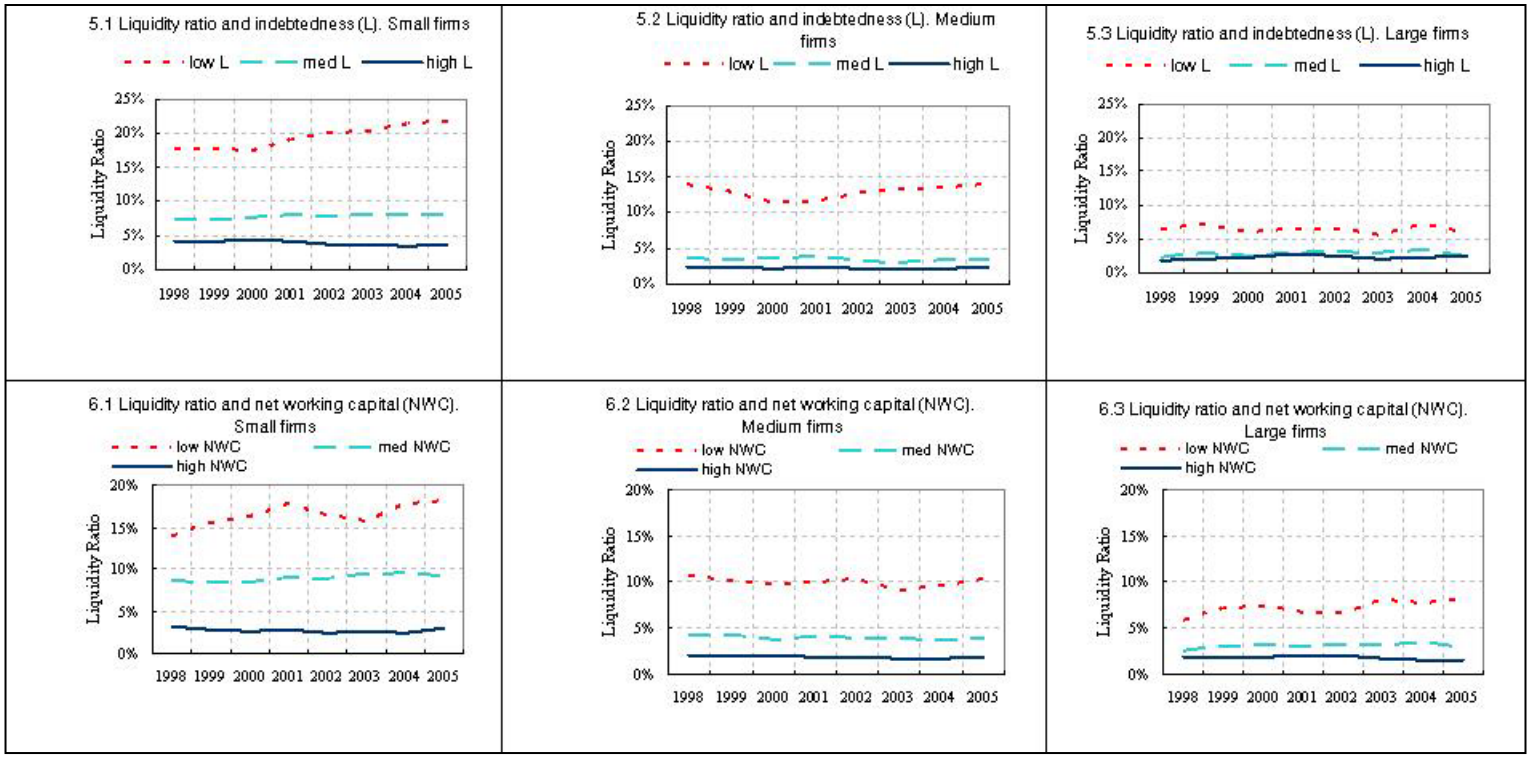
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6.1 Liquidity ratio and net working capital (NWC). Small firms
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6.3 Liquidity ratio and net working capital (NWC). Large firms
low NWC
med NWC
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Liquidity Ratio
20%
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APPENDIX

Table A1. Cash holding determinants. Estimation results with common instruments for all size classes

	Large firms		Medium firms		Small firms		Statistical difference: small vs. large
	coefficient	std error	coefficient	std error	coefficient	std error	p-value
$Cash_{it-1}$	0.616	0.051	0.553	0.107	0.809	0.095	0.20
$Cash_{it-2}$	0.086	0.020	0.197	0.088	0.025	0.080	0.08
CF_{it}	0.097	0.091	0.171	0.066	0.235	0.051	0.04
Spread	-0.890	0.271	-0.483	0.227	-0.375	0.179	0.00
CFV_{it}	0.001	0.001	0.002	0.001	0.003	0.001	0.08
NWC_{it-1}	-0.073	0.044	-0.046	0.024	-0.012	0.008	0.18
(TA/A)it-1	-0.020	0.035	-0.053	0.025	-0.046	0.015	0.07
L_{it-1}	-0.005	0.021	-0.015	0.016	-0.013	0.008	0.05
M_1	0.00		0.00		0.00		
M_2	0.11		0.39		0.04		
Sargan	0.39		0.09		0.00		
Number of firms	3382		11255		69459		
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Note: All equations include time and sectoral dummies. Estimated coefficients and asymptotic robust standard errors reported. Estimation by GMM-SYSTEM estimator using the robust one-step method (Blundell andBond,1998;Arellano andBond,1998).Sargan is a Sargan Test of over-identifying restrictions (p-value reported).Mj is a test of jth-order serial correlation in the first-differenced residuals (p-values reported). Instruments: in first-differences equation, following lagged values of the regressors: Cash (t-5), CF (t-5) CFV (t-4 to t-6), NWC (t-5,t-6) TA (t-5, t-6), L (t-5). In levels equations, first differences of the regressors dated as follows: Cash (t-4), CF (t-4), NWC (t-3), TA (t-3), L (t-3); *,**,*** indicate significance at 10%, 5% and 1% significance level, respectively. Last column shows the p-value associated with the null hypothesis that the corresponding coefficient is statistically different for small and large firms.

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