

# Cash holdings determinants in the Portuguese economy<sup>1</sup>

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## ABSTRACT

The analysis of liquidity management decisions by firms has recently been used as a tool to investigate the impact of financial constraints. Firms facing funding constraints need to accumulate more cash in order to protect themselves from the possibility of not being able to finance viable investment projects. This question is particularly relevant in the context of the current financial crisis. Thus, this article analyses the determinants of holding liquid assets (cash and deposits) by Portuguese companies

based on annual accounting data for the period 1990-2012 from the Central Balance Sheet of the Banco de Portugal. The results show that the share of liquid assets in total assets is positively affected by current cash flows and its past volatility, which suggests that Portuguese companies are in fact subject to liquidity constraints. In addition, the results suggest that the need to accumulate funds as a protection against future shocks is more pronounced for smaller companies (especially small and micro enterprises).

## 1. Introduction

In a world without financial frictions firms would not need to have cash and would apply these funds more profitably while avoiding the opportunity cost of holding money. Nonetheless, in firms' balance sheets, the item "Cash and deposits" has a non-negligible share. Companies demand for money to cover immediate expenses related to their current activity, dividend policy, or even investment projects since the transaction costs are higher when they use more profitable and less liquid assets as a means of payment. Companies, particularly those that have more difficulty getting external finance also demand for money for precautionary reasons, ie to reduce the risk of failing to raise the necessary funds to finance profitable investment projects. These considerations relate to the existence of information asymmetries that underlie the hypothesis originally due to Myers and Majluf (1984) that firms prefer to finance themselves primarily with internal resources and prefer debt to equity when have to resort to external funding sources ("pecking order" theory). In this context, the existence of restrictions on access to credit, which helps define the financial flexibility of a company (Denis, 2011), is a vital factor in the company's capital structure (Graham and Harvey, 2001).

The analysis of liquidity demand by firms has been used as a tool in the recent research on the existence of financial constraints. This analysis has emerged as a response to criticism from some authors to models that identify the existence of financial constraints based on the effect of cash flow on investment decisions (as in for instance Altı, 2003, Bond et al, 2004, and Farinha and Prego, 2013). In the estimation of a model of investment demand, if investment opportunities are correlated with cash flows realizations and are not being properly controlled by another variable, the relationship between cash flow and investment may be a reflection of the relationship between investment and investment opportunities. In this case it is not possible to identify the presence of financial constraints through the effect of cash flow on investment. However, as noted by Martínez-Carrascal (2010), this identification problem does not arise in the case of a model of liquidity demand given that for companies without financing constraints the demand for cash

and deposits should be independent of the cash flow and investment opportunities. Given this limitation, several alternatives have been suggested to empirically test the presence of financing constraints. In this context, Almeida, Campello and Weisbach (2004) present a model that analyzes the sensitivity of liquidity ratios to the cash flow generated by the firm. In this model, the authors argue that the sensitivity of liquidity to the cash flow ratio is only significant for firms with limited access to credit. Conversely, companies that have no restrictions on access to credit, and therefore no difficulty in raising funds to finance future projects, show no relationship between liquidity levels and internally generated funds. The aim of this study is to contribute to the analysis of the financial constraints of Portuguese companies, empirically testing the hypothesis of Almeida, Campello and Weisbach (2004) model. More specifically, we intend to test the statistical independence between the level of liquidity of the company and the level of cash-flow, with the independence between the two to be expected only for companies that do not have limited access to credit.

In turn, Han and Qiu (2007) argue that companies increase their level of liquidity as a way to protect themselves against future negative shocks. However, the authors demonstrate that this behaviour occurs only in companies that have difficulties in access to credit. Otherwise companies may resort to the credit market as a way to finance all possible capital needs when they face an unexpected reduction in profitability and business opportunities that require the availability of capital. Thus, Han and Qiu (2007) develop a model showing that firms with limited access to the credit market increase their liquidity levels in response to increases in the volatility of cash flows. The volatility of cash flows is used as a measure of the uncertainty on the future developments in companies' profitability. In this work, we also intend to test the hypothesis of statistical independence between the volatility of cash flow and liquidity of the company. The rejection of this hypothesis suggests the existence of restrictions on the ability of companies to raise external financing.

The results of this study suggest that Portuguese firms face restrictions on access to external financing. The results show that the firms' liquidity level are not independent of cash-flow and its past volatility, supporting the hypothesis of Almeida et al (2004) and Han and Qiu (2007). There is, however, some heterogeneity in the relationship between firms' liquidity variable and those variables. The results suggest that the level of restrictions appears to be significantly more pronounced for smaller firms. More specifically, the micro/small firms not only have, on average, a liquidity ratio higher than those of medium and large firms, but its sensitivity to cash flow and cash flow volatility differs statistically when compared with large firms.

The rest of the paper is structured as follows. Section 3 describes the sample used in the study and presents a descriptive analysis of the relationship between liquidity levels of firms and possible determinants of the demand for liquidity. Section 4 presents the econometric specification and the estimation method used, as well as the main results. Section 5 presents the main conclusions of the study.

## 2. Data and Descriptive Analysis

### 2.1. Data

In this study, we used information on a sample of firms with information on the Central Balance Sheet of Banco de Portugal (CB) during the period 1990-2012. Data from 1990 to 2005 correspond to a sample of firms that responded to the survey by CB. In this sample large companies are over-represented. Moreover, companies in a better financial situation are also more likely to have answered the questionnaire, especially in the case of SMEs. From 2006 onwards, CB data are based on the Informação Empresarial Simplificada (IES) which collects accounting information on the universe of companies.

The calculation of one of the variables of interest – cash flow volatility – requires companies to be present in the database for at least five consecutive years. This procedure led to the elimination of a significant number of observations and implies that the analysis relates to the period 1995-2012. Moreover, the analysis considers only the non-financial private sector companies that have some kind of interest bearing debt, thus excluding from the sample firms with zero debt and/or zero interest. We also excluded companies with one employee only. It was also necessary to eliminate companies that reported incomplete or inconsistent data, such as those showing zero or negative values for the total assets or turnover. Finally, and in order to eliminate the potential bias due to outliers, observations below (and above) the 1st percentile (99th percentile) of the relevant variables were excluded. Once these criteria have been applied, the data used in this study corresponds to an unbalanced panel with 50,614 observations on 13,253 firms observed between 1995 and 2012.

### 2.2. Descriptive Analysis

The aim of this study is to test the existence of financing constraints of Portuguese companies by analyzing the effect of cash flow and its past volatility on the liquidity of firms. However, there are other factors that may affect firm liquidity. Firm investment, for instance, being related with firm growth opportunities, should be positively related to its liquidity ratio. Companies with significant collateral are expected to have greater capacity to raise capital. Thus, the ratio of tangible assets to total assets should be negatively related to its liquidity ratio (Hart and Moore, 1994). The relationship between the indebtedness level and liquidity ratio of firms is ambiguous. On the one hand, indebted firms necessarily have a closer relationship with the banks allowing them easier access to funding (Ferreira and Vilela, 2004). On the other hand, firms with very high debt levels and hence higher probability of default may have difficulties in accessing financing. These companies tend to increase their liquidity in order to become more protected against the possibility of not being able to raise the necessary funds to finance their current activity and/or their investments. Finally, net working capital should be negatively related to the firm's liquidity ratio since it can be used as a substitute for assets recorded under "Cash and deposits".

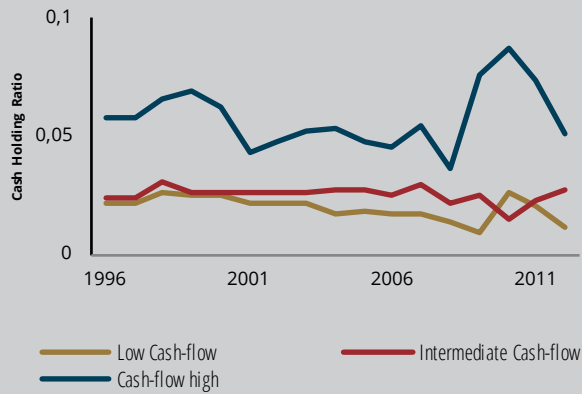
Presented below is a bivariate analysis of the relationship between the liquidity levels of the company and the various factors of interest in order to obtain a first indication of the relationship between liquidity and those factors. Charts 1 to 6 show the evolution of the liquidity levels for groups of companies at different percentiles of the distribution of the indicators; investment rate, tangible assets, net working capital, leverage, cash-flow volatility and cash-flow.<sup>1</sup> In particular, we consider firms with a low value of the indicator (ie, located in the first decile), intermediate values (situated between the 45 percentile and 55 percentile) and a high value (located on the top decile).

Chart 1 shows that the liquidity levels of companies with a high cash-flow value are considerably higher than that held by companies with an intermediate or low value. Additionally, it appears that for firms with a high cash-flow value liquidity levels reach a minimum in 2008 and maximum in 2010 (returning to average levels in 2012), which represents a substantial increase after the onset of the financial crisis. Finally, it can also be seen that liquidity levels of companies with an intermediate or low cash-flow value are very similar even though firms with lower profitability also have lower levels of liquidity (except for 2009). In Chart 2, firms with a high value of cash-flow volatility also experience higher levels of liquidity compared to companies of the other two classes. However, it should be noted that this difference decreases considerably over the period and in 2012 (the last year for observation) the liquidity level for companies with an intermediate value of cash-flow volatility is slightly higher than that of companies with a high value. These results are a first indication that companies face restrictions on access to credit, given that those who have greater ability to generate funds and those with higher volatility in this indicator have, on average, higher liquidity levels.

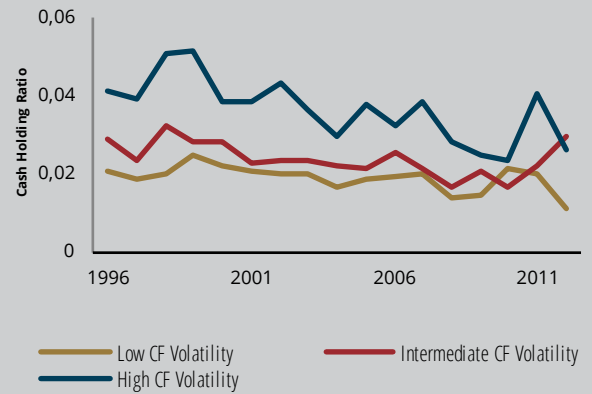
Regarding the relation between the level of liquidity and the share of tangible assets in total assets there are no significant differences in firm liquidity in the various sub-groups considered (Chart 3). However, from 2008 onwards companies with a high value of the tangible assets ratio present liquidity levels considerably lower than the other two sub-groups with the difference increasing significantly until 2012. Chart 4 shows the investment rate of the company and the pattern is very similar to the previous chart with no significant differences between the various sub-groups until 2008. From that year on differences emerge with firms with higher investment rates to show higher levels of liquidity. The relationship between leverage and liquidity is markedly negative and monotonic (Chart 5). Relative to the share of net working capital in total assets there is no indication of any specific relationship with the liquidity ratio (Chart 6). Nonetheless, it is important to highlight that the ratios obtained in this brief descriptive analysis are just indicative of a potential correlation. A regression analysis will be able to isolate the relationship between liquidity and the variables of interest after the effect of the other relevant variables be taken into account.

1. For the definition of the variables see Annex 1.

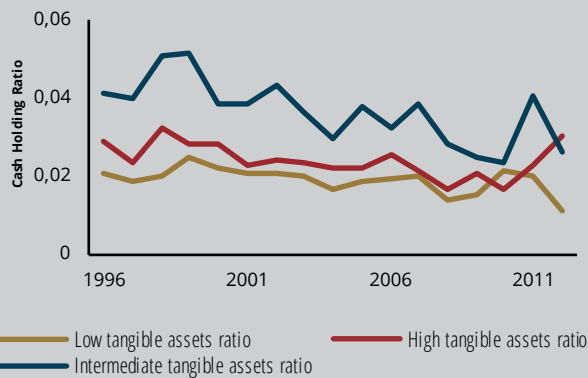
**Chart 1 • Relationship between cash holdings and cash-flows**



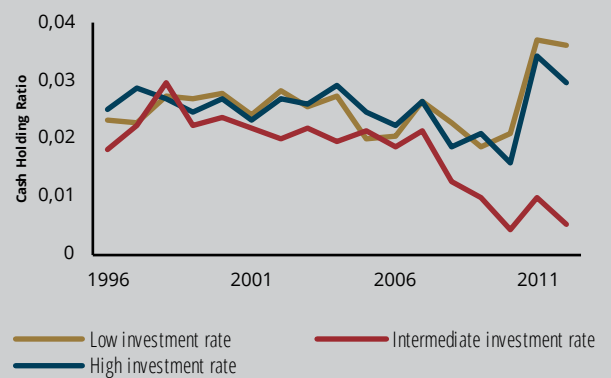
**Chart 2 • Relationship between cash holdings and cash-flow variability**



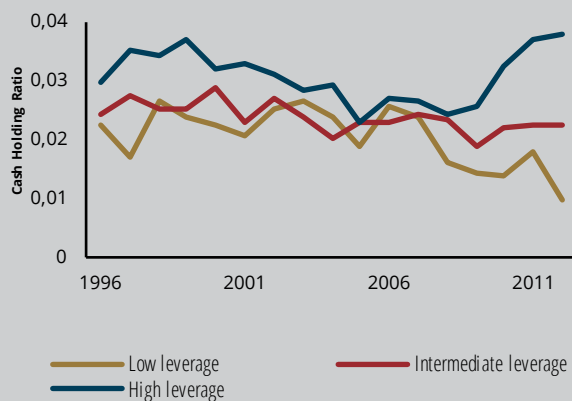
**Chart 3 • Relationship between cash holdings and tangible assets ratio**



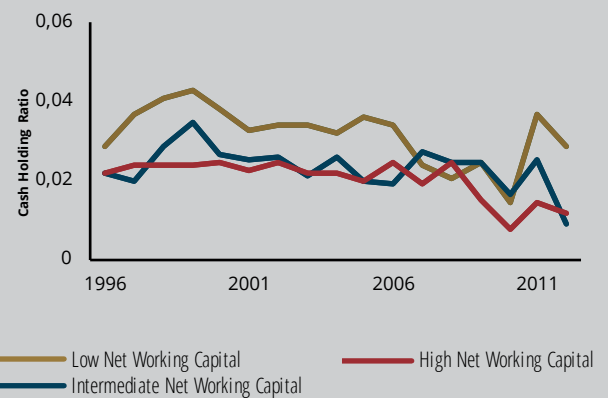
**Chart 4 • Relationship between cash holdings and investment rate**



**Chart 5 • Relationship between cash holdings and leverage**



**Chart 6 • Relationship between cash holdings and net working capital**



## 3. Econometric Analysis and Main Results

### 3.1. Methodology and model specification

The determinants of firm liquidity were also examined based on a regression analysis. In line with the recent empirical literature the following equation was estimated:

$$\begin{aligned} Cash_{i,t} = & \beta_1 Cash_{i,t-1} + \beta_2 Cash_{i,t-2} + \beta_3 Inv_{i,t-1} + \beta_4 Sales_{i,t-1} + \beta_5 CFV_{i,t-1} + \beta_6 NWC_{i,t-1} + \\ & + \beta_7 Lev_{i,t-1} + \beta_8 CF_{i,t-1} + \varphi_j Size_{j,t-1} + \alpha_i + \gamma_{i,t} + \theta_t + \varepsilon_{i,t} \end{aligned}$$

where  $i$  indexes firms  $i = 1, 2, \dots, N$ ,  $t$  indexes year  $t = 1, 2, \dots, T$  and  $j$  indexes each firm size category (where  $j = 1, 2, 3$  corresponds to Micro/Small, Medium and Large Firms respectively, with the latter being the omitted category). As for the variables used,  $Cash_{i,t}$  refers to the firm's  $i$  cash holdings ratio at time  $t$ ;  $CF_{i,t-1}$  represents firm's current cash-flow;  $CFV_{i,t-1}$  represents firm's cash-flow variability;  $Inv_{i,t-1}$  represents firm's investment rate;  $Tang_{i,t-1}$  represents firm's tangible assets ratio;  $NWC_{i,t-1}$  represents firm's share of net working capital (trade credit minus trade debit);  $Lev_{i,t-1}$  represents firm's leverage;  $Size_{j,t-1}$  represents firm's size category.  $\theta_t$  are time effects controlling for macroeconomic influences,  $\gamma_{i,t}$  are fixed industry effects,  $\alpha_i$  are firm fixed effects, and finally  $\varepsilon_{i,t}$  is the error term.

The model was estimated using the GMM-System estimator proposed by Arellano and Bover (1995) and further developed by Blundell and Bond (1998). These models are particularly indicated when the number of years is small and the number of firms is large, there are fixed individual effects, autoregressive variables that show high persistence and independent variables that are not strictly exogenous. By using this methodology, equations are estimated in levels and in differences and the instruments for these are the lagged values of the non-strictly exogenous variables. For all estimations, the Hansen test (at the conventional 5% level) for the validity of instruments and the Arellano and Bond (1991) test of non-existence of first and second order serial correlation in the first-differenced residuals (labelled AR 1 and AR 2) are presented.

### 3.2. Main results

The main objective of this analysis is to test the existence of liquidity constraints faced by firms, estimating a model for the liquidity ratio which includes as explanatory variables the cash-flow and the volatility of past cash-flow. Following the work of Almeida et al (2004) and Han and Qiu (2007), positive and significant effects of cash-flow and cash-flow volatility on the liquidity of companies can be interpreted as evidence of liquidity constraints.

Column 1 of Table 1 presents the main results of the estimation. It is found that the coefficients of the lagged dependent variable are positive and significant, indicating persistence in firms' decisions concerning their holdings of highly liquid assets. Additionally, both the cash-flow and cash-flow volatility relate positively and statistically significant to the liquidity ratio of the firm. These results support the hypotheses of Almeida *et al* (2004) and Han and Qiu (2007) and suggest that firms hold liquid assets to increase their financial flexibility as well as a for precautionary motives, indicating that some companies face difficulties raising external capital.

**Table 1** • Results for the econometric analysis using GMM

Variables	Aggregated	Micro and Small	Medium	Large	Hausman Test: Micro and Small vs Large ( <i>p-value</i> )
Cash <sub><i>it-1</i></sub>	0.3991*** (0.0413)	0.5132*** (0.0199)	0.5119*** (0.0357)	0.5642*** (0.0526)	0.295
Cash <sub><i>it-2</i></sub>	0.0534*** (0.0170)	0.1198*** (0.0136)	0.1058*** (0.0263)	0.1538*** (0.0416)	0.387
Inv <sub><i>it-1</i></sub>	-0.0073 (0.0156)	-0.0205 (0.0131)	0.0119 (0.0083)	0.0037 (0.0047)	0.053
Tang <sub><i>it-1</i></sub>	0.0070 (0.0046)	0.0030 (0.0042)	0.0023 (0.0031)	-0.0008 (0.0043)	0.001
NWC <sub><i>it-1</i></sub>	-0.0047*** (0.0018)	-0.0064*** (0.0017)	-0.0057*** (0.0018)	-0.0051 (0.0040)	0.782
Lev <sub><i>it-1</i></sub>	-0.0531*** (0.0118)	-0.0217** (0.0091)	-0.0159 (0.0132)	-0.0252* (0.0151)	0.740
CFV <sub><i>it-1</i></sub>	0.1213*** (0.0194)	0.0651*** (0.0129)	0.0476** (0.0187)	0.0083 (0.0339)	0.070
CF <sub><i>it-1</i></sub>	0.1252*** (0.0173)	0.0930*** (0.0132)	0.0190 (0.0213)	0.0442* (0.0233)	0.011
Micro / Small <sub><i>it-1</i></sub>	0.0222*** (0.0027)				
Medium <sub><i>it-1</i></sub>	0.0017 (0.0018)				
Fixed Effects	Yes	Yes	Yes	Yes	
Number of observation	50,072	33,381	11,199	3150	
Number of firms	13,085	9814	2790	728	
Hansen test	0.0976	0.259	0.0673	0.839	
AR(1)	0	0	0	1.35e-05	
AR(2)	0.454	0.634	0.631	0.243	

Source: Authors own calculations.

Note: Standard errors in parentheses. Statistical significance: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

The results also show that the relationship between the firm's indebtedness level and liquidity is negative and statistically significant. This result supports the theory presented by Ferreira and Vilela (2004), who argue that the existence of debt fosters a closer relationship between the firm and financial institutions which facilitates future financing, allowing the firm to reduce their liquidity levels.<sup>2</sup> As expected, the effect of net working capital is negative and statistically significant, which suggests that it may effectively function as a substitute for cash. Finally, it should be noted that the effect of both the firm's investment rate, which would aim to capture future business

2. The results that are presented were obtained for companies that have debt. However, we also estimated the model for the sample that also includes companies that do not have debt and including as explanatory variable a binary variable indicating whether the company is indebted or not. The effect captured by this variable is also negative and significant indicating that using only the indebted companies does not qualitatively change the results.

opportunities, and the proportion of tangible assets, from which we expected a negative coefficient since these tangible assets could, in theory, be used as collateral thereby facilitating access to credit (Hart and Moore, 1994), are not statistically significant.

The effect of the binary variables that control the activity sector enterprises indicates that the liquidity levels of firms differ significantly between sectors. Additionally, the model was re-estimated by dividing the sample into three sub-sectors of activity (industry, construction and services) where the qualitative results did not change.

Finally, focusing the analysis on the binary variables that control for firm size, we find that smaller firms tend to have a higher liquidity level, with only micro/small enterprises to have a statistically significant difference from the omitted group, i.e. the large enterprises. However, in order to test for significant differences in the effect of the variables of interest according to the firm size, namely the cash-flow and the cash-flow volatility, we estimated the model presented above for each size category.

Columns 2-4 of Table 1 summarize the main results of the estimations by firm size. Focusing attention on the variables which aim to assess the existence of liquidity constraints, both cash-flow and cash-flow volatility are positive and statistically significant. However, this statistical significance occurs only for micro/small and large companies in the case of cash-flow. Based on the model presented in Almeida et al (2004), this result suggests that these two size classes of firms are affected in credit access. Nevertheless in the case of large firms the magnitude of the coefficient is small and significant only at the 10 per cent confidence level. Additionally, and with the objective to test for statistical differences between these two categories, we performed a Hausman test and conclude that the coefficients of both groups are statistically different from one another, suggesting that the restrictions for micro/small enterprises are especially relevant. Regarding the cash-flow volatility, it is positive and statistically significant for micro/small and mid-size companies. This result reinforces those found previously, supporting the theory presented by Han and Qiu (2007). Finally, it should be noted that the net working capital is statistically significant except in the case of large firms suggesting that for these the need to use alternative sources of liquidity is lower.

## 4. Conclusion

The aim of this study is to test the existence of financial constraints in accessing credit by the business sector in Portugal. In that regard, we follow closely the work of Almeida et al (2004) and Han and Qiu (2007). With respect to Almeida et al (2004), the authors develop a model where companies that face financial constraints, due to the difficulty of getting credit, are dependent on realizing (and retaining) yearly profits to fund future business opportunities, while the companies without financial constraints do not exhibit this same dependence. Similarly, Han and Qiu (2007) present a model in which firms that have difficulty accessing credit are sensitive to past profits volatility while companies with no financing constraints exhibit no sensitivity.

From an aggregate perspective, the results of this study effectively point toward the existence of limited access to external financing by Portuguese companies. In this regard, firms' liquidity appears to be positively related to their profitability levels, indicating that they retain internal resources in order to finance future projects. Additionally, there are also signs of a positive relationship between liquidity and past cash-flow volatility suggesting that companies hold cash in order to protect themselves against future negative shocks.

Finally, there is evidence of heterogeneity within firm size groups. More specifically, the results indicate that although all types of firms do show some level of restrictions on credit access these are



especially relevant for smaller companies. In particular, micro and small firms exhibit significantly higher sensitivity than larger firms. This result may also suggest that, besides having greater difficulties in accessing credit, smaller firms attach a greater value to the option of holding liquid assets.

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## Annex 1 – Variables definition

Liquidity ratio (Liq.) – Ratio between “Cash and deposits” and total assets.

Cash flow (CF) – Ratio between EBIT (Earnings Before Interest and Taxes) and total assets.

Volatility of cash flow (CFV) – Standard deviation of cash flows recorded in the previous five years.

Investment rate (Inv) – Ratio between total investment and total assets.

Tangible assets ratio (Tang) – Ratio between tangible assets and total assets.

Net working capital (NWC) – Ratio between short term assets other than cash plus trade credit (net) and total assets.

Leverage (Lev) – Ratio between financing obtained and total assets.