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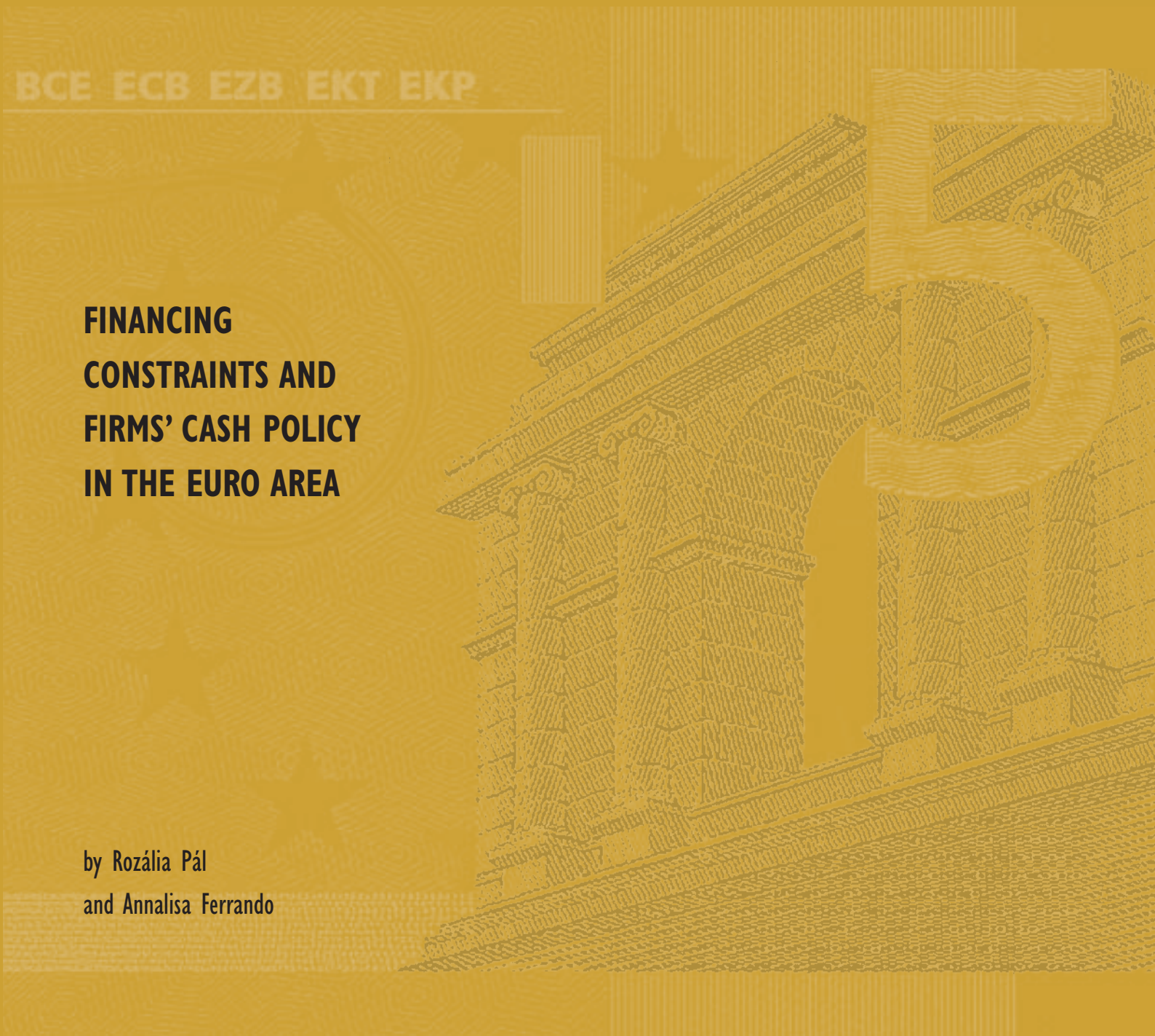

FINANCING CONSTRAINTS AND FIRMS' CASH POLICY IN THE EURO AREA

by Rozália Pál
and Annalisa Ferrando

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by Rozália Pál [2]
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In 2006 all ECB publications will feature a motif taken from the €5 banknote.

This paper can be downloaded without charge from http://www.ecb.int or from the Social Science Research Network electronic library at http://ssrn.com/abstract_id=907310

1 The paper draws from a project on financing constraints in the euro area, conducted while Rozália Pál was visiting the ECB. Previous versions of this paper were presented at the International Conference on Finance in Copenhagen, the Doctoral Student Seminar of FMA European Conference in Siena and FMA Annual Meeting in Chicago. The authors would like to thank Martin T. Bohl, Francesco Drudi, Michael Lemmon, Maria-Teresa Marchica, Adrian van Rixtel, Philip Vermeulen and Ralph Walkling, for providing useful comments at various stages of the project and Lucas Carbonaro for assistance with the data. The opinions expressed are those of the authors and do not necessarily reflect those of the ECB.

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Abstract

This paper investigates the financing conditions of non-financial corporations in the euro area. We develop a new firm classification based on micro data by distinguishing between three groups of firms: unconstrained, relatively and absolutely constrained firms. We also provide further evidence on the sources of the correlation between corporate cash flow and cash savings by conducting the analysis in a dynamic framework. Contrary to previous evidence based mainly on US firms, our results suggest that the propensity to save cash out of cash flows is significantly positive regardless of firms' financing conditions. This implies that even for firms with favourable external financing conditions, the internal cash flow is used in a systematic pattern for the inter-temporal allocation of capital. The results also indicate that the cash flow sensitivity of cash holdings cannot be used for testing financing constraints of euro area firms.

Keywords: financing conditions, cash policy decisions

JEL-Classification: D92, G3, G32

Non–technical summary

This paper investigates the financing conditions of non-financial corporations in the euro area. The effect of financing conditions on corporate behaviour is quite important since investment decisions are determined not only by the profitability of the project, but also by the availability and costs of external financing. The amount of external sources may be limited or may not even exist and, in this latter case, the amount of investment cannot exceed the internal sources. In the literature there has been an extensive discussion on how to find evidence for the presence of financing constraints. Many empirical studies have focused on the magnitude of the sensitivity of investment or firms' growth to internal sources: the higher the sensitivity the stronger the severity of financing constraints. This approach has been criticized because the investment-cash flow sensitivity has been found to be non-monotonic and therefore a higher sensitivity cannot be interpreted as evidence for the presence of higher financing constraints. Having these caveats in mind, another more recent strand of the literature has considered instead the cash flow sensitivity of cash holdings. In this paper, we follow this latter strand by investigating whether the cash flow sensitivity of cash holdings can be used for testing financing constraints of euro area firms.

Generally speaking, the literature on financing conditions suggests that the sensitivity results depend crucially on the a-priori criteria used to identify whether a firm experiences financing constraints or not. After having reviewed the pros and cons of various classification schemes used in the literature, we develop a new firm classification based on the interrelation of several financial variables derived from balance sheet and profit and loss accounts. We distinguish three groups of firms: unconstrained, relatively and absolutely constrained firms. Absolutely constrained firms are those that cannot get external finance, relatively constrained are those that can access

only expensive external sources and unconstrained firms are those that get external finance and pay, on average, the lowest financing costs available on the market. Based on this classification, we find that financially constrained firms invest at a lower rate and grow more slowly. They also hold relatively higher cash positions that grow substantially also under depressed economic conditions, confirming the precautionary cost hypotheses of holding cash. The significant long-term debt sensitivity of unconstrained firms indicates that cash savings are used for inter-temporal allocation of both internal and external sources of funds. Firms can decide to allocate the obtained long-term credit over time and not to invest the entire available amount in the first year. We also find that the distribution of financially constrained firms does not depend on the firm's size or its listing at a stock exchange.

In the paper we provide further evidence on the sources of the correlation between corporate cash flow and cash savings by conducting the analysis in a dynamic framework. Contrary to previous evidence based mainly on US firms, our results suggest that the propensity to save cash out of cash flows is significantly positive regardless of firms' financing conditions. This implies that even for firms with favourable external financing conditions, the internal cash flow is used in a systematic pattern for inter-temporal allocation of capital. The level of sensitivity is affected, apart from the precautionary savings, by future investment opportunities captured partly by the cash flow variable. Hence, the high and significant sensitivity of unconstrained firms simply reflects the high growth opportunities of this group of firms. While constrained firms save cash to hedge the fluctuations in their cash flow, unconstrained firms may save to boost future investments. The results indicate that the significance of the cash flow sensitivity of cash savings does not provide reliable evidence to distinguish euro area firms experiencing different financing conditions.

1 Introduction

The effect of financing conditions on corporate behaviour has been extensively investigated in the finance literature. The theoretical model of Myers and Majful (1984) shows that firms may give up valuable investment opportunities when internal sources of funds are not sufficient (see also Myers (1984)). Opposite to the perfect market environment of Modigliani and Miller (1958)[1], in the real world firms take investment decisions not only looking at the profitability of the project, but also on the basis of the availability and costs of external financing. The amount of external sources may be limited or may not even exist and, in extreme cases, the amount of investment may even be limited by the availability of internal sources. Consequently, many empirical studies argue that the fluctuation of internal sources helps to explain the investment decisions of companies. More specific, the higher sensitivity of investment or firms' growth to internal sources was taken as evidence for the presence of financing constraints (see for instance Fazzari et al. (1988), (2000) and Carpenter and Petersen (2002)). However, after the contradicting results presented by Kaplan and Zingales (1997) and (2000), several studies have criticised the empirical test based on the cash flow sensitivity. One of the arguments has been that the investment-cash flow sensitivity is non-monotonic and therefore a higher sensitivity cannot be interpreted as evidence for the presence of higher financing constraints. Even financially successful firms may rely on internal sources of financing because of factors not related to the unavailability of low cost external funds and consequently they may exhibit high investment-cash flow sensitivity. Additional critiques have been put forward by Ericson and Whited (2000), Alti (2003) and

[1] In a perfect market environment, investment decisions are taken exclusively on the basis of the expected profitability of the investment project.

Bond et al. (2004), all arguing that the cash flow already contains information about a firm's investment opportunities. The significance of the cash flow sensitivity of investment may then provide additional information on expected profitability rather than on the severity of the financing constraints.

Having these caveats in mind, we search for an alternative way of testing the presence of financing constraints. We follow the methodology of Almeida, Campello, and Weisbach (2004, hereafter ACW) that focuses on the analysis of the cash flow sensitivity of cash holdings. ACW argue that their approach overcomes the problem of the previous literature in the sense that the predictions of the model for financially unconstrained firms are not influenced by the future investment opportunities. In particular, in their theoretical model the unconstrained firms' change in cash holdings should depend neither on current cash flows nor on future investments opportunities. Therefore, the liquidity demand of unconstrained firms is indeterminate and this can constitute the basis for empirical predictions to be tested. However, it is important to notice that their model is not able to test the degree of the financing constraints, as it is recognised by the authors themselves.[2]

In this paper, we implicitly investigate the usefulness of the measure of financial constraints proposed by the ACW model for a sample of euro area firms. First, we identify groups of firms experiencing different financing conditions. Then we look for the firms with the best financing conditions and check whether the liquidity demand test is able to distinguish them from the rest of the sample. Hence, we challenge the link between the outcome of the ACW theoretical model and the empirical test hypothesis. Our approach is similar

[2]Formulated as follows: "... The reason why the degree of financial constraints does not affect cash levels is that varying the degree of constraints affects both benefits and the costs of holding cash in an offsetting manner, so a relatively more constrained firm will not necessarily save any more or less cash than a less constrained one." See ACW, p. 1785-1786.

to the investigation conducted by Kaplan and Zingales (1997). By selecting firms under different financing conditions, we give a higher importance to the "a-priori classification" of firms according to their respective degree of financing constraints. In the second stage of our investigation, we check the determinants of the liquidity demand under alternative financing conditions. While Kaplan and Zingales (1997) use information from the firms' management reports and financial statements for the a-priori classification, we define different scenarios by combining the information on the financing gap and on the firms' reliance on external capital. Based on this information, we distinguish absolutely constrained, relatively constrained and unconstrained firms.

Our approach, similar to the Kaplan and Zingales investigation, is subject to the criticism that endogenous variables are used for the classification. The variables used in our classification can be affected by the same factors that determine firms to be constrained. This could influence the empirical results in sense that only those firms that we defined a-priori as constrained should assign a positive cash flow sensitivity, if the empirical test hypothesis is properly defined. An additional problem, resulting from the endogeneous character of the variables and present in the financing constraints literature in general, is that variables are determined by more than one factor. For example, lower investments could be the result of unavailable external financing sources but also of worse investment opportunities. We try to reduce such problems by combining several financial variables for three consecutive years. For example, if a firm has a financing gap (i.e. total investment is higher than its cash flow) but decreased its leverage for three consecutive years, it hardly could be the case that this firm does not need external financing because of the lack of profitable projects. Neither can it be argued that this firm has decided to reimburse credit because it has a surplus left after covering the financing costs of all profitable projects with its retained earnings. Therefore,

we consider such a firm as absolutely constrained since it is most probably unable to get new external financing and therefore it is forced to allocate its cash flow to the reimbursement of its debt. In the regression analysis, the endogeneity problem is controlled with the help of the instrumental variables estimation and system GMM estimation.

Following the ACW theoretical model, we define a-priori as unconstrained those firms that are able to get new external financing or their internal funds is sufficient for all their investments. The ACW theoretical model assumes that unconstrained firms can always invest under their first best level and that there is no use and no costs of holding cash. However, such perfect market conditions are hard to achieve in reality. Even firms under the best financing conditions operate in an imperfect market environment and, just as predicted by the theoretical model in the constrained case, the sensitivity is positively determined by the future investment opportunities. We also find that constrained firms hold higher cash reserves than other firms, consistent with the precautionary motive of holding cash. Despite of the differences in the cash level, all firms in our sample exhibit significantly positive cash flow sensitivity and have a mean reverting cash balance, regardless of their financing conditions.

Our results suggest that all firms save cash out of their cash flow in a systematic way, since they operate under market imperfections where liquidity is relevant for the intertemporal allocation of capital. This is in line with the transaction cost motive of holding cash. The fixed costs induce firms to raise external funds infrequently and to use cash holdings as a buffer. Hence, regardless of the financing constraints, there is an optimal amount of cash holdings. In the theoretical model proposed by ACW, unconstrained firms are defined as firms operating in perfect market conditions where liquidity reserves just as financing decisions becomes irrelevant. The explanation of our findings is that none of the firms in

our sample operates in such perfect market environment and that not even firms with the best financing conditions can be considered "unconstrained" based on the definition used by the theoretical ACW model. The sensitivity measure is positively related to growth opportunities captured by the cash flow variable and is not influenced by the degree of financing constraints. Consequently, we conclude that the empirical model proposed by ACW cannot be used as a test of the financing conditions of euro area firms, since it cannot be interpreted in the light of the corresponding theoretical model.

Our study also contributes to the empirical cash holdings literature that focuses mostly on the determinants and implications for firms of holding cash (see for instance Opler, Pinkowitz, Stulz and Williamson, 1999, and Ferreira and Vilela, 2004). We try to capture the importance of variables on the changes in cash holdings under different financing conditions. While the ACW model takes into consideration only the effect of short-term debt on cash savings, we investigate the effect of several types of external sources, i.e. trade credit, short-term debt and long-term debt. Complementary to the ACW's instrumental variables approach, we develop a system GMM model (see Arellano and Bond (1991) and Blundell and Bond (1998)), which controls for biases due to unobserved firm-specific effects and endogenous variables through the lagged values of the variables taken as instruments. The system GMM model checks also the mean reverting pattern of cash savings, which could suggest a desired level of cash positions.

The remainder of the paper is organized as follows. Section II describes the data sources and sample characteristics. Section III presents the cash flow sensitivity of cash based on the ACW methodology. Section IV describes the new scheme to identify the financially constrained firms. It also investigates the relationship between financial constraints and firms' cash policy. The final section concludes.

2 Data description

Our analysis is based on a sample of non-financial corporations in the euro area. Data on balance sheets as well as profit and loss statements are collected from the AMADEUS database of Bureau van Dijk. We select firms that provide consolidated balance sheets for the period 1994-2003. Furthermore, we select only firms which provide data on the variables used in our classification criteria for at least three consecutive years. After having applied some quality checks the final sample consists of 2,190 firms with a total of 10,927 observations (see the appendix for some descriptive statistics). However, the number of observations in the regression analysis is reduced to 8,737, when we include in the model the second lagged values of some variables.

We take into consideration the inter-group relationships specific to European companies by using consolidated accounts.[3] It is important to mention that for a huge number of European firms, especially for small firms, only unconsolidated balance sheets are available. We are aware of the limitation of our sample coverage in terms of firm size, which may introduce some selection bias (see the appendix for more information on the sample composition).

3 ACW's cash flow sensitivity of cash; the case of euro area firms

ACW propose a theoretical model of corporate demand for liquid assets where firms are concerned about present and future investments. The authors show that firms that have

[3]For example, the different ways how the assets of an affiliate are considered could change totally the capital structure of the company. Companies with unconsolidated balance sheets report a subsidiary firm's net assets as equity (a long-term investment). As a result, they present lower equity ratios and higher leverage than in case of consolidated accounts.

limitations regarding their capacity to raise external finance hedge their future cash flow by saving cash. They derive that, in the presence of asymmetric information, cash holdings are increasing if future investment opportunities are more profitable relative to current ones:

$$\frac{\partial C^*}{\partial c_0} = \frac{f''(I_0)}{f''(I_0) + g''(I_1)}, \tag{1}$$

where C^* is the optimal cash policy, c_0 is the current cash flow of existing assets, $f(I_0)$ and $g(I_1)$ define the cash flow from the current and future investment respectively.

$$f(I_0) \equiv F(I_0) + qI_0, \tag{2}$$

$$g(I_1) \equiv G(I_1) + qI_1, \tag{3}$$

where $F(I_0)$ and $G(I_0)$ define the production functions, that are increasing, concave and continuously differentiable. q is the pay-off rate of investment liquidation and the investment levels I_0 and I_1 are less than their first best level because of financial constraints.

Moreover, they argue that the financially unconstrained firms' value is not affected by their financial policy and there is no systematic relationship between changes in cash holdings and their current cash flows. The testable empirical implication of the "irrelevance of liquidity" suggested by the authors is that the cash flow sensitivity of cash holdings is not significantly different from zero. They also mention that the level of cash flow sensitivity of cash holdings for constrained firms does not quantify the degree of financial constraints and that it is more related to investment opportunities (see equation(1)).

In this section, we test the empirical predictions of the ACW theoretical model for our sample of euro-area firms. For the sake of comparison, we use similar a-priori classifications

to those proposed by the ACW model to group firms with similar characteristics. We use firms' average real asset size over the sample period to rank them and we define as small (large) firms those on the bottom (top) three deciles of the size distribution. However, we are aware of the sample selection bias which is due to the use of consolidated balance sheets. Accordingly, in addition to asset size, we also use the size classification adopted by the European Commission Standards. Firms are considered small- and medium-sized enterprises (SME) if they satisfy two out of the following three conditions: 1) number of employees is equal or less than 250, 2) maximum turnover of 407 million euro and 3) maximum balance sheet total of 275 million euro. Since the payout ratio and bond and commercial paper ratings are not always available for unlisted firms, we use quotation as an alternative classification criterion to proxy rating. Firms listed at the stock exchange need to satisfy certain listing requirements, dispose a higher solvability and consequently should have more easy access to external finance from both financial institutions and markets.

The change in cash holdings is modelled as a function of a number of sources and uses of funds:

$$\begin{aligned}\frac{\Delta CH_{i,t}}{TA_{i,t-1}} &= \alpha_0 + \alpha_1 \frac{CF_{i,t}}{TA_{i,t-1}} + \alpha_2 \Delta logS_{i,t} + \alpha_3 \Delta logS_{i,t-1} + \alpha_4 \frac{\Delta TFA_{i,t} + Depr_{i,t}}{TA_{i,t-1}} \\ &+\alpha_5 \frac{\Delta IFA_{i,t}}{TA_{i,t-1}} + \alpha_6 \frac{\Delta FFA_{i,t}}{TA_{i,t-1}} + \alpha_7 \frac{\Delta NWC_{i,t}}{TA_{i,t-1}} + \alpha_8 \frac{\Delta STD_{i,t}}{TA_{i,t-1}} + \alpha_9 \log TA_{i,t} \\ &+\lambda_i + \mu_t + \nu_{i,t} \end{aligned} \quad (4)$$

where the dependent variable is the annual change in cash and marketable securities ($\Delta CH_{i,t}$) scaled by the amount of total assets at the beginning of the year ($TA_{i,t-1}$). Cash flow ($CF_{i,t}$) is defined as the earnings before extraordinary items plus depreciation. The amount of sales is a proxy for output and $\Delta \log S_{i,t}$ as well as $\Delta \log S_{i,t-1}$ are the first differences of the natural logarithm of sales. $\Delta TFA_{i,t}$, $\Delta IFA_{i,t}$ and $\Delta FFA_{i,t}$ represent the

changes in tangible, intangible and financial fixed assets respectively as a proxy for investment. The depreciation expenditures, denoted by $Depr_{i,t}$, are also taken in consideration in the tangible investments.[4] $\Delta NWC_{i,t}$ denotes the change in non-cash net working capital and is calculated as the annual change in inventory stocks and debtors (trade receivables) minus the change in trade credit (trade payables). $\Delta STD_{i,t}$ represents the annual change in short-term debt. All these variables are scaled by the beginning of the year total assets. The natural logarithm of total assets ($\log TA_{i,t}$), is a proxy for size. λ_i and μ_t are the parameters of the firm- and year-fixed effects and $\nu_{i,t}$ represents the error term.

Table 1, Panel A, describes the main variables used in the regression estimation of equation (4). The median firm has a yearly increase in cash holdings equal to 0.1% of total assets, a cash flow of 8.6% of total assets and a sales growth of 6.7%. From the set of fixed investment variables, the investment in tangible assets is the highest, representing 6% of the total assets. Investment in intangible and financial fixed assets is lower than 1%. The annual growth of net working capital represents on average 2.3% of total assets. Means and medians do not differ significantly which suggests that the coefficient estimates of the regression is not influenced by the presence of outliers.

Table 1 about here

The main hypothesis to be tested through equation (4) is that small, unquoted firms face worse financing conditions relative to large, quoted firms. The empirical implication of this test hypothesis proposed by ACW is based on the cash flow sensitivity measures under alternative financing conditions. The hypothesis would be accepted if we find a significant positive sensitivity for this group of firms and an insignificant sensitivity for large, quoted firms. Expected profitability is controlled by current and past sales growth (see Manigart et

[4]These variables correspond to the investment expenditures and acquisitions used by ACW.

al. (2002) and Bond et al. (2004)).[5] We expect an increase in cash holdings whenever the expected profitability of future investments is higher. As a proxy for investments changes in tangible, intangible and financial assets plus depreciation are used. Firms can draw down on cash reserves in a given year in order to invest and we expect the estimates of α_4, α_5 and α_6 to be negative. The changes in net working capital and in short-term debt are included because they can be substitutes for cash and consequently we expect a negative relation to cash holdings' changes. Based on the predictions of economies of scale in cash management, it is usually assumed that bigger firms hold relatively less ready available cash, so we expect a negative coefficient estimate for the size variable (α_9).

We test the presence of endogeneity using the Hausman test, which is based on the difference between the OLS and the instrumental variables estimators. The null hypothesis can be rejected at the 1% significance level, which suggests that endogeneity should be controlled for. The set of instruments used in the regression are the first and second lags of tangible fixed assets, the lagged intangible assets, the lagged financial assets, lagged net working capital, lagged short-term debt and the lagged sales. Being aware of the existence of country specificities in using data for firms located in various countries, we use country dummies as instruments. Time and industry dummies are also included as additional instruments. We control for the unobserved individual heterogeneity by firm-fixed effects.

Table 2 presents the results of the regression. The first two columns present the estimates for small and large firms based on their total assets. Alternatively, columns three and four present the estimates for the small- and medium-sized enterprises (SME) and large enterprises (LE), classified on the basis of the European Commission Standards. The last

[5] In ACW's equation, future investment opportunities and expected profitability are captured by Tobin's Q. Since market value cannot be defined for unlisted firms, we use sales growth instead.

two columns report the results for firms that have been selected on the basis of their listing at a stock exchange.

Table 2 about here

The cash flow sensitivity of cash savings (α_1) is significant for all firm-groups of size and quotation (the group of unquoted firms is significant only at 10% level). The highly significant cash flow sensitivity of all firm-groups implies that the hypothesis of relatively worse financing conditions for small, unquoted firms is rejected. Growth opportunities captured by sales growth variables (α_2 and α_3) do not seem to affect liquidity demand. However, this result must be interpreted with caution. Future investment opportunities might be important for cash holding variation, but it could be captured by another variable than sales growth. In particular, the cash flow seems to be a better proxy for growth opportunities. This is line with the ACW findings of the theoretical derivations in the presence of asymmetric information (see equation (1)) suggesting that all firm-groups of size and quotation, to some degree, face market imperfections. The coefficients of the different type of investments (α_4, α_5 and α_6) have the expected negative signs, but they are not significant, except for the estimate for the sample of small firms. The coefficient of net working capital (α_7) in some samples has the expected negative sign and it is significant, implying that it is used as a substitute for cash holdings. Firms' cash savings are positively affected by an increase in short-term leverage (α_8). The coefficient is significant at 10% level for most of the firm-group with the exception of SMEs and unquoted firms. This implies that, for most of the firms, external financing plays an important role in their liquidity management. Contrary to our expectations, we find a positive size effect (α_9) for the small and SMEs sample, indicating a higher growth in cash reserve for larger firms within the samples. One explanation could be that the larger firms in our sample grow in general faster and consequently the increase in the cash holdings is also higher. However, it is more likely that the size proxy captures some

other effects not controlled in the regression. The significant coefficients of the constants of these two samples suggest also that some important variables could be omitted. For the sake of comparison we use in this section the empirical model proposed by ACW, however as a solution for omitted variables we propose in the next section a dynamic model with additional variables.

The significant estimate for the cash flow sensitivity of cash for the sample of large and quoted firms is in contradiction with the American evidence. ACW find insignificant cash flow sensitivity for those US firms that are large, with high pay-out ratios and whose bonds or commercial paper have been rated during the sample period. However, the firms defined as unconstrained using the Kaplan-Zingales (KZ) index (1997) seem to have significant sensitivity.[6] Furthermore, more recent studies bring supporting evidence for the Kaplan and Zingales results. Moyen (2004), for instance, by using a simulated sample of 2000 firms over 10 years, shows that the constrained model produces similar results to those presented by Kaplan and Zingales. Also Cleary (1999) supports the Kaplan and Zingales results for a larger sample of firms and with a classification scheme based on an index of financial constraints. All these results indirectly cast some doubts on the interpretation of the empirical findings of the ACW model.

The estimated significant cash flow sensitivity of large and quoted firms could be interpreted in two ways. First, large and quoted European firms could face the same external

[6]Firms at the bottom (top) three deciles of the KZ index ranking are considered financially unconstrained (constrained), where the index is defined as:

$$\begin{aligned} KZindex &= -1.002 \times Cashflow + 0.283 \times Q + 3.139 \times Leverage - 39.368 \times Dividends \\ &\quad -1.315 \times CashHoldings \end{aligned}$$

financing barriers as small, unquoted firms. Obviously, in this case size and quotation are not the proper classification criteria to investigate the euro-area firms under various financing conditions. Consequently, we would need an alternative methodology to identify firms that most probably face relatively worse/better financing conditions. The second interpretation would be that the empirical test based on the cash flow sensitivity of cash savings is not able to capture the behaviour of firms under different financing conditions. But then, we face the same problem as under the first interpretation, i.e. the lack of a reliable methodology to identify the financing conditions of euro-area firms. As a solution, we provide a purely empirical approach. In the next section, we introduce a more precise a-priori classification of firms by ranking them in three groups based on the relationship between their financing needs and sources of funds (internal and external).

In the subsequent section (section 4.2), we check the validity of the first interpretation, i.e. the financing conditions with respect to firms' size and quotation, by classifying firms under different financing conditions and then by looking at the distribution of firms with financing problems according to differences in size and quotation.

We investigate the second interpretation in more details in section 4.3. As can be seen from equation (1), the degree of financial constraints does not affect the level of the sensitivity. A relatively more constrained firm will not necessarily save more cash than a less constrained one. However, the proposed model should be able to detect the unconstrained firms based on the prediction that cash flow sensitivity of cash is not significantly different from zero for unconstrained firms. Hence, we look for firms with the best financing conditions in our sample and check whether the liquidity demand test is able to distinguish them from the rest of the sample. In addition, we provide an explanation for the sources of correlation between cash flow and cash savings other than the financing condition of the firm and investigate other determinants of the cash holdings.

4 Financial constraints and the cash policy

In this section a new classification scheme of financing conditions is described and an in-depth analysis of the determinants of corporate cash policy is presented. With the help of this methodology we can answer the two main questions. First, whether the small, unquoted firms face relatively worse financing conditions relative to large, quoted firms and second, whether firms with the best financing conditions can afford to have an irrelevant cash policy as suggested by ACW.

4.1 Classification scheme

The literature on financing conditions suggests that sensitivity results depend crucially on the a-priori criteria used to identify whether a firm experiences financing constraints or not. For instance, Fazzari et al. (1988) and subsequent studies (for a literature overview see Schiantarelli (1995) and Hubbard (1998)) define a-priori four groups of firms based on the dividend payout ratio relying on the assumption that firms with lower payout ratio are more financially constrained. However, Kaplan and Zingales (1997, 2000) questioned the interpretation of the empirical results based on the Fazzari et al. classification scheme. They classified firms based on the availability and demand for funds using information from managers' report and financial accounts and they find regression results that contradict the previous literature. Moyen (2004) also shows that different measures used for the a-priori classification (payout policy, asset size, bond ratings, commercial paper ratings, KZ index) pick up firms with very different characteristics and behaviours. While it is usual to consider

as financially constrained firms that face difficulties in obtaining external finance, there is no clear way described in the empirical literature to identify them.

In this subsection, we introduce a new scheme that can be used to detect the presence of financial constraints. The classification takes into account information derived from balance sheet and profit and loss accounts. As Schiantarelli (1995) argues, one of the weaknesses of the previous literature is that firms are partitioned in groups with different financial status based on a single indicator, which may or may not be a sufficient statistic to assess the existence of financing constraints. Being aware of this shortfall, we try to use all the available information relying on accounting items. Our interpretation is then based on the interrelation of several financial variables within some scenarios. According to these scenarios, we decide whether the firm is relatively more or less financially constrained.

Following Vermeulen (2002), we distinguish absolutely constrained, relatively constrained and unconstrained firms. Absolutely constrained firms are those that cannot get external finance, relatively constrained are those that can access only expensive external sources and unconstrained firms are those that get new debt financing and pay, on average, the lowest financing costs available on the market. We construct our scenarios based on the interrelation of total investment, financing gap, financial debt and issuance of new shares obtained in the given year, and average interest payments on debt relative to interest rates charged in the local credit market. We also use a broader definition of the financing gap than the one defined by Vermeulen (2002).[7] Our definition is more related to the definition of Shyam-Sunder and Myers (1999), considering the net increase in working capital as part of investment. The underlying idea is that if firms face financing gaps, they need to find other sources besides their current cash flow. Firms are considered as unconstrained when they face favourable

[7]Vermeulen (2002) defines the financing gap as the difference between fixed investment and cash flow. However, firms may have to invest also in inventories and accounts receivable.

external financing conditions, i.e. they can increase their leverage whenever it is needed with low financing costs relative to market conditions. We expect that the demand for financial debt decreases as its cost increases. Those firms that can get only expensive credits tend to use less external finance relative to the unconstrained firms and we consider those firms as constrained in relative sense. And finally, we consider constrained in absolute sense those firms that despite of the financing gap do not get any credit or additional capital from the stock market. These firms need to use cash savings from the previous periods or liquidate current assets as additional source of finance. Table 3 summarises the criteria used in the classification.

Table 3 about here

The second column shows the percentage of the firm-years from the total sample of the given category. Total investment is positive in most of the cases. We consider negative investment (decrease in fixed assets) as a sign of constraints since the firm is liquidating (relatively constrained type-4 and absolutely constrained type-2). In this case, we distinguish relatively or absolutely constrained firms based on their relation to external finance (given from the changes in total debt).

The third column reports the financing gap, which is positive in most of the cases indicating that the firms' total investment is higher than the current cash flow. The two exceptions are the unconstrained type-1 and relatively constrained type-1. The first category covers the case when firms invest less than their current cash flow and they do not need external sources. We consider as relatively constrained those firms that invest less than their current cash flow and at the same time reimburse their credit. It is not certain if their investment is constrained by reimbursement or if they do not invest because of the lack of profitable investment opportunities. For the purpose of the study, we have to be rigorous in considering

a firm as unconstrained and whenever there is a sign of possible constraints we define firms as relatively constrained.[8]

In the fourth column, we look at the changes in total debt in order to see whether firms receive external finance whenever there is a need for it (positive total investment and financing gap). Unconstrained type-2 and relatively constrained type-2 firms get financial debt, as external sources. To distinguish these two types of firms, we consider the average interest payment on debt as the cost of credit showed in the last column. Being aware of the existence of country specificities in using data for firms located in various countries, we use as a benchmark the country-specific retail interest rates ($RIR_{c,t}$).

If a firm is not taking external finance despite having a positive financing gap, it is considered as absolutely constrained (absolutely constrained type-1). In case a firm with a positive financing gap does not take credit but still is able to issue shares, such as presented in column five, we consider it relatively constrained (relatively constrained type-3). We implicitly assume that issuing shares is more costly than debt financing because of the presence of asymmetric information, just as suggested by the pecking order theory of Myers (1984).

After having classified each observation (firm-year), we consider a firm as being constrained or not by applying a long-term view. For this, we look at the characteristics for three consecutive years. First, firms are defined as constrained in absolute sense if for three consecutive years they are categorised as absolutely constrained. Second, when firms are categorised as constrained (combination of relatively and absolutely constrained or only relatively constrained firm-years) for three years, then they are considered constrained in

[8]For a robustness check we reproduce the main results of the paper using an alternative classification, where all firms with negative financing gap are considered unconstrained. Results do not change significantly and they are available on request.

relative sense. Third, unconstrained firms are those that are not included in the previous two categories. A firm is considered unconstrained if the financial constraints (absolute or relative) are present for a maximum of two consecutive years only. The final outcome of the classification is presented in Table 4 and the dynamic regression analysis presented in the next subsection is based on this long-term view classification.

Table 4 about here

4.2 Firms' characteristics and financial constraints

We test the equality of the mean values of the different variables across the various firm-groups using a t-test. Summary statistics are presented in Table 5. Based on the t-statistics, there is no significant difference in the mean value of cash flow among the three groups of firms. Hence, profitability cannot be considered as a cause of being constrained. Investments, the second variable, are negatively related to financial constraints. This suggests that firms with similar cash flows invest differently based on the external financing conditions. Since constrained and unconstrained firms are equally profitable and have comparable internal sources (cash flow), unconstrained firms take more credit and invest more.

Table 5 about here

Looking at the third variable presented in Table 5, it is easy to detect a positive relationship between the absence of financial constraints and firms' sales growth. The evidence provided by the existing literature on the US for the constraints-growth relationship is contradictory. Our results are in line with the findings of Cleary (1999), which shows that firms that cut dividends, and therefore are considered as constrained firms, have lower market-to

book ratio and sales growth. Whited and Wu (2004) also show that constrained firms have lower investment and sales growth.[9] Mizen and Vermeulen (2005) analyse European firms and argue that high sales' growth is an indicator of financial health and future profitability that opens up access to external finance. If we take into consideration the endogenous character of this relationship, it can be argued that less constrained firms do not have to give up profitable investment projects because of insufficient funds, so unconstrained firms can grow faster (see Carpenter and Petersen (2002)).

Unconstrained firms, despite of the higher leverage, face lower financing costs. The bankruptcy costs of leverage suggest a positive relationship, in the sense that higher leverage increases the bankruptcy cost and the higher risk should be compensated by higher financing costs. However, reliable firms with less volatile earnings should be able to increase leverage at low costs. The higher leverage of unconstrained firms is in line with the results obtained by Faulkender and Petersen (2003), which show that firms may be rationed by lenders, leading some firms to be under-levered relative to unconstrained firms. Absolutely constrained firms pay a high cost for the credit obtained prior to the period under consideration and this could likely be one of the reasons why they do not take any further credit obligations.[10] The presented patterns of selected variables confirm the validity of our classification.

Figure 1 shows that absolutely constrained firms have the highest percentage of cash savings. This confirms both the precautionary and the transaction cost hypotheses that firms facing difficulties in accessing external finance sources tend to hold higher cash levels over time (see Deloof (2001)), Ferreira and Vilela (2004), Whited and Wu (2004)).

[9]They use for the a-priori classification an index measuring the shadow cost associated with raising new equity, which is the cost of external finance relative to internal finance.

[10]It is worth noticing that in our classification, the cost of credit is not used as a criterion to define absolutely constrained firms.

Figure 1 and Figure 2 about here

It is important to notice that the cash savings of relatively constrained and unconstrained firms are not significantly different. The relatively significant amount of cash savings of unconstrained firms could be explained by the higher sales growth of this group of firms (see Opler et al. (1999)). Another explanation is related to the specific characteristics of the European financial system. The most important external sources of finance for European companies are credits obtained from financial intermediaries instead of capital obtained from the stock market. Taking into consideration the penalty interest rates of delayed repayments, it is more costly for leveraged firms to be short of liquid assets. Additionally, liquidity also could be a criterion to obtain credits, since firms with stable liquidity are usually considered as less risky.

Looking at Figures 1 and 2, we can see the impact of general macroeconomic conditions on firms' behaviour with respect to cash savings and firms' growth. In periods of favourable economic conditions and higher firms' growth (the 1996-2000 period), cash holdings are lower while in periods of higher uncertainty and downturns the proportion of savings to total assets is increasing (after 2000). We can also conclude that absolutely constrained firms' cash flows fluctuate more strongly. These results are in line with the dynamics of liquidity management as a response to macroeconomic shocks in the US such as presented by ACW.

Table 6 shows the distribution of financially constrained firms among samples of different size and quotation. All groups of large, small, quoted and unquoted firms consist of similar percentages of absolutely constrained and relatively constrained firms. A slightly higher percentage of LEs are absolutely constrained compared to SMEs. These figures suggest that

firm size and quotation cannot be used as indicators of financial status of euro-area firms particular to our sample.[11]

Table 6 about here

The results also confirm the previous evidence on the financing conditions of European firms. Mizen and Vermeulen (2005) find also that firm size cannot be used as an indicator of financial status for a sample of German and UK firms. Chatelain et al. (2001) show that only in the case of Italian firms, investment expenditures of SMEs react more to cash flow movements than those of large firms. Similarly, Vermeulen (2002) finds no sign of worse financing conditions for unlisted French and Spanish firms relative to those listed on the market. A possible explanation for similarities across size and quotation groups is given by Mizen and Vermeulen (2005). Since the debt obtained from financial institutions is the most important external financing source used by European firms, criteria based on the distinction between small-large and listed-unlisted do not separate European firms into those that obtain external financing from financial institutions versus those that are market financed. This is unlike the case for American large quoted firms that rely mostly on capital obtained from the stock market, while the rest of the firms are facing relatively worse financing conditions without access to this source of financing.This could explain the different results obtained based on the European and the US market.

4.3 Cash flow sensitivity of cash holdings

In this subsection we investigate the sources of cash flow sensitivity and its relation to

[11]The results for SMEs may be peculiar to the selected sample of firms, where on average the number of employees is 126 and the mean total assets is about 30 mill. euro. A different sample with very small firms might provide some differences in financing conditions among size and quotation groups.

the financing constraints. First, we estimate the ACW model for the three firm-groups based on the regression model described by equation (4). Second, we develop a dynamic model of inter-temporal allocation of uses and sources of funds, incorporating in the model as explanatory variables all types of debt, such as trade credits, short- and the long term debt.

In the previous subsections, we identified the firm-group with optimal financing conditions for our sample as the unconstrained firms. Based on ACW's liquidity irrelevance hypothesis, we expect that for this firm-group the estimated cash flow sensitivity of cash would be not significantly different from zero.

Table 7 reports the results by fitting the instrumental variable model (equation (4)) for each firm-group. The model is estimated with fixed effects and robust standard errors. The three columns report the estimates for absolutely, relatively constrained and unconstrained firms.

Table 7 about here

The sensitivities to the internal sources (α_1) are highly significant for all subsamples and their magnitude is the highest in case of the unconstrained firms. These results are in line with the US evidence obtained by ACW using the KZ index as a-priori classification and in contradiction with the rest of ACW empirical results. The significant cash flow sensitivity of unconstrained firms suggests that none of the firms can invest irrespectively of the financing decisions.

Similar to the results based on the different subsamples of sizes and quotation presented before, sales growth does not seem to capture the future growth opportunity (α_2 and α_3). The coefficients of the investments in tangible, intangible and financial fixed assets (α_4, α_5 and α_6) have in most of the cases the expected negative sign but are statistically not

significant (except α_6 for relatively constrained firms significant at 10% level). Net working capital (α_7) is negatively related to the cash holding changes and it becomes significant at the 10% level for the sample of relatively constrained firms. An increase in short-term debt (α_8) results in a significant (at the 10% level) increase in savings in the case of relatively constrained firms, that is, of firms having access to external finance but paying a relatively higher cost for it. We estimate a significant positive size effect (α_9) which could be explained by the particularity of our sample that larger firms grow faster and consequently their cash reserves grow with a higher rate. However, as mentioned before, the size proxy could capture some other effects not controlled in the regression. The estimated significant coefficients of the constants support this argument. Hence,in the followings we propose a dynamic model with additional control variables.

The null hypothesis of the Hausman test can be rejected at the 1% significance level, which suggests that one should control for endogeneity. The selected instruments are those described for the previous estimation of equation (4).

As a next step, we propose a dynamic model with two step system GMM estimation. We check the liquidity demand hypothesis in a dynamic framework using a technique that has been widely used in the investment sensitivity literature. The model allows past realisations of the lagged cash savings to affect its current cash savings. The long-term debt variable is also included as an additional external source of funds. We believe that these additional variables contribute significantly to the explanation of liquidity demand. The lagged dependent variable could reveal the mean reverting pattern of cash savings suggesting a desired level of cash positions. Long-term debt obligations could play an important role in cash policy mainly for two reasons. First, in the presence of a long-term investment project, firms can decide to allocate the obtained credit over time and not to invest the entire available

amount in the first year. Hence, the amounts not invested in the first year are held under the category of cash and cash equivalent. Second, highly leveraged firms have higher monthly interest obligations and the obligation of debt repayment in the future. As a result, cash management should play an important role in fulfilling their financial obligations. There are also differences in the uses of short- versus long-term external funds. While short-term debts could be used by firms to increase the cash reserves or to be invested in current assets, long-term debts are mostly associated with long-term investments. Moreover, the accessibility of short- and long-term debt could be influenced by different firm characteristics but both could play an important role in the cash policy of a firm. We expect a higher effect of long-term debt on the liquidity demand for unconstrained firms that are able to obtain such sources of funds.

$$\begin{aligned}\frac{\Delta CH_{i,t}}{TA_{i,t-1}} &= \delta_0 + \delta_1 \frac{\Delta CH_{i,t-1}}{TA_{i,t-2}} + \delta_2 \frac{CF_{i,t}}{TA_{i,t-1}} + \delta_3 \Delta \log S_{i,t} + \delta_4 \Delta \log S_{i,t-1} \\ &+ \delta_5 \frac{\Delta TFA_{i,t} + Depr_{i,t}}{TA_{i,t-1}} + \delta_6 \frac{\Delta IFA_{it}}{TA_{i,t-1}} + \delta_7 \frac{\Delta IFA_{i,t-1}}{TA_{i,t-2}} + \delta_8 \frac{\Delta FFA_{i,t}}{TA_{i,t-1}} \\ &+ \delta_9 \frac{\Delta DI_{i,t}}{TA_{i,t-1}} + \delta_{10} \frac{\Delta Cred_{i,t}}{TA_{i,t-1}} + \delta_{11} \frac{\Delta STD_{i,t}}{TA_{i,t-1}} + \delta_{12} \frac{\Delta LTD_{i,t}}{TA_{i,t-1}} + \delta_{13} \log TA_{i,t} \\ &+ \sum \delta_j D_{year} + \sum \delta_k D_{industry} + \sum \delta_l D_{country} + \varepsilon_{i,t} \end{aligned} \quad (5)$$

In addition to the variables defined under the instrumental variable estimation model, we include in equation (5) the first lag of the dependent variable ($\Delta CH_{i,t-1}$), the first lag of intangible fixed investment ($\Delta IFA_{i,t-1}$) and the long term debt ($\Delta LTD_{i,t}$). Past investment in research and development (as part of intangible assets) is included since it may indicate the growth potential of the company in addition to the sales growth variable. Instead of including net working capital, we separate it into short-term uses and sources of funds, i.e. debtors (trade receivables) plus inventories ($\Delta DI_{i,t}$) and trade credit (trade payable) ($\Delta Cred_{i,t}$). Summary statistics of these additional variables are presented in Panel B of

Table 1. Inventory stocks and debtors on the asset side increase more, with an average of 4.4% of total assets, than trade credits on the liability side, which increase on average by 1.5% of total assets. The change in long-term debt to total assets is on average 1%, while the increase in short-term debt to total assets is on average about 2%. Cross-country differences in the institutional environment, in the importance of the banking sector and in affiliation to different business groups may play a role on firms' behaviour.[12] Hence, we control for such country-specific effects by including country dummy variables. For the possibility that firms belonging to some particular industries have a higher desire to save cash, we also include industry dummies as a control variable.

The dynamic GMM model controls for bias due to unobserved firm-specific effects and endogeneity through the lagged variables taken as instruments. The lagged dependent variable takes into account the adjustment of the actual cash holdings to their previous levels. Such adjustment could also indicate the existence of an active cash management policy. In case firms have not adopted such a policy, we should expect an insignificant coefficient of the lagged cash savings. Under the irrelevance hypothesis, there is no unique optimal cash policy for unconstrained firms and savings should fluctuate in an undetermined manner. A positive significant coefficient of the lagged dependent variable would imply the existence of a target cash level, inconsistent with the irrelevant liquidity hypothesis.

Table 8 presents the results obtained from the estimation of the dynamic GMM model. The significant negative values of the lagged dependent variables (δ_1) for all type of financing conditions point to the existence of a mean-reversion of cash savings, which, in turn, implies a target cash level and systematic cash savings. The cash flow sensitivity of cash (δ_2) has

[12]For instance, Deloof (2001) finds that Belgian firms' intragroup relations reduce the need for liquid reserves and Ferreira and Vilela (2004) find that firms in EMU countries with superior investor protection hold less cash.

the highest coefficient for unconstrained firms. The sensitivity measures are positive and significant at the 1% level for all type of firms, however the magnitude of the coefficient is lower than those estimated with the previous model. The lower values could be explained by the presence of the additional explanatory variables and by the use of different set of instruments.

Table 8 about here

None of the proxies for future investment opportunities measured by sales growth(δ_3), lagged sales growth (δ_4)and lagged investment in intangible assets(δ_7) are significant. Again, the insignificance of sales growth and intangible assets for the rest of the sample should be interpreted with more caution. It is more likely that these variables do not capture efficiently the future investment opportunity, rather than that savings are unaffected by future investment opportunities. Cash savings are used for inter-temporal allocation of investment in fixed assets of unconstrained (significant at 1% level),relatively and absolutely constrained firms (significant at 10% level) as detected by the significantly negative coefficients of the tangible investment proxy (δ_5). Investment in intangible assets (δ_6) has the expected negative sign but not significant. Investment in financial assets (δ_8) affects significantly (at 5% level of significance) the cash savings of unconstrained firms.

The sensitivities of cash savings to current operations (inventories and trade debt, δ_9 and trade credit, δ_{10}) show the expected signs. They have a significant influence on the cash savings for absolutely and relatively constrained firms. The cash savings of absolutely and relatively constrained firms are affected neither by changes in short-term debt nor by long-term debt changes. The cash savings of unconstrained firms are positively affected by an increase in long-term debt. The insignificant effect of financial debt in the case of absolutely constrained firms is not surprising, since, based on our classification criteria, they

do not get new external sources in most of the years. For relatively constrained firms, which are able to obtain financial debt, changes in leverage does not influence their cash reserves. The significant debt sensitivity of unconstrained firms is consistent with our expectation and it indicates that cash savings are used for inter-temporal allocation of both internal and external sources of fund. Firms can decide to allocate the obtained long-term credit over time and not to invest the entire available amount in the first year. In addition, an increase in leverage of the firm could result in an increase of liquidity in order to fulfil the higher interest obligations and credit repayment in the future. Contrary to the estimates of the instrumental variables model, the estimated size effect and intercepts are not significant, which reconfirm the problem of the previous model caused by omitted variables.

All regression models are accepted based on the Hansen test that confirms the validity of the selected instruments. The first-difference equation residuals are first-order autocorrelated ($AR(1)$), just as expected based on the model specification. The rejection of higher order autocorrelation ($AR(2)$) indicates that the selected instruments are exogenous and the parameter estimates are consistent. Based on the two step GMM estimation the robust covariance matrix is provided with finite sample correction of standard errors.

In general, our results point to the fact that even firms under the best financing conditions operate in an imperfect market environment and save cash out of their realised profits. The savings are positively related to the future investment opportunities. Firms' cash savings adapt to an optimal level and are positively affected by internal sources, irrespective of the difficulties to raise external financing sources. There is also evidence that the amount of external financing determines the cash savings evolution for unconstrained firms. Firms without significant financing barriers still face higher external than internal costs of financing and they save cash in a systematic way to achieve an optimal inter-temporal allocation of

financial sources. Since the cash flow already contains information about the firms' future investment opportunities, unconstrained firms exhibit the highest sensitivity. Hence, the cash flow sensitivity does not reveal information on the financing condition of the firm.

5 Conclusion

This paper has developed a new classification scheme that can be used to detect the presence of financing constraints. Based on this new classification, we find that financially constrained firms that are unable to obtain external financing or face higher costs of borrowing invest at a lower rate and grow more slowly. They also hold relatively higher cash positions that grow substantially under depressed economic conditions, confirming the precautionary cost hypotheses of holding cash. The cash savings of unconstrained firms are positively affected by an increase in long-term debt. The significant debt sensitivity of unconstrained firms indicates that cash savings are used for inter-temporal allocation of both internal and external sources of fund. Firms can decide to allocate the obtained long-term credit over time and not to invest the entire available amount in the first year. In addition, an increase in leverage of the firm could result in an increase of liquidity in order to fulfil the higher interest obligations and credit repayment in the future. We find that the distribution of financially constrained firms does not depend on the firm's size or its listing at a stock exchange. However, for a proper investigation of SMEs, a better coverage of small firms is needed than that provided in this paper.

We provide evidence that all types of euro-area firms, regardless of their financing conditions, save their internal sources in a systematic pattern. The liquidity irrelevance hypothesis of Almeida, Campello, and Weisbach (2004) holds only for firms operating under perfect

market conditions where internal and external financing sources are interchangeable. Such conditions can be hardly found, since even for those firms that are able to raise external sources under the best market conditions, there is a wedge between the internal and external costs of financing. Our results show that all firms are constrained to a certain degree by the imperfect market environment and consequently all of them have a determined cash policy.

For firms under best financing conditions, that we categorise as unconstrained, we estimate the highest cash flow sensitivity of cash holdings. This result, which appears puzzling at first sight, can be explained as follows. First, similar to the findings of ACW, when market imperfections are present greater cash flow sensitivity of cash savings does not reflect higher financial constraints. The level of sensitivity is affected, apart from the precautionary savings, by future investment opportunities captured partly by the cash flow variable. Hence, the highest sensitivity of unconstrained firms simply reflects the high growth opportunities of this group of firms. While constrained firms save cash to hedge the fluctuations in their cash flow, unconstrained firms may save to boost future investments. Second, the cash flow sensitivity of cash should be interpreted in the light of the flow of external financing. We find a significant relationship between cash savings and the flow of long-term external sources. This can be explained by the fact that unconstrained firms use more intensively external financing sources, mostly long-term debt, to fund additional investments. In this case, cash holdings play an important role to balance the external and internal financing sources and the repayment obligations and interest costs. All these factors make liquidity relevant even for firms with the best financing conditions. We can conclude that the significance of cash flow sensitivity of cash savings does not provide reliable evidence to distinguish euro area firms experiencing different financing conditions.

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Table 1: Summary statistics of the variables used in regression analyses

Variables	Mean	Median	St.dev.	Min.	Max.
Panel A					
$\frac{\Delta CH_{i,t}}{TA_{i,t-1}}$	0.006	0.001	0.063	-0.593	0.998
$\frac{\Delta CF_{i,t}}{TA_{i,t-1}}$	0.091	0.086	0.070	-0.497	0.499
$\log S_{i,t}$	0.070	0.067	0.297	-7.717	6.021
$\frac{\Delta TFA_{i,t}+Depr_{i,t}}{TA_{i,t-1}}$	0.082	0.060	0.104	-0.642	1.017
$\frac{\Delta IFA_{it}}{TA_{i,t-1}}$	0.009	0.000	0.057	-0.598	0.989
$\frac{\Delta FFA_{i,t}}{TA_{i,t-1}}$	0.007	0.000	0.053	-0.736	0.892
$\frac{\Delta NWC_{i,t}}{TA_{i,t-1}}$	0.023	0.012	0.105	-0.847	2.682
$\frac{\Delta STD_{i,t}}{TA_{i,t-1}}$	0.019	0.004	0.103	-0.791	0.897
$\log TA_{i,t}$	11.641	11.323	1.570	3.045	19.150
Panel B					
$\frac{\Delta DI_{i,t}}{TA_{i,t-1}}$	0.044	0.025	0.138	-0.872	2.812
$\frac{\Delta Cred_{i,t}}{TA_{i,t-1}}$	0.015	0.008	0.078	-0.591	1.592
$\frac{\Delta LTD_{i,t}}{TA_{i,t-1}}$	0.010	0.000	0.088	-0.782	0.985

Note: The sample comprises 2,190 firms from the euro-area with a total of 8,737 observations in the period 1994-2003. Panel A describes the main variables used in equation (4). The cash holdings refer to cash and marketable securities. Cash flow is the earnings before extraordinary items plus depreciation. The first differences of the natural logarithm of sales capture the growth opportunities faced by the firm. The changes in tangible, intangible and financial fixed assets and the depreciation are proxy for investments. The change in net working capital is calculated as the annual change in inventory stocks and debtors minus the change in trade credit. Short-term debt is the financial debt with maturity less than one year. Size is defined as the natural logarithm of assets. Panel B describes the additional variables used in equation (5). Long-term debt represents the financial debt with maturity above one year.

Table 2: Cash flow sensitivity based on size and quotation

$$\begin{aligned}\frac{\Delta CH_{i,t}}{TA_{i,t-1}} &= \alpha_0 + \alpha_1 \frac{CF_{i,t}}{TA_{i,t-1}} + \alpha_2 \Delta logS_{i,t} + \alpha_3 \Delta logS_{i,t-1} + \alpha_4 \frac{\Delta TFA_{i,t} + Depr_{i,t}}{TA_{i,t-1}} \\ &+\alpha_5 \frac{\Delta IFA_{i,t}}{TA_{i,t-1}} + \alpha_6 \frac{\Delta FFA_{i,t}}{TA_{i,t-1}} + \alpha_7 \frac{\Delta NWC_{i,t}}{TA_{i,t-1}} + \alpha_8 \frac{\Delta STD_{i,t}}{TA_{i,t-1}} + \alpha_9 \log TA_{i,t} \\ &+\lambda_i + \mu_t + \nu_{i,t}\end{aligned}$$

	Small	Large	SME	LE	Unquoted	Quoted
α_0	-0.524	-0.476	-2.191	-0.282	-0.009	-0.453
	(-2.83)***	(-0.54)	(-2.93)***	(-0.67)	(-0.01)	(-0.72)
α_1	0.320	0.376	0.314	0.319	0.246	0.443
	(8.18)***	(2.78)***	(2.86)***	(3.01)***	(1.69)*	(2.88)***
α_2	0.004	-0.010	-0.044	0.012	0.092	-0.033
	(0.15)	(-0.10)	(-0.42)	(0.17)	(0.48)	(-0.35)
α_3	-0.066	0.004	-0.135	0.028	0.048	-0.009
	(-1.68)*	(0.03)	(-1.46)	(0.25)	(0.25)	(-0.06)
α_4	-0.097	-0.010	0.056	-0.011	-0.027	-0.039
	(-1.8)*	(-0.16)	(0.20)	(-0.18)	(-0.23)	(-0.46)
α_5	-0.075	-0.113	-1.404	-0.057	-0.219	-0.114
	(-0.51)	(-0.65)	(-1.67)*	(-0.41)	(-1.17)	(-0.61)
α_6	-0.102	-0.303	0.313	-0.258	-0.411	-0.236
	(-1.31)	(-1.50)	(0.81)	(-1.44)	(-1.2)	(-0.92)
α_7	-0.232	-0.117	0.057	-0.121	-0.137	-0.108
	(-6.62)***	(-1.07)	(0.40)	(-1.48)	(-0.86)	(-0.90)
α_8	0.186	0.170	-0.391	0.162	0.089	0.176
	(6.01)***	(1.65)*	(-1.36)	(1.80)*	(0.55)	(1.78)*
α_9	0.052	0.033	0.223	0.021	-0.002	0.033
	(2.74)***	(0.49)	(2.85)***	(0.58)	(-0.02)	(0.65)
N	2444	2810	1294	2400	7443	6337
Hausman χ^2	39.64	57.37	45.21	133.11	120.17	36.47
(prob)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.05	0.02	0.01	0.03	0.05	0.01

Table 2 (continued)

Note: The sample comprises 2,190 firms from the euro-area with a total of 8,737 observations in the period 1994-2003. We assign the letter for unconstrained firms, for relatively constrained firms and for absolutely constrained firms. IV estimates with t statistics corresponding to heteroskedastic-consistent standard errors are reported. The used instruments are the country and industry dummies and the initial stock of each asset: the first and second lag of tangible fixed assets, lagged intangible assets, lagged financial assets, lagged net working capital, lagged short-term debt and lagged sales. All regressions include time dummies (not reported in the table). The unobserved individual heterogeneity is controlled for by firm-fixed effects. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Table 3: Firm-years' Classification

% from sample	Total investment	Financing gap	Debt changes	New shares issue	Interest payments
Absolutely constrained firm-years					
1. (25%)	≥ 0	≥ 0	≤ 0	≤ 0	-
2. (9%)	< 0	-	≤ 0	-	-
Relatively constrained firm-years					
1. (9%)	≥ 0	< 0	< 0	-	-
2. (36%)	≥ 0	≥ 0	> 0	-	$\geq RIR_{c,t}$
3. (1%)	≥ 0	≥ 0	≤ 0	> 0	-
4. (2%)	< 0	-	> 0	-	-
Unconstrained firm-years					
1. (3%)	≥ 0	< 0	≥ 0	-	-
2. (14%)	≥ 0	≥ 0	> 0	-	$\leq RIR_{c,t}$

Note: $RIR_{c,t}$represents the retail interest rate of the given country and year reported by ECB statistics.

Table 4: Firms' classification

Final outcome	No. of obs.	No. of firms	% of firms
Absolutely constrained firms			
	3,440	532	24%
Relatively constrained firms			
	5,906	1238	57%
Unconstrained firms			
	1,581	420	19%

Table 5: Summary Statistics

Variables	Mean	Median	Std. Dev.	P-value $(U = R)$	P-value $(R = A)$
1. Cash flow				0.452	0.060
U	0.091	0.083	0.076		
R	0.092	0.087	0.069		
A	0.089	0.085	0.069		
2. Investment rate				0.000	0.000
U	0.117	0.076	0.154		
R	0.101	0.072	0.132		
A	0.082	0.057	0.124		
3. Sales growth				0.000	0.000
U	0.106	0.085	0.393		
R	0.074	0.074	0.296		
A	0.048	0.052	0.239		
4. Leverage ratio				0.000	0.312
U	0.326	0.315	0.175		
R	0.250	0.233	0.151		
A	0.247	0.220	0.167		
5. Paid interest rate				0.000	0.104
U	0.065	0.052	0.063		
R	0.125	0.087	0.115		
A	0.121	0.084	0.115		

Note: The sample period is 1994-2003 including 2,190 firms located in the euro-area with a total of 10,927 observations. Cash flow is defined as profits after tax plus depreciation. Investments are calculated as the yearly increase in fixed assets plus depreciation. Both investments and cash flow are deflated by the beginning of period total assets. Sales growth is calculated as the first difference of the logarithm of annual sales. Leverage ratio is the ratio of total debt to total assets. Paid interest rate is calculated as the ratio of the amount of interest paid divided by total debt. We assign the letter for unconstrained firms, for relatively constrained firms and for absolutely constrained firms. We test the hypothesis that the mean value of the variables of one group is not significantly different across firm groups using a t-test. P values of the t-test are presented in the last two columns.

Figure 1. Cash holdings[1]

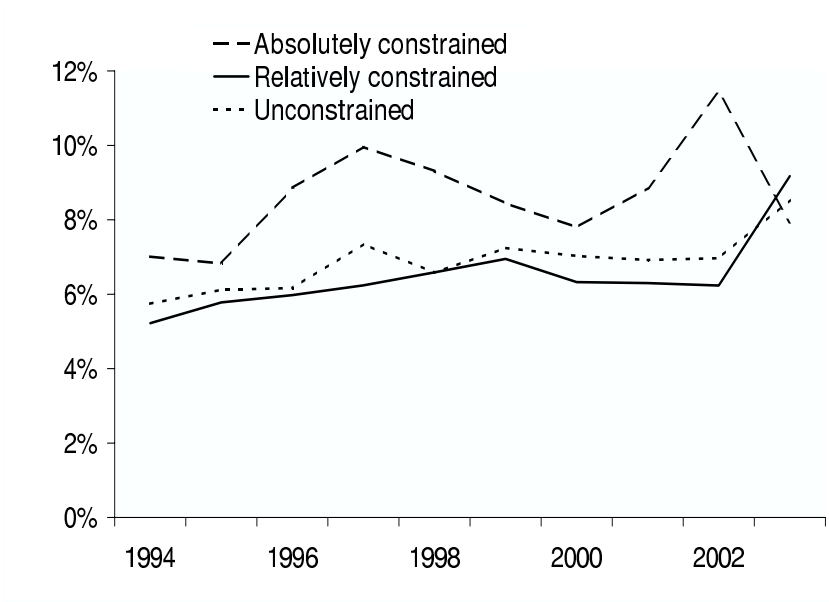
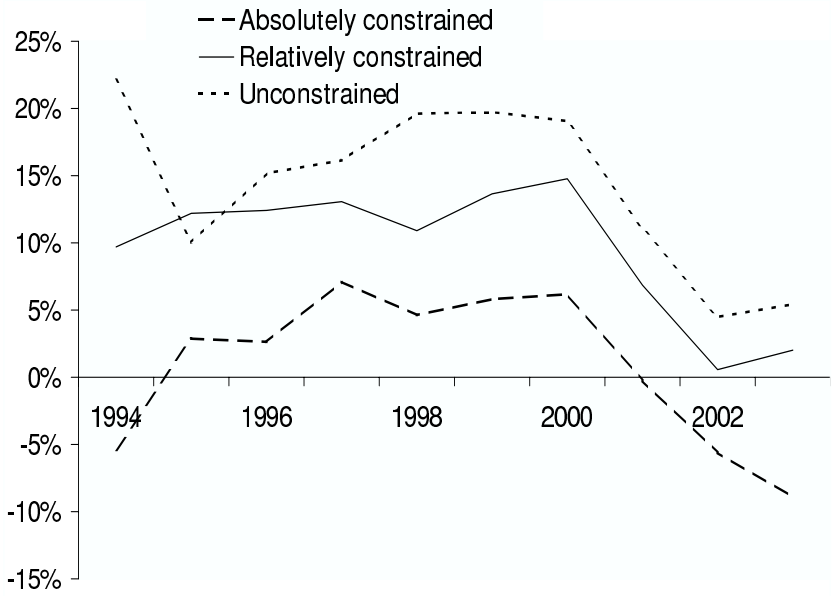


Figure 2. Firms' growth [2]



Note: (1) cash and cash equivalent / total assets; (2) first difference of total assets/ beginning of period total assets.Source: Bureau van Dijk and ECB calculation.

Table 6: Financial constrains by size and quotation

		A	R	U	Total
Small	No. of firms	213	511	154	878
	% from Small	24%	58%	18%	100%
Large	No. of firms	177	404	144	725
	% from Large	24%	56%	20%	100%
SME	No. of firms	107	327	101	535
	% from SME	20%	61%	19%	100%
LE	No. of firms	482	1076	357	1915
	% from LE	25%	56%	19%	100%
Quoted	No. of firms	120	282	99	501
	% from Quoted	24%	56%	20%	100%
Unquoted	No. of firms	412	956	321	1689
	% from Unquoted	24%	57%	19%	100%

Note: Firms are defined as small (large) firms allocated in the bottom (top) three deciles of the size distribution and quoted firms are firms listed at a stock exchange. SME and LE defines the small and medium size enterprises and large enterprises based on the European Commission Standards. We assign the letter U for unconstrained, R for relatively constrained and A for absolutely constrained firms.

Table 7: Cash flow sensitivity of cash and financial constraints. Instrumental variable estimation with fixed effects

$$\begin{aligned}\frac{\Delta CH_{i,t}}{TA_{i,t-1}} &= \alpha_0 + \alpha_1 \frac{CF_{i,t}}{TA_{i,t-1}} + \alpha_2 \Delta logS_{i,t} + \alpha_3 \Delta logS_{i,t-1} + \alpha_4 \frac{\Delta TFA_{i,t} + Depr_{i,t}}{TA_{i,t-1}} \\ &+\alpha_5 \frac{\Delta IFA_{i,t}}{TA_{i,t-1}} + \alpha_6 \frac{\Delta FFA_{i,t}}{TA_{i,t-1}} + \alpha_7 \frac{\Delta NWC_{i,t}}{TA_{i,t-1}} + \alpha_8 \frac{\Delta STD_{i,t}}{TA_{i,t-1}} + \alpha_9 \log TA_{i,t} \\ &+\lambda_i + \mu_t + \nu_{i,t}\end{aligned}$$

	A	R	U
α_0	-0.289	-0.217	-0.568
	(-2.92)***	(-3.16)***	(-3.01)***
α_1	0.332	0.282	0.567
	(5.71)***	(5.51)***	(4.70)***
α_2	0.014	0.025	-0.054
	(0.46)	(-0.68)	(-1.13)
α_3	0.029	-0.004	-0.089
	(-0.73)	(-0.17)	(-1.32)
α_4	-0.027	0.006	0.124
	(-0.28)	(0.07)	(0.84)
α_5	-0.137	-0.078	0.052
	(-0.81)	(-0.49)	(0.22)
α_6	0.029	-0.374	-0.270
	(0.17)	(-1.78)*	(-0.68)
α_7	-0.145	-0.153	0.038
	(-1.03)	(-1.64)*	(0.22)
α_8	0.176	0.131	0.022
	(1.19)	(1.87)*	(0.11)
α_9	0.023	0.017	0.045
	(2.71)***	(3.04)***	(2.85)***
N	2908	4668	1161
Hausman χ^2	50.85	57.36	63.72
test (prob.)	(0.00)	(0.00)	(0.00)
R^2	0.03	0.04	0.02

Table 7 (continued)

Note: The sample comprises 2,190 firms from euro-area with a total of 8,737 observations in the period 1994-2003. We assign the letter U for unconstrained firms, R for relatively constrained firms and A for absolutely constrained firms. IV estimates with t statistics corresponding to heteroskedastic-consistent standard errors are reported. The used instruments are the initial stock of each asset: the first and second lag of tangible fixed assets, lagged intangible assets, lagged financial assets, lagged net working capital, lagged short-term debt and lagged sales. Not reported in the table, all regressions include time dummies. The unobserved individual heterogeneity is controlled by firm-fixed effects. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Table 8: Cash flow sensitivity of cash and financial constraints. Dynamic system GMM estimation

$$\begin{aligned}\frac{\Delta CH_{i,t}}{TA_{i,t-1}} &= \delta_0 + \delta_1 \frac{\Delta CH_{i,t-1}}{TA_{i,t-2}} + \delta_2 \frac{CF_{i,t}}{TA_{i,t-1}} + \delta_3 \Delta \log S_{i,t} + \delta_4 \Delta \log S_{i,t-1} \\ &+\delta_5 \frac{\Delta TFA_{i,t} + Depr_{i,t}}{TA_{i,t-1}} + \delta_6 \frac{\Delta IFA_{it}}{TA_{i,t-1}} + \delta_7 \frac{\Delta IFA_{i,t-1}}{TA_{i,t-2}} + \delta_8 \frac{\Delta FFA_{i,t}}{TA_{i,t-1}} \\ &+\delta_9 \frac{\Delta DI_{i,t}}{TA_{i,t-1}} + \delta_{10} \frac{\Delta Cred_{i,t}}{TA_{i,t-1}} + \delta_{11} \frac{\Delta STD_{i,t}}{TA_{i,t-1}} + \delta_{12} \frac{\Delta LTD_{i,t}}{TA_{i,t-1}} + \delta_{13} \log TA_{i,t} \\ &+ \sum \delta_j D_{year} + \sum \delta_k D_{industry} + \sum \delta_l D_{country} + \varepsilon_{i,t}\end{aligned}$$

	A	R	U
δ_0	-0.009	-0.067	-0.130
	(-0.33)	(-1.43)	(-1.56)
δ_1	-0.112	-0.137	-0.137
	(-3.74)***	(-2.82)***	(-2.79)***
δ_2	0.191	0.190	0.388
	(2.57)***	(2.63)***	(3.08)***
δ_3	-0.006	-0.006	-0.014
	(-0.49)	(-0.43)	(-0.76)
δ_4	0.011	0.019	-0.003
	(1.24)	(1.46)	(-0.30)
δ_5	-0.071	-0.090	-0.182
	(-1.85)*	(-1.80)*	(-2.75)***
δ_6	-0.040	-0.015	-0.106
	(-0.53)	(-0.22)	(-1.13)
δ_7	-0.006	-0.034	-0.021
	(-0.13)	(-0.83)	(0.42)
δ_8	-0.100	-0.129	-0.265
	(-0.89)	(-1.51)	(-2.45)**
δ_9	-0.078	-0.146	-0.097
	(-2.03)**	(-2.65)***	(-1.19)
δ_{10}	0.137	0.185	0.144
	(2.43)**	(2.24)**	(1.15)

Table 8 (continued)

	A	R	U
δ_{11}	0.022	0.067	0.120
	(0.69)	(1.29)	(1.68)*
δ_{12}	0.050	0.056	0.227
	(1.54)	(1.09)	(2.85)***
δ_{13}	0.000	0.004	-0.008
	(0.11)	(1.12)	(-1.23)
N	2908	4668	1161
Hansen test χ^2	199.08	191.31	137.33
(prob.)	(0.71)	(0.82)	(1.00)
$AR(1)$	-6.09	-5.37	-3.31
(prob.)	(0.00)	(0.00)	(0.00)
$AR(2)$	-0.44	-0.36	-1.54
(prob.)	(0.66)	(0.73)	(0.13)

Note: The sample comprises 2,190 firms from the euro-area with a total of 8,737 observations in the period 1994-2003. We assign the letter for unconstrained firms, for relatively constrained firms and for absolutely constrained firms. Two-step system GMM estimates are presented with finite-sample correction to the two-step covariance matrix (robust standard errors). The GMM instruments are the second to third lags of the variables. All regressions include time, industry and country dummies (not reported in the table). t-statistics are reported in parenthesis. *, ** and *** indicate statistical significance at the 10%. 5% and 1% level, respectively.

Appendix - Data and sample selection

Data on balance sheets and profit and loss statements are collected from the AMADEUS database of Bureau van Dijk. We start from a sample of non-financial firms providing consolidated items (15,972 firms). For the sample period 1994-2003, we selected firms that provided information on the number of employees, total assets or turnover (12,519 firms).[13] The sample size is further reduced when we included the following quality checks. First we checked that the reported balance-sheet items were positive and that the sum of the subcategories of a balance-sheet item did not differ more than 10% from the reported value of the item (9,164 firms). Then, we selected those firms reporting in their accounts values for our variables of interest (cash holdings, sales, tangible fixed assets, other fixed assets, intangible fixed assets, current assets, loans, long term debt and the interest paid) (6,825 firms). Finally, we retained only those firms reporting data for, at least, three consecutive years (2,821 firms). Our final sample consists of 2,190 firms after 1% trimming based on variables of cash flow and change in cash holdings.

Figure A1. Size/country composition

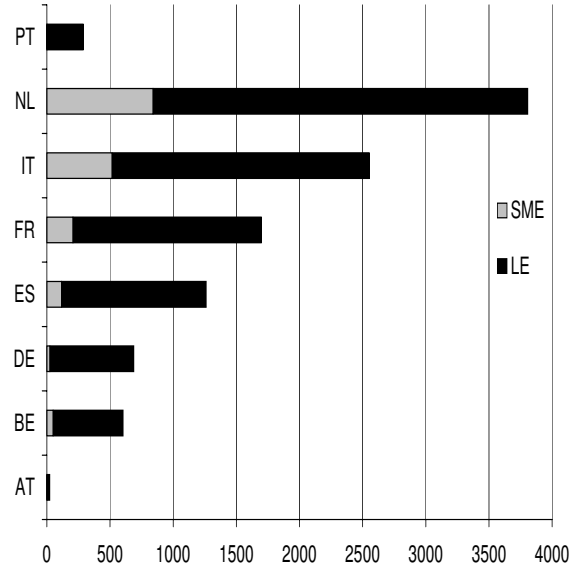
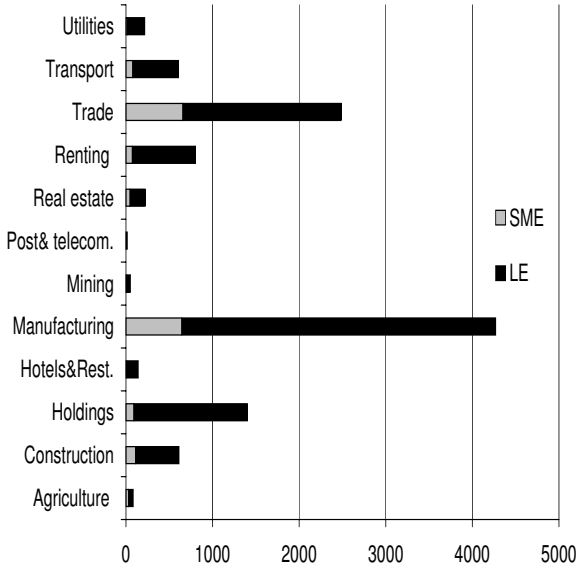


Figure A2. Industry composition



Source: Bureau van Dijk and ECB calculations Total sample 2,190 firms, 10,927 observations.

Note: SME and LE define the small and medium size enterprises and large enterprises respectively based on the European Commission Standards. SMEs are firms that satisfy two out of the following conditions: maximum number of 250 employees, maximum turnover of 407 mio. euro and maximum balance sheet total of 275 mio. euro.

[13]Information on these variables is necessary to define the size of a company.

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