DISCLOSURE AND LIQUIDITY[♦]

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Abstract

The purpose of this paper is to test empirically the relationship between two important concepts: disclosure and liquidity. Using a sample of Spanish quoted firms between 1994 and 2000 we show that the estimation of the relationship between disclosure and liquidity depends crucially on two factors: a) the multidimensionality of the concept of liquidity; b) the use of an econometric methodology that deals properly with the features of the sample used. However the use of the Amihud (2002) illiquidity measure provides evidence in favour of a positive relationship between disclosure and liquidity.

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1. INTRODUCTION

The level of transparency of companies' annual reports has become a central theme of debate in recent years. On both sides of the Atlantic, companies that seemed perfectly healthy from a financial point of view suddenly had to announce that were experiencing solvency problems and in few months or weeks had collapsed. These major bankruptcies called into question the usefulness of annual reports as an information source for investment decisions.

These doubts on the relevance of accounting information for stock valuation are not new. Already Lev (1989) questioned the usefulness of earnings as value relevant information in a stock market.

However the recent debate has shifted the focus of attention from the usefulness of "accounting numbers" to the importance of "transparency" on issues regarding company life. The public reaction to the scandals has obviously called into question existing accounting standards on issues that are quantifiable and may enter directly company accounts. But it has also raised the question of how much information companies should provide on non quantifiable issues regarding corporate governance (composition of the board, connections with other companies, etc…) or on quantifiable issues that may not enter directly company accounts (risk evaluation, market forecasts, etc…).

This is the reason why it is critical to increase our understanding of how transparency of companies' annual reports affects, for example, volatility, expected returns or liquidity.

Using a database of companies that quote on the Madrid Stock Exchange (MSE, hereafter), we want to study if a different level of disclosure quality in the annual report has an effect on the liquidity of the company stock.

The remainder of the paper is organized as follows. In the following section we review the relevant related literature and we present our hypothesis and the novelty of our analysis. In section 3 we summarize the sample selection procedure and the variables we will use in our study. Section 4 presents our empirical results. Finally, section 5 provides some conclusions.

2. RELATED LITERATURE

The possible effects of quantity and quality of disclosure on the stock market behaviour have been studied fairly extensively, both from a theoretical and from an empirical point of view.

From a theoretical point of view Dye (2001) pointed out that there exist two main strands in the disclosure literature: mandatory disclosure and voluntary disclosure.

Mandatory (or exogenous) disclosure models are usually set up as extensions of general equilibrium asset pricing model. Suppose for simplicity that there exists only one risky asset. Risk-averse traders receive some information (disclosure) about the value of the risky asset and afterwards are allowed to trade. Verrecchia (2001) calls these models "association-based disclosure models" and provides a comprehensive survey of those that have appeared in the accounting literature. While trying to theoretically found the existence of a relationship between disclosure and liquidity, "association-based disclosure models" seem to be the natural candidates because they clearly derive mathematical relations between disclosure and price and/or volume.

The reason why public disclosure can be a crucial determinant of liquidity in these models is fairly intuitive. The intuition was already implicit in the original model by Kyle (1985) or Glosten and Milgrom (1985). In these models, liquidity is negatively related to the level of adverse selection present in the market. The more likely it is that there exist traders in the market that have an informational

advantage over the rest of the traders the less liquid is the market. This reduction of liquidity can be observed in higher level of spreads (Glosten and Milgrom, 1985) or lower amount of depth (Kyle, 1985).

More public information known by the agents that interact in the market may imply lower adverse selection and hence, higher liquidity. Consequently it is natural to extend this analysis by studying the effect that public disclosure can have over the level of adverse selection and liquidity in the market. If more transparency implies lower level of adverse selection, then we expect to find a positive relationship between disclosure and liquidity. This can be stated in the following hypothesis:

H_1(a): Higher levels of quality of the information disclosed by a company annual report implies higher levels of liquidity of its stocks.

However, it has to be pointed out that there exist theoretical models that provide a rationale for the opposite result to hold. According to Kim and Verrecchia (1994), if public announcements are interpreted differently by different traders, then it is possible that information asymmetry increases after the announcement has taken place. This is because sophisticated investors may learn more from the public announcement than unsophisticated investors. If this is the case, then disclosure actually decreases market liquidity. Hence we can state the following alternative hypothesis:

H_1(b): Higher levels of quality of the information disclosed by a company annual report implies lower levels of liquidity of its stocks.

Turning our attention to the second strand of literature, we can describe the theoretical literature on voluntary (endogenous) disclosure as a natural extension of the asymmetric information models. Assuming that information about the stock is imperfect and/or incomplete, then any "disclosure" made by an informed party(s) (the firm) to some other less informed party(s) (the investors) may affect

the amount of information asymmetry and as a consequence on some relevant variables like volatility or liquidity.

The original unravelling result of, for example, Milgrom (1981) tells us that no value relevant information can be successfully withheld in equilibrium. This prediction seems to go against the observation that in real life companies do manage to hide information to the market. This is the reason why voluntary disclosure models have tried to explain why we have only partial disclosure in equilibrium instead of full disclosure. However the basic intuition of the original unravelling result is still valid in most of the following models: companies that are convinced that they have some good news have an incentive to voluntarily disclose them. If they do not do it, it is because there are some other elements that prevent them (e.g. some cost of disclosure that outweighs its benefit).

Voluntary disclosure models do not study directly the effect of disclosure on liquidity. They usually focus on the effects on information revelation on the valuation of a company and predict that higher transparency should be correlated with a higher equilibrium price or with a lower cost of equity capital.[3] The reason behind the result is similar to the one presented for the mandatory disclosure models: public disclosure reduces the level of adverse selection in the market. Hence if liquidity is an inverse function of adverse selection, then voluntary disclosures should increase market liquidity. Hence the voluntary disclosure literature provides theoretical support to a positive relationship between disclosure and liquidity (i.e. to hypothesis $H_1(a)$)

As we can see, both in the mandatory case and in the voluntary case the effect of disclosure on liquidity is never a direct one. It always goes through the effect of disclosure on the level of adverse selection, which is difficult to measure empirically.

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[3] However Gietzmann and Trombetta (2003) shows that the relationship may be more complicated if various communication channels can be used.

Another important issue to take into account is the trading mechanism operating in markets. We can distinguish between "driven by order" markets and "driven by prices" markets. The main difference between them is the existence or not of market makers doing transactions by their own account. Driven by orders markets, like the Spanish one, can be formally described by the ideal electronic open limit order book framework proposed by Glosten (1994). This author presents a theoretical model of price revisions due to the information conveyed by trading throughout the limit order book mechanism. This is the framework in which the relationship between disclosure and liquidity is estimated. According to Glosten's model, liquidity measures are direct measures of adverse selection[4].

Lee *et al.* (1993) provide evidence on the bi-dimensional character of liquidity as a concept. Spread and depth do not measure the same aspect of liquidity. Hence an analysis that only considers one of the liquidity dimensions may be biased, because results depend on the variable used to measure liquidity. More generally, it is important to highlight that in order to asses the impact of information decisions on liquidity we should consider simultaneously immediacy costs (spreads), depth and variables that are considered good proxies of liquidity. This is the reason why we are going to measure liquidity using four different proxies. If multidimensionality is relevant, then the results should depend on the liquidity measures used. We state this in the following hypothesis

H₂: The effect on liquidity of the quality of the information disclosed by a company annual report, depends on the liquidity measures considered.

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[4] We are not going to estimate directly the level of adverse selection characterizing the stocks object of our analysis. As Van Ness *et al.* (2001) show, the results related to the level of adverse selection of an asset depend very much on the model used to estimate it. Moreover, these authors compare the adverse selection measures and the spread with several volatility measures. Their results show that spread contains an important part of the adverse selection and that it is related to volatility.

Four previous studies are directly related to ours: Welker (1995), Healy, et al. (1999), Heflin, et al. (2002) and Leuz and Verrechia (2000).

Welker (1995), Healy, et al. (1999) and Heflin, et al. (2002) all work with US data and use the Association for Investment and Management Research (AIMR) score to measure disclosure.

Welker (1995) uses a panel of data including those companies that have an AIMR disclosure score for the years 1983 to 1990. He finds that disclosure has a positive effect on liquidity. While he correct for the possible endogenous nature of the disclosure variable, he does not correct for any possible time or company dependence generated by the type of data (panel) used. Moreover he only uses the relative bid-ask spread as a measure of liquidity. In our study we are going to use proper panel data estimation techniques and to apply them to four alternative measures of liquidity.

Healy, et al. (1999) start from a similar set of data, i.e. companies with an AIMR score for the years 1980 to 1990, but investigate the effect of "substantial" increases in disclosure levels. Hence they include as observations in their estimations only the maximum increases in the disclosure score for each of the company in the sample, no matter in which year it has taken place. They find that a substantial increase in disclosure has a positive effect on liquidity.Their sample selection procedure delivers a fairly small sample (97 observations) and restricts the analysis to a specific aspect of the disclosure, i.e. substantial increase in disclosure. Moreover, as Welker (1995) they use only the relative bid-ask spread as their liquidity measure. We believe that a more general analysis of the effect of disclosure levels on liquidity levels is still worth pursuing through the use of a panel of data.

Heflin, et al. (2002) use only one year of AIMR data (1988) and considers both effective spread and depth. They find that firms with higher quality disclosures have lower effective bid-ask spreads but lower quoted depths. To investigate the

nature of this effect, they estimate information asymmetry spread components within different levels of trade size (scaled by depth). Their main result is that firms with high disclosure quality exhibit less likelihood of informed trading, even when trade size is close to the quoted depth. As a consequence, they show that higher quality disclosures policy reduces the risk of informed trading and enhances market liquidity. The work by Heflin et al. (2002) is the only one so far, that has explicitly dealt with the multidimensionality problem of liquidity. However the fact of using only one year of data leaves out the possibility of taking into account the possible time dependence of liquidity for a certain company. The use of a full panel of data for 7 years will allow us to take this aspect into account. Moreover we introduce the Amihud (2002) illiquidity measure that represents the price impact when trade volume is normalised to one euro. The results regarding this measure can be seen as a parsimonious way of reconciling the potentially contrasting results regarding spread and depth.

Finally, Leuz and Verrecchia (2000) examine bid-ask spreads for German firms that choose to adopt an higher level of disclosure, i.e. that adopt IAS or US accounting standards. They find that these firms have lower bid-ask spreads than firms that adopt a lower level of disclosure, i.e. that adopt German accounting standards. However, similar top Heflin et al. (2002), they restrict their analysis to the 1998 reporting choice. Moreover the dichotomous nature of their disclosure variable prevents from studying the effects of more than two levels of disclosures.

In summary, even if these are already important results, we believe that there are some good reasons to investigate further the relationship between disclosure and liquidity empirically. In particular we believe that study of the relationship between disclosure for a full panel of data, considering various alternative measures of liquidity and using proper panel data estimation technique is still lacking. The aim of this paper is to provide this analysis as the basis to test the hypothesis presented before.

3. SAMPLE SELECTION AND DATA

Our initial sample is made of all the companies that quote on the Madrid Stock Exchange (MSE) between 1994 and 2000 and for which we have a measure of the quality of disclosure in their annual report. From this initial sample we only consider those firms for which we have liquidity measures and returns. The final size of our sample depend on the liquidity measures used and ranges from 658 firm-year observations to 704 firm-year observations.

3.1 Proxy for disclosure

Our measure of disclosure quality is taken from a business magazine ("Actualidad Económica"). This magazine publishes each year a ranking of the annual reports of the companies that trade on the Spanish continuous market.

A pool of experts grades several aspects of the information contained in the annual report. These grades are added up in order to produce a score that measures the quality of the information provided. Contrary to the AIMR score used in the previous US based studies, in the Spanish case the pool of experts is the same for all the companies considered. This guarantees consistency across industries.

Among the items considered we find: historical data, analytical account of results, composition of shareholding, shares percentage held by the board of directors, order and clarity of the report, design, number of branches, directors' remuneration, returns on shares, market evolution, review of operations, on-line information[5].

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[5] The full list of items is provided in the appendix.

A score is given for each one of these items of the annual report. With these scores we have created a disclosure index based on the sum of scores obtained divided by the maximum sum of scores obtainable. For example, CEPSA in 2000 was given a total score of 54, and as the maximum available was 100 points, the index of quality of disclosure takes the total value 0.54.

3.2 Liquidity measures

We use various liquidity measures. The main reason to study the effects on different liquidity measure is to capture the bidimensionality problem. The first paper that deals empirically with the bidimensionality problem is Lee *et al*. (1993). These authors show that NYSE specialists actively manage information asymmetry risk by adjusting both immediacy costs (spreads) and market depth. The main implication is that definitive inferences about market liquidity are impossible analysing only immediacy costs or depth. Other papers as, for example, Jones and Lipson (2001) and Chordia *et al*.(2001), point out the relevance of considering both dimensions simultaneously to measure the impact of policy decisions and information events on liquidity.

So, liquidity unambiguously changes whenever immediacy costs and depth move in opposite directions or one of them changes and the other one remains constant. In order to take into account this problem we calculate four different liquidity variables:

i.   Bid-Ask spreads: calculated as the yearly average of daily relative bid-ask spreads. These daily bid-ask spreads are calculated as the average of the best bid and ask quotes divided by their mid point.

ii. Depth: is an aggregate measure of the shares available in the best level of the limit order book. They are calculated like relative spreads

iii. The Market Quality Index (MQI hereafter) proposed by Bollen and Whaley (1998): it is well know that depth and relative spread can be considered ex-ante liquidity measures. As we point out before one of the problems related with these measures is ambiguity. In order to avoid this problem different authors propose alternative measures that put together spreads and depths. Among the different measures we find Pascual *et al* (2004), Martinez *et al* (2004), or Beston *et al* (2000). MQI is a ratio of mean average Depth divided by relative spread. We use daily observations of both variables. Its formula is

$$MQI = \frac{(\text{Depth at bid} + \text{Depth at ask})/2}{\text{Relative spread}}$$

iv. The Amihud (2002) measure: this measure captures in a very simple but intuitive way the price impact as the response associated with one euro of trading volume. However we will use an alternative adjusted for market liquidity.

Amihud (2002) formula is given by

$$ILLQ_{jt} = \frac{1}{D_{jt}} \sum_{d=1}^{D_{jt}} \frac{\left| R_{jdt} \right|}{V_{jdt}}$$

where R_{jdt} and V_{jdt} are, respectively, the return and euro volume on day d in month t, and D_{jt} is the number of days with observations in month t of stock j. When a particular stock has a high value of $ILLQ_{jt}$ it indicates that the price moves quite a lot in response to trading volume and, therefore, the stock is considered to be illiquid. It is important to point out that Hasbrouck (2002) finds that this measure appears to be the best among the usual proxies employed to capture Kyle´s lambda. Also, Martinez *et al.*

(2005) find that Amihud measure is the only aggregated liquidity variable that is priced in MSE.

3.3 Control Variables

i.   Volatility

We construct one measure of *volatility* (VOLAT). This variable is the standard deviations of the daily returns for each stock on each year divided by the same volatility measure of the value weight index of SIBE, IBEX-35®. We calculate this ratio of standard deviations of daily returns of stocks relative with the IBEX-35® to obtain idiosyncratic volatility measures relative to market volatility. Values of the ratio above 1 will show higher volatility than the mean average independently of stock volatility level.

ii.   Size

Size is measured by the logarithm of the market value at the 30th of June of each year. Bigger firms are shown by investors as less information asymmetry risky, because the level of information available is usually higher for this kind of firms. For Spanish listed stocks, López and Marhuenda (2002) provide evidence of a higher level of analysts' following for bigger firms, which provide filtered and processed information regarding the company. Hence, we expect a positive relationship between our proxy for size and liquidity.

iii.   Effective Volume

Effective Volume is measured by the natural logarithm of the annual average of the daily effective volume (number of shares times transaction price) of each year.

This list of control variables is in line with the previous literature such as Heflin et al. (2002) or Welker (1995).

4. EMPIRICAL ANALYSIS

4.1 Univariate analysis

Table 1 provides sample size and summary statistics for each year of our analysis.

[Table 1 around here]

We can observe that median disclosure quality experiences a period of steady increase between 1993 and 1998, but then falls back to the 1995 level. Relative spread is non increasing almost every year (1997 is the only exception). We can also notice the decrease in the standard deviation of this liquidity measure. In the final years of the sample we can also observe a decrease in depth. MQI is increasing all over the sample, except for year 1999 and 2000. It is important to note that Amihud measure suffer an important change in the median and standard deviation values from the first part of the sample (1994 to 1997) relative to the last part (1998-2000). This change means an important increase in liquidity.

In table 2 Spearman correlations coefficients are provided

[Table 2 around here]

In terms of correlations we can notice that the disclosure index is highly correlated with all the other variables except depth. The correlation with size and volume may cause a multicollinearity problem. This is the reason why we will orthogonalise these variables in the rest of the analysis. The high correlation

between disclosure and volatility provides us with a first proof that volatility can play a crucial role in determining the effect of disclosure on liquidity.

Also, the correlations between disclosure and all the liquidity measures (except for depth) are all of the expected sign and significant indicating that higher disclosure is related with higher level of liquidity.

4.2 Multivariate analysis

In order to test our hypothesis we will first use the following model

$$LIQ_{it} = \alpha + \beta_1 DISC_{i,t-1} + \beta_2 RSIZE_{it} + \beta_3 VOLAT_{it} + \beta_4 REFFEC_{it} + \varepsilon_{it} \quad (1)$$

where,

   i.   LIQ is one of the 4 liquidity measures described in the previous section (Relative spread, Depth, MQI or ILLQ (Amihud))

   i.   DISC is the lagged index of annual report disclosure quality

   ii.   RSIZE are the residuals of an OLS regression of the natural logarithm of the market value at the 30th of June of year t on the index of annual report disclosure quality of year $t-1$

   iii.   VOLAT is the annual average of the daily standard deviation of the stock return divided by the annual average of the daily standard deviation of the return of the IBEX market index, calculated for year t

   iv.   REFFEC are the residuals of an OLS regression of the natural logarithm of the annual average of the daily effective volume (number of shares times transaction price) on the natural logarithm of the market value and on the index of annual report disclosure quality. All the variables are calculated in year t.

The use of orthogonalised variables for size and effective volume is due to the willingness to avoid multicollinearity problems.

Table 3 presents the results of running a simple OLS regression using the pooled data.

[Table 3 around here]

We can see that disclosure has a positive and significant direct effect on liquidity. This is true for each of the four alternative liquidity measures except for Amihud (2002) illiquidity variable. One reason behind this non significance could be the differences in the variable from some years to the others. So, from these results we can accept hypothesis H_1 because it seems that there exist a significantly positive relationship between disclosure quality and liquidity.

However many companies appear in various years of our sample and this could give raise company specific effects. Moreover if we include year dummy variables in the same OLS regressions we find that most of them are significant.[6] This provides evidence in favour of some time dependence of the results. Both these problems may give raise to estimates of the parameters that can be inconsistent and/or inefficient.

In order to take into account the possibility of company specific effects we will estimate the same model but with cross-section specific intercepts (fixed effects).[7] To deal with the year dependency problem we modify our dependent variable. We subtract from the liquidity measure for a certain company in a certain year the average across companies of the same liquidity measure for that particular year.

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[6] The results are available from the authors

[7] We have considered the alternative of using random effects. However the results of the Hausmann test on the equality of the estimates under the two methods in general are in favour of the fixed effect technique. Results are available from the authors.

These modifications should take into account the fact that part of the liquidity level for each firm is explained by year specific effects.

The modified model is the following

$$(LIQ_{it} - \overline{LIQ_t}) = \alpha_i + \beta_1 DISC_{i,t-1} + \beta_2 RSIZE_{it}$$
$$+ \beta_3 VOLAT_{it} + \beta_4 REFFEC_{it} + \varepsilon_{it}$$

(2)

where all the variables are defined as before apart from $\overline{LIQ_t}$, which is the average across firms of the liquidity measure for year t. Notice that now the intercept is company specific. The results of the estimation of this fixed effect model are presented in Table 4. In order to save make the presentation clearer, the company specific intercepts have been omitted.

[Table 4 around here]

If we compare the results of table 3 with the results of table 4 we notice important differences. Disclosure is always significant as a determinant of liquidity, no matter which liquidity measures is used. However the *direction* of the effect of disclosure on liquidity depends crucially on the liquidity measures used. If we look at the relative spread or at the Amihud (2002) illiquidity measure we see that higher level of disclosure imply higher level of liquidity. This is in line with the results of table 3 and supports hypothesis H_1(a). However if we look at depth and at the MQI index higher level of disclosure imply lower levels of liquidity. These latter results contradicts the simple OLS results of table 3 and supports hypothesis H_1(b).

Overall the results of table 4 confirm the existence of a multidimensionality problem in the study of liquidity and support hypothesis H_2, i.e. the nature of the relationship between disclosure and liquidity depends on the liquidity measures used.

The same is true if we look at the size variable. In the fixed effects models its sign is the opposite that in the standard OLS regressions when we consider depth and MQI. Hence also the effect of size on liquidity depends on the liquidity measures used. Effective volume and volatility are almost always not significant, whereas they were always significant in the standard OLS regressions.

The final column of table 4 provides the values of the Durbin-Watson statistic. In the controversial cases, i.e. depth and MQI, its value is fairly low and rejects the hypothesis of absence of serial correlation. So the next step in our analysis is to re-specify the model by including an autoregressive component as follows.

$$(LIQ_{it} - \overline{LIQ}_t) = \alpha_i + \delta(LIQ_{i,t-1} - \overline{LIQ}_{t-1}) + \beta_1 DISC_{i,t-1} + \beta_2 RSIZE_{it} \\ + \beta_3 VOLAT_{it} + \beta_4 REFFEC_{it} + \varepsilon_{it} \tag{3}$$

Even if, according to their Durbin-Watson statistic in table 4, serial correlation did not seem to be a problem in the case of relative spread and Amihud (2002) illiquidity measure we run model (3) for all four liquidity measures. The results are provided in table 5.

[Table 5 around here]

The inclusion of the autoregressive component in the model does not change the substance of the results. However it is significant in three cases out of four, showing the importance of taking into account the autocorrelation of liquidity in a yearly basis. Disclosure is always significant as a determinant of liquidity, but again the *direction* of its effect depends on the liquidity measures used. It has a positive effect on the relative spread and on the Amihud illiquidity measure, but it has a negative effect on depth and on the MQI.

5. CONCLUSIONS

The recent corporate scandals on both sides of the Atlantic have brought the issue of transparency to the centre of the public debate on market regulation. In this paper we have investigated whether the quality of annual report disclosures is significantly related to a crucial dimension of the functioning of the stock market: liquidity.

Using a sample of firms quoted on the Spanish Stock Exchange between 1994 and 2000, for which we have a measure for the quality of annual report disclosures, we have tested the hypothesis that more transparency is associated with a higher level of liquidity.

Our regressions show how the direction of the relationship depends crucially on the liquidity measures used. More transparency reduces the relative spread and the Amihud (2002) measure of market illiquidity, but it also reduces depth and the Market Quality Index proposed by Bollen and Whaley (1998). These results are in line with those obtained by Heflin et al. (2002) for the US market. However we have extended their analysis by taking into account the Amihud (2002) illiquidity measure. This measure provides a representation of the price impact once we have normalized trade *volume* to one euro. With respect to this representation, our findings show a positive effect of disclosure on liquidity. This result is also in line with the findings of Heflin et al. (2002) that disclosure affects positively market liquidity once we control for trade *size*. So we can interpret our results concerning the Amihud (2002) illiquidity measures as another parsimonious way of reconciling the contrasting evidence in terms of spread and depth and conclude that indeed disclosure has a positive effect on liquidity.

Moreover we were able to show the importance of using an appropriate estimation technique when using panel data. For the two of the four liquidity measures the sign of the coefficient of the disclosure variable changes when we move from

standard OLS regressions to a fixed effect model that takes into account time dependence as well. So a result that would have seemed clear from standard OLS regressions, i.e. disclosure has a positive effect on liquidity, becomes far less clear when we use panel data techniques. Moreover variables that seem to play a crucial role as determinant of liquidity when standard OLS are used, looses their significance when possible company specific and year specific effects are taken into account. In particular this is the case of volatility that ceases to be significant.

Hence the main message of our analysis is that the relationship between disclosure and liquidity can not be studied without taking into account two fundamental issues: a) the multidimensionality of the concept of liquidity and consequently the choice of the liquidity measures; b) the use of an econometric methodology that deals properly with the features of the sample used.

Finally we have also shown that liquidity can have an important autoregressive component in a yearly basis that had not been highlighted by the previous studies.

In terms of future research we believe that more theoretical work is needed in order to rationalise the contrasting evidence regarding spread and depth. Moreover the list of control variables should be extended to include a proxy for the composition of shareholdings. The crucial role played by this variable in mediating disclosure effects has already been shown by the work of Bushee and Noe (2000).

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TABLE 1

Median, Standard Deviation and Number of Observations of the Variables

	Years	1993	1994	1995	1996	1997	1998	1999	2000
Disclosure	**Median**	0.53	0.55	0.60	0.60	0.62	0.65	0.58	0.58
	Std.Dev.	0.13	0.15	0.16	0.16	0.16	0.16	0.16	0.15
	N	131	137	133	138	142	125	103	122
Relative Spread	**Median**		1.21	1.01	0.94	0.83	0.88	0.88	0.88
	Std.Dev.		1.78	1.76	1.26	1.09	1.27	0.61	0.73
	N		120	122	130	146	154	132	134
Depth/1000	**Median**		1.85	1.91	1.98	1.85	1.56	1.14	1.17
	Std.Dev.		18.90	31.56	35.71	105.98	280.13	896.84	141.32
	N		120	122	130	146	154	145	134
MQI/1000	**Median**		1.65	2.24	2.32	2.51	2.04	1.69	1.72
	Std.Dev.		54.59	105.45	89.23	90.31	156.96	392.32	163.38
	N		120	122	130	146	154	132	134
ILLQ	**Median**		13.26	23.49	12.11	7.71	3.04	1.68	2.65
	Std.Dev.		39.72	85.40	34.34	34.16	5.88	2.82	4.63
	N		110	115	119	126	135	124	124
Volatility	**Median**		1.10	0.49	0.44	0.88	1.09	0.88	0.69
	Std.Dev.		3.02	1.91	1.55	0.90	1.58	1.39	2.09
	N		117	123	122	130	137	142	145
Effective Volume	**Median**		23.72	28.88	61.88	99.51	77.48	75.71	91.04
	Std.Dev.		104.37	155.63	258.98	494.41	721.18	1040.26	1194.51
	N		120	122	130	146	154	145	134
LnMkvalue	**Median**		10.51	10.58	10.70	11.11	11.27	11.01	11.13
	Std.Dev.		1.58	1.64	1.70	1.63	1.61	1.72	1.72
	N		106	108	115	125	119	130	134

NOTES: Relative Spreads are calculated as the yearly average of the daily relative spreads. Depth is an aggregated measure of the number of shares available in the best level of the limit order book. MQI is the mean average depth divided by relative spread. We use daily observations of both variables. ILLQ captures the price impact as the response associated with one euro of trading volume. It is defined as the average of the stock returns divided by the effective volume. DISC is the index of quality of disclosure. VOLAT is the standard deviation of daily stock returns for each stock, divided by the same volatility measure of the value weight index of SIBE, IBEX-35®. Effective Volume is measured by the natural logarithm of the annual average of the daily effective volume (number of shares times transaction price) of each year.

TABLE 2

SPEARMAN CORRELATION COEFFICIENTS

	ILLQ	MQI	LnMkvalue	LnEffec	Depth	Volat	Spread
MQI	-0.67						
	(0.00)***						
LnMkvalue	-0.82	0.39					
	(0.00)***	(0.00)***					
LnEffec	-0.94	0.68	0.74				
	(0.00)***	(0.00)***	(0.00)***				
Depth	-0.36	0.88	0.07	0.40			
	(0.00)***	(0.00)***	(0.04)**	(0.00)***			
Volat	0.28	-0.01	-0.33	-0.20	0.15		
	(0.00)***	(0.87)	(0.00)***	(0.00)***	(0.00)***		
Spread	0.89	-0.74	-0.71	-0.81	-0.37	0.24	
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	
Disclosure	-0.41	0.17	0.48	0.33	-0.02	-0.32	-0.39
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.56)	(0.00)***	(0.00)***

NOTES: Relative Spreads are calculated as the yearly average of the daily relative spreads. Depth is an aggregated measure of the number of shares available in the best level of the limit order book. MQI is the mean average depth divided by relative spread. We use daily observations of both variables. ILLQ captures the price impact as the response associated with one euro of trading volume. It is defined as the average of the stock returns divided by the effective volume. DISC is the lagged index of quality of disclosure for period 1993 to 1999. VOLAT is the standard deviation of daily stock returns for each stock, divided by the same volatility measure of the value weight index of SIBE, IBEX-35®. Effective Volume is measured by the natural logarithm of the annual average of the daily effective volume (number of shares times transaction price).

*Statistically significant at a 10% level

** Statistically significant at a 5% level

*** Statistically significant at a 1% level

TABLE 3

OLS REGRESSIONS

$$LIQ_{it} = \alpha + \beta_1 DISC_{i,t-1} + \beta_2 RSIZE_{it} + \beta_3 VOLAT_{it} + \beta_4 REFFEC_{it} + \varepsilon_{it}$$

(p-value in brackets)

Dependent Variable	n	Intercept	DISC	RSIZE	VOLAT	REFFEC	Adj.R^2 F-statistic
Spread	685	1.76 (0.00)***	-1.78 (0.00)***	-0.25 (0.00)***	0.24 (0.00)***	-0.35 (0.00)***	0.48 (0.00)***
Depth	704	-13.99 (0.00)***	23.33 (0.00)***	2.76 (0.00)***	4.25 (0.00)***	3.05 (0.00)***	0.07 (0.00)***
MQI	685	-28.66 (0.00)***	50.38 (0.00)***	10.48 (0.00)***	5.14 (0.00)***	5.10 (0.00)***	0.11 (0.00)***
ILLQ	681	-12.85 (0.31)	-5.92 (0.48)	-2.01 (0.01)**	13.40 (0.02)**	-6.03 (0.00)***	0.15 (0.00)***

NOTES: LIQ. Is one of our four proxies of liquidity/illiquidity (Relative Spread, depth, MQI ratio or Amihud). Bid-ask spread are calculated as the yearly average of the daily relative bid-ask spreads. Depth is an aggregated measure of the number of shares available in the best level of the limit order book. MQI is the mean average depth divided by relative spread. We use daily observations of both variables. ILLQ captures the price impact as the response associated with one euro of trading volume. It is defined as the monthly average ratio of absolute return and euro volume. DISC is our lagged proxy for obtained for each year from 1993 to 1999. RSIZE is our proxy for firm size, obtained from the residuals of the regression of size (Lnmkvalue) on disclosure, so that we include an orthogonalised variable in order to avoid a multicollinearity problem. VOLAT is the standard deviations of daily stock returns for each stock on each year, divided by the same volatility measure of the value weight index of SIBE, IBEX-35®. REFFEC is our proxy for firm trading activity, obtained from the residuals of the regression of the natural logarithm of the annual average of daily effective volume on the natural logarithm of market value and disclosure, in order to obtain an orthogonalised variable and avoid again multicollinearity.

*Statistical significance at the 10% level
** Statistical significance at the 5% level
*** Statistical significance at the 1% level

TABLE 4

FIXED EFFECTS

$$(LIQ_{it} - \overline{LIQ_t}) = \alpha_i + \beta_1 DISC_{i,t-1} + \beta_2 RSIZE_{it} + \beta_3 VOLAT_{it} + \beta_4 REFFEC_{it} + \varepsilon_{it}$$

(p-value in brackets)

Dependent Variable	n	DISC	RSIZE	REFEC	VOLAT	Adj.R² F-statistic	Durbin-Watson
Spread	685	-1.71 (0.00)***	-0.37 (0.00)***	-0.22 (0.00)***	-0.09 (0.10)	0.63 (0.00)***	2.31
Depth	704	-36.33 (0.00)***	-8.58 (0.00)***	0.53 (0.63)	-2.62 (0.25)	0.40 (0.00)***	1.26
MQI	685	-42.09 (0.05)**	-7.41 (0.11)	1.82 (0.38)	0.17 (0.96)	0.42 (0.00)***	1.52
ILLQ	681	-31.88 (0.02)**	-7.16 (0.01)**	1.79 (0.75)	8.24 (0.04)**	0.53 (0.00)***	2.95

NOTES: LIQ. Is one of our four proxies of liquidity/illiquidity (Relative Spread, depth, MQI ratio or Amihud). Bid-ask spread are calculated as the yearly average of the daily relative bid-ask spreads. Depth is an aggregated measure of the number of shares available in the best level of the limit order book. MQI is the mean average depth divided by relative spread. We use daily observations of both variables. ILLQ captures the price impact as the response associated with one euro of trading volume. It is defined as the monthly average ratio of absolute return and euro volume. $\overline{LIQ}$ is the average of the liquidity measure across firms for each year. DISC is our lagged proxy for obtained for each year from 1993 to 1999. RSIZE is our proxy for firm size, obtained from the residuals of the regression of size (Lnmkvalue) on disclosure, so that we include an orthogonalised variable in order to avoid a multicollinearity problem. VOLAT is the standard deviations of daily stock returns for each stock on each year, divided by the same volatility measure of the value weight index of SIBE, IBEX-35®. REFFEC is our proxy for firm trading activity, obtained from the residuals of the regression of the natural logarithm of the annual average of daily effective volume on the natural logarithm of market value and disclosure, in order to obtain an orthogonalised variable and avoid again multicollinearity.

*Statistical significance at the 10% level
** Statistical significance at the 5% level
*** Statistical significance at the 1% level

TABLE 5

FIXED EFFECTS WITH AR(1) COMPONENT

$$(LIQ_{it} - \overline{LIQ}_t) = \alpha_i + \delta(LIQ_{i,t-1} - \overline{LIQ}_{t-1}) + \beta_1 DISC_{i,t-1} + \beta_2 RSIZE_{it} + \beta_3 VOLAT_{it} +$$
$$+ \beta_4 REFFEC_{it} + \varepsilon_{it}$$

(p- value in brackets)

Dependent Variable	n	Lagged dependent	DISC	RSIZE	REFEC	VOLAT	Adj.R^2 F-statistic	Durbin-Watson
Spread	685	-0.07 (0.45)	-0.73 (0.07)*	-0.36 (0.00)***	-0.25 (0.00)***	-0.05 (0.27)	0.70 (0.00)***	1.81
Depth	704	0.32 (0.02)**	-46.70 (0.00)***	-7.32 (0.00)***	3.06 (0.00)***	-1.16 (0.37)	0.44 (0.00)***	2.29
MQI	685	0.33 (0.06)*	-46.12 (0.03)**	-4.92 (0.30)	3.53 (0.07)*	2.96 (0.20)	0.43 (0.00)***	2.09
ILLQ	681	-0.41 (0.00)***	-36.40 (0.01)**	-11.64 (0.00)***	0.13 (0.95)	5.96 (0.00)***	0.82 (0.00)***	1.29

NOTES: LIQ. Is one of our four proxies of liquidity/illiquidity (Relative Spread, depth, MQI ratio or Amihud). Bid-ask spread are calculated as the yearly average of the daily relative bid-ask spreads. Depth is an aggregated measure of the number of shares available in the best level of the limit order book. MQI is the mean average depth divided by relative spread. We use daily observations of both variables. ILLQ captures the price impact as the response associated with one euro of trading volume. It is defined as the monthly average ratio of absolute return and euro volume. $\overline{LIQ}$ is the average of the liquidity measure across firms for each year. DISC is our lagged proxy for obtained for each year from 1993 to 1999. RSIZE is our proxy for firm size, obtained from the residuals of the regression of size (Lnmkvalue) on disclosure, so that we include an orthogonalised variable in order to avoid a multicollinearity problem. VOLAT is the standard deviations of daily stock returns for each stock on each year, divided by the same volatility measure of the value weight index of SIBE, IBEX-35®. REFFEC is our proxy for firm trading activity, obtained from the residuals of the regression of the natural logarithm of the annual average of daily effective volume on the natural logarithm of market value and disclosure, in order to obtain an orthogonalised variable and avoid again multicollinearity.

*Statistical significance at the 10% level
** Statistical significance at the 5% level
*** Statistical significance at the 1% level

APPENDIX

Our key independent variable is a measure of the quality of the companies' annual report disclosures produced by a well known business magazine ("Actualidad Económica"). The following is the list of the items considered by the magazine while computing the score.

The President's Letter: If it is signed during the first quarter of the year, it gets one point. The contents of the letter may be awarded up to 5 points if a clear definition of the company's strategy is outlined. (Scale: from 0 to 6 points).

Historical Data: 2 points if the main data for year t-2 of the profit and loss account and of the balance-sheet appear. 4 points if those for year t-3 are also included, and 6 if those for year t-4 appear as well. (Scale: from 0 to 6 points).

Basic Data: 8 points if a summary of the main data of the accounts, financial ratios and market ratios appear. Both the quantity and the quality of the data are evaluated. (Scale: From 0 to 8 points).

Analysis of results: Full analysis of the operations, mean total assets, quarterly results analysis of year t compared to year *t-1* are given up to 6 points. If only data for year *t* are included, 4 points are given. (Scale: from 0 to 6 points).

The Management's Report: 6 points, if all legally required information is included: i.e., the evolution of the business and of the current situation of the company, events that occurred after the closing of the audit, the evolution of the company, its purchases of its own shares and R+D activities. The clarity and the quantity of the information is awarded up to 12 points. (From 0 to 12 points).

Order and Clarity: the clarity, conciseness and precision of the language are valued here, as well as whether the information follows a logical order. (From 0 to 3 points).

Design: The quality of the design and its graphics and pictures. (From 0 to 2 points).

Affiliates: Two points for information about the activity, home, participation, own funds and results of different affiliates. 4 points if the dividends received by the affiliates and their book-values are included. 6 points if the accounts are included. (From 0 to 6 points).

Segmental reporting: Break-down of the business by categories of activities and geographical markets. A complete analysis of the contribution to the overall results for each of these areas is rewarded with 4 points. (From 0 to 4 points).

The Audit: 4 points for audits without qualifications, 2 for those that contain qualifications and zero if the auditor indicates limitations or reserves his opinion. The cost of the audit is evaluated on a 2-point scale. (From 0 to 6 points).

Shareholders: 2 points if it gives information about the shareholders who hold more than 10% of the firm's total stock. 4 points if the percentage of total capital is specified, and 6 if any additional information is included. (From 0 to 6 points).

Board of Directors: 2 points for information on the shares held by the board. 4 points if the participation of some of its members is also specified, and 6 if it is detailed. (From 0 to 6 points).

Directors' Remuneration: If there is global information on the total remuneration 2 points are given. 4 points if there is a breakdown. 6 points if the breakdown of Directors' remuneration is done nominally. (From 0 to 6 points).

Stock options plans: A description of the plans, beneficiaries, conditions, cost to the company and other characteristics. To achieve the maximum points, the options granted to their executives and directors must be broken-down by individual. (From 0 to 4 points).

Other Information: up to 4 points are granted to companies that offer excellent information on their true situation. The degree of concentration of sales and suppliers; their market-share; a market analysis; the volume of

distribution channels, or, information on either quality or environmental initiatives, are some of the items considered here. (From 0 to 4 points).

On-line Information: The inclusion of the annual report in the company's web page is evaluated on a two-point scale. If quarterly reports are also included it is added 2 more points. (From 0 to 4 points).

Good Policy Norms: A complete and detailed declaration of the firm's norms and policies. To achieve the maximum points, the company must explain to what degree it has managed to implement the recommendations included in the Spanish good governance ("Olivencia") Report. (From 0 to 5 points).

Evolution of the Market: 3 points if information is included on the evolution of the interest-rate, recruiting volume and days of trading. 4 if market ratios are included. 5 if the rate is compared to the general Stock Market index or the Ibex35, and 6 if it also includes the sector's index. (From 0 to 6 points).