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DISCLOSURE AND LIQUIDITY IN A DRIVEN BY ORDERS MARKET: EMPIRICAL EVIDENCE FROM PANEL DATA

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The purpose of this paper is to study the relationship between disclosure and liquidity. Previous empirical tests have focused only on US markets and have used standard least square estimation techniques even in the presence of panel data. We analyse a market (Madrid Stock Exchange) with special institutional features and use proper panel data techniques. We provide evidence in favour of a positive relationship between disclosure and liquidity. Our results prove that this positive relationship is robust to different market architectures and to the use of different liquidity measures.

Keywords: Disclosure, liquidity, market microstructure.

(*JEL* G14, M40, M41)

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,

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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.

This 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 companies' annual reports affect important features of stocks trading. The previous literature has already studied some of these issues, and has investigated the relationship between transparency and, for example, cost of equity capital (Botosan and Plumlee (2002)) or shareholders behaviour and volatility (Bushee and Noe (2000)). In this paper we will focus on liquidity. Previous research papers have already documented a positive relationship between transparency and liquidity for the US market: Welker (1995), Healy, *et al.* (1999) and Heflin, *et al.* (2005) among others. We contribute to the existing literature in three ways.

First of all, we use a database of companies that quote on the Madrid Stock Exchange (MSE, hereafter). The MSE is a driven by orders market. Contrary to what happens in the NYSE or NASDAQ, in this type of markets, there is (are) not a designated liquidity provider(s) like specialists in the NYSE or Market Makers in the NASDAQ[1]. This paper is the first to look at disclosure and liquidity in a driven by orders market. Moreover we will use both *ex-ante* and *ex-post* measures of liquidity in order to check the robustness of our results.

[1]It should be noted that the design of US markets have change from the nineties to today. Now, NASDAQ and NYSE are towards hybrid systems like Supermontage^{TM} where specialist and market makers co-exist with competitive ECNs or private investors providing liquidity to the market.

Second, we apply a different econometric technique that adapts to the type of data that we are managing. We use panel data techniques as is appropriate when using time series and cross-section data at the same time. Petersen (2007) shows that, in these cases, the use of standard OLS estimation can have important consequences on the standard errors of the coefficients estimates.

Third, we deal with the problem of measuring liquidity in a different way. Heflin, *et al.* (2005) show that the relationship between disclosure and liquidity can assume opposite signs depending on whether we look at spreads or at depth. To solve this dilemma, they use depth-adjusted effective spreads in their empirical tests. We use a new measure from the market microstructure literature. This measure proposed by Amihud (2002) captures changes in prices and trade volume at the same time. The main advantages of this illiquidity measure are twofold. First it avoids computational and data difficulties by measuring the price impact when trade volume is normalised to one euro. Secondly, previous studies, such as Acharya and Pedersen (2005) for the US and Martinez, *et al.* (2005) for Spain, prove that this measure is the only aggregated liquidity factor that is priced in the stock market.

Our results show the following.

First of all, our consistent panel data estimates show that for both the ex-ante measures (spread and depth), disclosure improves liquidity. However the effect on depth is not always statistically significant.

When we use the Amihud (2002) illiquidity *ex-post* measure we are able to document an overall positive relationship between transparency and liquidity. Hence we are able to show that this result, similar in spirit to the result of Heflin, *et al.* (2005), is robust to the use of a different measure in a different market and to the use of panel data estimation techniques.

The remainder of the paper is organized as follows. In the following section, we review the relevant related literature. In Section 3 we develop our research hypothesis. In Section 4, we summarize the sample selection procedure and the variables we will use in our study. Section 5 presents our empirical results. Finally, Section 6 provides some conclusions.

2. Related literature

Traditionally, market microstructure theory has focussed on quote driven markets with one or more market makers (see O'Hara, 1995 for an overview). However, recent studies have shifted the attention to driven by orders markets.

One of the reasons behind this increased interest in driven by order markets is the difficulty in establishing direct intermarket comparisons. Real world market structures are more complex than simple models and these structures evolve through time[2]. Hence it is not correct to assume that results established for a certain market (e.g. the NYSE) can be easily extended to market with a different institutional structure.

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. Extensions of Glosten (1994) model in a dynamic setting show different results. Parlour (1998), Foucault (1999) or Foucault, Kadan and Kandel (2005), among others, show how the order placement decision is influenced by the depth available at the inside quotes or the resiliency of the limit order book increases with the proportion of patient traders and decreases with the order arrival rate.

From the empirical point of view, we can also observe an increasing interest in explaining the empirical facts observed in driven by orders markets. DeJong, Nijman and Roëll (1996), Såndas (2001), Frey and Grammig (2006), Boehmer, Saar and Yu (2005) or Kalay, Sade and Wohl (2004), all study different and important characteristics of this type of markets. Two of the main results of this empirical literature are that, in driven by orders markets, there exist significant adverse selection costs and that these costs are more severe for smaller capitalized stocks. Moreover, in this type of markets, liquidity supply and adverse selection costs are inversely related.

In a driven by orders market, liquidity emerges from the public investors demand and supply schedules. The theoretical motivation be-

[2]For example, on one hand, during the nineties, NASDAQ and MSE are pure driven by prices and driven by orders markets respectively. On the other, NYSE has elements of both auction and dealer markets.

hind specialists' or market makers' demand and supply schedules is different from the theoretical motivation behind public investors' demand and supply schedules. Moreover, in a driven by orders market, the demand and supply schedules provided by public market participants have only ex-ante liquidity effects, i.e. before a transaction is ready to be executed. On the contrary, in a driven by prices market, after public market participants have provided their demand and supply schedules and transactions are ready to be executed, specialists liquidity providers have a chance to intervene with a better quote. This feature of driven by prices markets has the potential to create also ex-post liquidity effects over and above the ex-ante liquidity effects generated by the public market participants, as it that has already been pointed out in previous research like Parlour and Seppi (2003). For this reason the relationship between disclosure and liquidity could be different in a driven by orders market than in a driven by prices market.

This intuition is confirmed by the work of Seppi (1997) and Baruch (2005). Both authors show that the introduction of specialists into a pure driven by order market changes the behaviour of the limit order traders and, consequently, changes important features of the functioning of the market such as the relationship between tick size and liquidity (Seppi, 1997) or the effect of making the limit order book more transparent (Baruch, 2005).

Four studies are directly related to ours: Welker (1995), Healy, *et al.* (1999), Leuz and Verrechia (2000) and Heflin, *et al.* (2005).

Welker (1995), Healy, *et al.* (1999) and Heflin, *et al.* (2005) 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. However, 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 three 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.

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, 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[3].

Finally, Heflin, *et al.* (2005) use five years of AIMR data (1988-1992) 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 a depth-adjusted effective spread. Their main result is that firms with higher rated disclosures have lower depth-adjusted effective spread across different levels of trade size. As a consequence, they show a robust positive relationship between disclosure and liquidity. The work by Heflin, *et al.* (2005) is the only one so far, that has explicitly dealt with the multidimensionality problem of liquidity described, among others, by Lee, *et al.* (1993). However, as they note in the conclusion, the analysis is hindered by the fact that you need to identify splitting orders. This is not possible in our sample.

[3]Lesmond and Comprix (2005) analyse the relationship between disclosure and liquidity for a cross-country sample of firms in year 2000. They find that higher level of disclosure (measured by the Standards&Poors transparency index) is associated with higher liquidity no matter what liquidity measures is used. They also use panel data estimation techniques in order to control for country specific factors. However, given that their sample covers only one year, contrary to ours, their data set is not a conventional panel data set.

In our empirical tests we will use an alternative measure of liquidity proposed by Amihud (2002). This measure has never been used before in the disclosure and liquidity literature. In particular the Amihud (2002) illiquidity measure avoids computational and data difficulties by measuring 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. It is important to point out that Hasbrouck (2006) finds that this measure appears to be the best among the usual proxies employed to capture Kyle´s lambda. Also, Martinez, *et al.* (2005) and Acharya and Pedersen (2005) among others find that Amihud measure is the only aggregated liquidity factor that is priced. Moreover, Amihud illiquidity measure is an *ex-post* liquidity measure while traditional liquidity measures, such as bid-ask spread and depth, are *ex-ante* liquidity measures. This means that the Amihud measure captures liquidity after the price is formed and the transaction has taken place, whereas the *ex-ante* measures captures liquidity before a transaction takes place.

The importance of taking into account possible firm specific and time specific effects while using financial panel data sets, has been clearly underlined by the work of Petersen (2007). He shows both theoretically and empirically that the use of standard OLS techniques with panel data can produce biased standard errors of the estimates of the parameters.

Moreover Nikolaev and Van Lent (2005) show that the use of proper fixed-effects panel data estimation is also an effective way to deal with the endogeneity problem that characterizes the empirical disclosure literature. The endogeneity problem can be seen as a problem of correlation between the disturbance term and one or more independent variables due to some unobservable omitted variable. The fixed-effects estimation technique is a way to deal with such a problem.

The existing literature on disclosure and liquidity, while using panel data, has not checked properly the robustness of the results to the use of proper panel data estimation techniques. It is our intention to fill in this gap.

3. Research hypothesis

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). It is well known that information asymmetry is covered by adverse selection spread component and it does not affect to inventory costs or order handling cost. As a consequence, 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.

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.

Voluntary disclosure models do not study directly the effect of disclosure on liquidity. They usually focus on the effects of 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[4]. 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. Consequently 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[5].

Therefore, most of the empirical and theoretical literature provides support for the following research hypothesis:

HYPOTHESIS^0 *Higher levels of quality of the information disclosed by a company annual report affect positively the liquidity of its stocks.*

4. 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 for at least one of these years. Given that we have 196 different companies for 7 years, this creates a potential panel of 1372 firm-year observations. From this initial sample we only consider those firm-year observations for which we have at the same time: the disclosure score,

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

[5]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.

the liquidity measure, the control variables and the necessary returns[6]. The final size of our sample depend on the liquidity measures used and ranges from 684 firm-year observations to 703 firm-year observations.

4.1 The Market

The MSE is organized as an electronic continuous double auction market that provides real time information on its screens and automatic relaying of trading information, so that transparency is fully guaranteed. The MSE is a centralized market, in which a single order book exists for each stock. During the period object of the analysis a trading day was divided into three parts: Pre-opening period, Open Market period and Special Operations period. We focus our analysis on the Open Market period where we can observe continuous transactions. During this period, limit and market orders are introduced and if a counterpart is found they are automatically executed. If not, the order remains in the limit order book until an incoming order fits it, or the order is cancelled. During this period prices of the stocks are changing in real time depending on the flow of buy and sell orders[7]. Nowadays Open Market period goes from 9am to 5:30pm, orders. The order book is open and available to all market members and there exist time/price priority to sort the orders.

4.2 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.

[6] For some companies we do not have enough observations to build our liquidity measures because of lack of sufficient market activity.

[7] The Pre-opening is an auction designed to obtain an equilibrium price. During this period there are no transactions. The Special Operations period is designed to transact previously agreed block trades.

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 three different liquidity variables:

1. Bid-Ask spreads are calculated as the yearly average of daily relative bid-ask spreads. For each day we calculate the daily bid-ask spreads as the average of the best bid-ask spreads along the trading day.

$$RSp_{jy} = \frac{1}{D_{jy}} \sum_{d=1}^{D_{jy}} \frac{A_{jd} - B_{jd}}{(A_{jd} + B_{jd/2})}$$

   where D_{jd} is the number of days with observations in year y of stock j and $A_{jd}(B_{jd})$ is the Ask (Bid) price for stock j at day d.

2. Depth: is an aggregate measure of the shares available in the best level of the limit order book. It is calculated as the yearly average of daily depth. These daily depths are done summing up the average of the depth at the best bid and the average of the depth at the best ask.

$$Depth_{jy} = \frac{1}{D_{jy}} \sum_{d=1}^{D_{jy}} (Depth_{Ajd} + Depth_{Bjd})$$

   where D_{jy} is the number of days with observations in year y of stock j and $Depth_{Ajd}$ and $Depth_{Bjd}$ represents the average depth at each quote.

3. 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 version of this measure that is adjusted for overall market liquidity. The reason for this adjustment is to obtain relative values that can be compared among assets.

   Amihud (2002) formula is given by

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

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 $AILLQ_{jt}$ it indicates that the price moves quite a lot in response to trading volume and, therefore, the stock is considered to be illiquid.

To obtain the market-adjusted stock liquidity measure, first we construct a mean average across stocks.

$$AILLQ_t = \frac{1}{N_t} \sum_{j=1}^{N_t} AILLQ_{jt}$$

Finally, we construct the ratio market-adjusted $ILLQ$

$$ILLIQ_{jt} = \left[\frac{AILLQ_{jt}}{AILLQ_t} \right]$$

4.3 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 MSE. 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. 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[8]. 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.

The score we used is similar in spirit to the AIMR score used for many US based disclosure studies. However, contrary to the AIMR score, in the Spanish case the pool of experts is the same for all the companies considered. This guarantees consistency across industries.

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

We consider this feature an advantage of this score with respect to the AIMR score. Moreover, the Spanish score is based only on information provided in the Annual Report, wehereas the AIMR score included also other disclosure activities that took place during the year. This feature can be considered as a weakness of the Spanish score.

If we look at the international comparisons provided by, for example, Hope (2003) or Young and Guenther (2003), the Spanish disclosure environment is certainly less transparent than the US. However it is more transparent, for example, than Germany or Italy.

4.4 Control Variables

We use the set of control variables that have been used in previous studies. This list of control variables is in line with the previous literature such as Heflin, *et al.* (2005) or Welker (1995) or from market microstructure literature such as Demsetz (1968). This set includes:

1) 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 company specific 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. The use of a ratio instead of the variable is important because we capture relative volatility. Doing so, we avoid trends of aggregated volatility.

2) Size

   Size is measured by the logarithm of the market value at the 30th of June of each year.

3) 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.

4) Inverse price

The inverse of the price is calculated as the inverse of the average price of a firm during a year.

5. Empirical analysis

5.1 Univariate analysis

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

TABLE 1
Descriptive Statistics: full Sample

	Rel. Spread (%)	Depth	ILLQ	DISC	LNEFFEC	LNSIZE	VOLAT	INVP	TURN
n	932	926	853	904	926	832	927	901	803
mean	1.2677	11.7157	1.0000	0.5837	18.2255	11.0026	1.8296	0.0009	7.3685
min	0.0729	0.0453	0.0000	0.1700	12.1857	5.0844	0.0000	0.0000	2.6303
Max	13.8221	1601.0300	47.6770	0.9600	24.8304	16.3182	7.8587	0.0169	17.1286
St.Dev.	1.2945	77.5873	2.8886	0.1561	2.1335	1.6832	0.8534	0.0018	1.3980
5^{th}	0.1991	0.3912	0.0020	0.325	14.6522	8.4085	0.8262	0.0000	4.6139
25^{th}	0.5000	0.8877	0.0339	0.4700	16.8586	9.8853	1.2577	0.0001	6.7259
50^{th}	0.9039	1.6776	0.1978	0.5952	18.1327	10.9449	1.6753	0.0003	7.6100
75^{th}	1.6309	4.1649	0.7717	0.7000	19.6481	12.0291	2.2302	0.0007	8.1908
95^{th}	3.3688	26.7926	4.4092	0.83	21.9926	13.9988	3.3546	0.0047	9.1310
Skewness	3.9617	15.5219	8.5868	-0.1295	0.1550	0.1453	1.6896	4.1390	-0.3481
Kurtosis	28.9826	278.5139	107.3881	2.5064	2.9355	3.3810	9.8834	23.8772	6.5413
J-B	16400	114000	708000	6.29	0.38	3.33	404.37	10800	105.94
Pr (Sk)	0.0000	0.0000	0.0000	0.110	0.054	0.086	0.0000	0.0000	0.0000
Pr (Kur)	0.0000	0.0000	0.0000	0.0000	0.764	0.041	0.0000	0.0000	0.0000
Pr (J-B)	0.0000	0.0000	0.0000	0.0431	0.8269	0.1896	0.0000	0.0000	0.0000

Relative Spread is the yearly average of daily relative bid-ask spreads. *Depth* is an aggregate measure of the shares available in the best level of the limit order book. It is calculated as the yearly average of daily depth. ILLIQ is the Amihud (2002) measure and captures the price impact as the response associated with one euro of trading volume. DISC is the lagged index of annual report disclosure quality. LNEFFEC is given by the natural logarithm of the annual average of the daily effective volume (number of shares times transaction price) of each year. LNSIZE is the logarithm of the market value at the 30th of June of each year. INVP is calculated as the inverse of the average price of a firm during a year. 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*. TURN is the logarithm of effective volume divided by size.

All the normality tests reject the null hypothesis of normality for all the variables except from DISC, LNEFFEC and LNSIZE.

We can observe that median disclosure quality experiences a period of steady increases between 1993 and 1998, but then decreases. If we compare our disclosure score statistics with those provided by, for example Heflin *et al.* (2005), for the US AIMR score, we can see that the Spanish score is smaller, confirming the idea that the Spanish disclosure environment is less transparent than the US.

Relative spread is decreasing from 1994 to 1997 and then stabilizes. We can also notice a tendency to decrease in the standard deviation of this liquidity measure. Contrary to this evidence of increasing liquidity, we can see that depth decreases in the final years of the sample. Both variables show contradictory evidence. The Amihud measure suffers an important change in the median and standard deviation values during the first part of the sample (1994 to 1997) relative to the last part (1998-2000). This change means an important decrease in liquidity that cannot be observed in the ex-ante liquidity measures. Looking at the control variables, we can observe how prices increase (price inverse decreases) and, probably as a consequence, size also increases.

In Table 2 the correlations coefficients are provided.

TABLE 2
Correlation Coefficients

	Rel. Spread	Depth	ILLQ	DISC	LNEFFEC	LNSIZE	VOLAT	INVP
Depth	-0.0439[a]							
	(0.2005)							
ILLQ	0.634*	-0.034						
	(0.0000)	*(0.3321)*						
DISC	-0.271*	-0.017	-0.186*					
	(0.0000)	*(0.6300)*	*(0.0000)*					
LNEFFEC	-0.639*[a]	0.120*	-0.415* b	0.341*				
	(0.0000)	*(0.0003)*	*(0.0000)*	*(0.0000)*				
LNSIZE	-0.533*	-0.050[b]	-0.277*[b]	0.502*	0.742*			
	(0.0000)	*(0.1562)*	*(0.0000)*	*(0.0000)*	*(0.0000)*			
VOLAT	0.321*[b]	0.042	0.332*[b]	-0.337*[b]	-0.252*[b]	-0.385*[b]		
	(0.0000)	*(0.2235)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*(0.0000)*		
INVP	0.057[b]	0.156*	0.058[b]	-0.225*[a]	-0.159*	-0.409*	0.341*[b]	
	(0.0987)	*(0.0000)*	*(0.0958)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	
TURN	-0.314*	0.278*[a]	-0.238*	-0.089[a]	0.585*	-0.110*	0.152*	0.254*[a]
	(0.0000)	*(0.0000)*	*(0.0000)*	*(0.0167)*	*(0.0000)*	*(0.0019)*	*(0.0000)*	*(0.0000)*

Relative Spread is the yearly average of daily relative bid-ask spreads. *Depth* is an aggregate measure of the shares available in the best level of the limit order book. It is calculated as the yearly average of daily depth. ILLIQ is the Amihud (2002) measure and captures the price impact as the response associated with one euro of trading volume. DISC is the lagged index of annual report disclosure quality. LNSIZE is the logarithm of the market value at the 30th of June of each year. LNEFFEC is given by the natural logarithm of the annual average of the daily effective volume (number of shares times transaction price) of each year. 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*. INVP is calculated as the inverse of the average price of a firm during a year. TURN is the logarithm of effective volume divided by size.

*Statistically significant at a 1% level

[a] Difference between 1994-1997 and 1998-2000 significant at a 5% level

[b] Difference between 1994-1997 and 1998-2000 significant at a 1% level

In terms of correlations we can notice that the disclosure index is highly correlated with all the other variables except depth. The correlations

between disclosure and size measures (size, effective and price inverse) and between disclosure and volatility are in line with previous studies on disclosure.

Liquidity variables are correlated in the expected way. The only exception is depth that does not show any significant correlation with the relative spread and the Amihud illiquidity measure. Moreover, bigger and less volatile firms are more liquid.

Given the differences noticed before in the behaviour of some of the series between the 1994-1997 and 1998-2000 periods, we have also calculated the correlations coefficients for these two sub-periods[9]. Subsequently we have tested for the differences between the correlations coefficients between these two sub-periods. As reported in Table 2, in 17 out of the 36 cases the correlation is significantly different in the two sub-periods.

5.2 Multivariate analysis

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

$$LIQ_{it} = \alpha + \beta_1 DISC_{1,t-1} + \beta_2 LNEFFEC_{it} + \beta_3 LNSIZE_{it} + \\ + \beta_4 VOLAT_{it} + \beta_5 INVP_{it} + \varepsilon_{it} \qquad [1]$$

where,

— LIQ is one of the three liquidity measures described in the previous section (Relative spread, Depth, or ILLIQ (Amihud))

— DISC is the lagged index of annual report disclosure quality

— LNSIZE is the logarithm of the market value at the 30th of June of each year.

— LNEFFEC is given by the natural logarithm of the annual average of the daily effective volume (number of shares times transaction price) of each year.

— 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.

[9] The values are note reported for brevity. They are available from the authors.

— INVP is calculated as the inverse of the average price of a firm during a year.

Table 3 – Panel A presents the results of running a simple OLS regression using the pooled data for the whole sample.

TABLE 3
Ols Regressions

$$LIQ_{it}=\alpha+\beta_1 DISC_{i,t-1}+\beta_2 LNEFFEC_{it}+\beta_3 LNSIZE_{it}+\beta_4 VOLAT_{it}+\beta_5 INVP_{it}+\varepsilon_{it}$$

(robust p-value in brackets)

Dependent Variable	n	Intercept	DISC	LNEFFEC	LNSIZE	VOLAT	INVP	Adj.R^2 F-statistic
Panel A: Full sample								
Spread	684	6.443***	-0.404**	-0.366***	0.103**	0.4830***	-108.85***	0.54
		(0.000)	*(0.039)*	*(0.000)*	*(0.046)*	*(0.000)*	*(0.000)*	*58.27*
Depth	703	-61.635***	1.689	1.060**	4.068***	-2.150**	9335.72***	0.25
		(0.000)	*(0.765)*	*(0.012)*	*(0.000)*	*(0.025)*	*(0.000)*	*8.06*
ILLIQ	*681*	7.227***	-0.856	-0.796***	0.550*	1.483**	-149.24	0.27
		(0.000)	*(0.315)*	*(0.001)*	*(0.075)*	*(0.027)*	*(0.107)*	*8.97*
Panel B: 1994-1997								
Spread	*397*	6.364***	-0.591*	-0.405***	0.172***	0.603***	-171.3***	0.53
		(0.000)	*(0.087)*	*(0.000)*	*(0.002)*	*(0.000)*	*(0.000)*	*57.32*
Depth	*397*	-86.02***	-10.99	1.265	6.446***	-0.119	8060***	0.19
		(0.000)	*(0.337)*	*(0.282)*	*(0.000)*	*(0.959)*	*(0.000)*	*12.61*
ILLIQ	*397*	3.533**	-1.040	-0.842***	0.914***	1.974***	-257.7**	0.25
		(0.029)	*(0.384)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.032)*	*17.23*
Panel C: 1998-2000								
Spread	*287*	5.801***	-0.431**	-0.272***	0.0319	0.159***	41.26*	0.62
		(0.000)	*(0.017)*	*(0.000)*	*(0.251)*	*(0.002)*	*(0.095)*	*94.26*
Depth	*306*	-44.601***	15.805***	0.166	2.736***	0.668	11883***	0.55
		(0.000)	*(0.001)*	*(0.738)*	*(0.000)*	*(0.659)*	*(0.000)*	*55.41*
ILLIQ	*284*	11.188***	-0.396	-0.780***	0.267***	1.135***	83.386	0.43
		(0.000)	*(0.545)*	*(0.000)*	*(0.009)*	*(0.000)*	*(0.343)*	*31.49*

LIQ is one of the three liquidity measures. *Spread* is the yearly average of daily relative bid-ask spreads. *Depth* is an aggregate measure of the shares available in the best level of the limit order book. It is calculated as the yearly average of daily depth. ILLIQ is the Amihud (2002) measure and captures the price impact as the response associated with one euro of trading volume. DISC is the lagged index of annual report disclosure quality. LNSIZE is the logarithm of the market value at the 30th of June of each year. LNEFFEC is given by the natural logarithm of the annual average of the daily effective volume (number of shares times transaction price) of each year. 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*. INVP is calculated as the inverse of the average price of a firm during a year.

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

First, we can see that disclosure has a positive direct effect on the relative spread. In the case of the Amihud illiquidity measure and the depth, the relationship is not statistically significant. Consequently, it is difficult to draw conclusions about our research hypothesis from these results.

Looking at the control variables, volatility is negatively associated with liquidity. We can observe the same results for the three variables used to capture liquidity. The previous evidence is similar in spirit. Empirical studies by Stoll (1978) or Foster and Viswanathan (1993), among others, find that volatility is negatively associated with liquidity for different markets.

The inverse price variable shows a positive relationship with liquidity although in the case of the Amihud measure this relationship is not statistically significant. This result can be related to size effects, given that a bigger size or a higher price usually imply lower liquidity. Effective volume is also positively related to liquidity. The intuition behind this result can be referred to models like Harris and Raviv (1993). These authors present a model where investors receive the same information but they differ in the way they process it. So, volume shocks are the consequence of the degree of agreement among investors and not of information asymmetry. Rubio and Tapia (1996) show empirical evidence for the MSE consistent with this result. Lastly, because of the presence of effective volume and price inverse, size does not follow the expected negative relationship with spread and the Amihud measure[10].

We also rune the same OLS regression for the two sub-sample periods: 1994-1997 and 1998-2000. With respect to the disclosure variable we can see that in the second sub-period we detect a positive effect also on depth.

However the use of the OLS regression technique on a pooled panel-data set is questionable.

Many companies appear in various years of our sample and this allows us to control for company specific effects. Petersen (2007) provides us with a criterion to decide whether company specific effects are present in the panel-data set. If the robust standard errors clustered by company are larger than the White standard errors, then a correction for

[10] If we include as control variable only size and drop the inverse price, the sign and significance for the size variable are the expected.

company specific effects is needed. Non tabulated results show that this is the case in our data set. Moreover Nikolaev and Van Lent (2005) show how the use of proper panel data estimation techniques reduces the effects of a possible endogeneity bias and produces consistent results.

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)[11].

It is also possible that our panel may suffer from serial correlation and heteroskedacity. In order to check for this possibility we run the Wooldridge (2002) test for panel data serial correlation and a Likelihood Ratio test for heteroskedacity. The results can be found in Table 4.

TABLE 4
Panel Data Test

	Wooldridge serial correlation F-test	p-value	LR test for heteroskedacity	p-value
Spread	3.962	*0.0491*	890.99	*0.0000*
Depth	10.848	*0.0013*	2083.22	*0.0000*
ILLIQ	55.571	*0.0000*	1614.49	*0.0000*

Spread is the yearly average of daily relative bid-ask spreads. *Depth* is an aggregate measure of the shares available in the best level of the limit order book. It is calculated as the yearly average of daily depth. ILLIQ is the Amihud (2002) measure and captures the price impact as the response associated with one euro of trading volume.

For both tests and for all the three liquidity measures, the null hypotheses of absence of serial correlation and homoskedacity are both rejected. For this reason we estimate our panel data regressions by using robust standard errors and by correcting the serial correlation problem through the estimation of appropriate correlation coefficients.

For all these reasons we re-estimate model [1] with robust GLS. The results are included in Table 5.

If we compare the results of Table 3 with the results of Table 5 we notice important differences. First, in the full sample specification disclosure becomes significant with the expected negative sign when we use Amihud measure. Although, the depth proxy continuous to be

[11] 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.

non significant the sign of the coefficient is the expected. These results supports hypothesis H_1.

TABLE 5
Panel Data GLS Estimation

$$LIQ_{it}=\alpha+\beta_1 DISC_{i,t-1}+\beta_2 LNEFFEC_{it}+\beta_3 LNSIZE_{it}+\beta_4 VOLAT_{it}+\beta_5 INVP_{it}+\varepsilon_{it}$$

(robust p-value in brackets)

Dependent Variable	n	Intercept	DISC	LNEFFEC	LNSIZE	VOLAT	INVP	Chi squared *p-value*
Panel A: Full sample								
Spread	661	5.8901***	-0.5780***	-0.2800***	0.0244**	0.3647***	-112.83***	99819.11
		(0.0000)	*(0.0000)*	*(0.0000)*	*(0.0240)*	*(0.0000)*	*(0.0000)*	*0.0000*
Depth	680	-27.8249***	1.2661	0.7454***	1.6984***	-2.1079***	5405.14***	78843.72
		(0.0000)	*(0.1060)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*0.0000*
ILLIQ	*663*	6.2248***	-1.0758***	-0.3890***	0.0919***	0.5769***	-119.27***	982.41
		(0.0000)	*(0.0000)*	*(0.0000)*	*(0.0080)*	*(0.0000)*	*(0.0000)*	*0.0000*
Panel B: 1994-1997								
Spread	*386*	6.5260***	-0.3073***	-0.3847***	0.1189***	0.5469***	-186.27***	91298.03
		(0.0000)	*(0.0110)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*0.0000*
Depth	*386*	-50.6517***	0.2004	1.1587***	3.0336***	-1.0244***	5772.10***	1848935
		(0.0000)	*(0.8660)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*0.0000*
ILLIQ	*386*	1.9483***	0.2429	-0.2035***	0.1176***	0.4252***	-63.30117**	77.0300
		(0.0000)	*(0.3970)*	*(0.0000)*	*(0.0230)*	*(0.0000)*	*(0.0390)*	*0.0000*
Panel C: 1998-2000								
Spread	*240*	5.0742***	-0.3298**	-0.2344***	0.0236***	0.1035***	59.7531***	58869.36
		(0.0000)	*(0.0000)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*0.0000*
Depth	*268*	-51.7694***	15.4221***	0.3122***	3.1315***	0.8179***	12383.46***	119226.38
		(0.0000)	*(0.0000)*	*(0.0010)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*0.0000*
ILLIQ	*244*	8.0992***	-0.3634***	-0.5177***	0.0886***	0.7488***	137.1402***	42691.16
		(0.0000)	*(0.0000)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*(0.0000)*	*0.0000*

LIQ is one of the three liquidity measures. *Spread* is the yearly average of daily relative bid-ask spreads. *Depth* is an aggregate measure of the shares available in the best level of the limit order book. It is calculated as the yearly average of daily depth. ILLIQ is the Amihud (2002) measure and captures the price impact as the response associated with one euro of trading volume. DISC is the lagged index of annual report disclosure quality. LNSIZE is the logarithm of the market value at the 30th of June of each year. LNEFFEC is given by the natural logarithm of the annual average of the daily effective volume (number of shares times transaction price) of each year. 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*. INVP is calculated as the inverse of the average price of a firm during a year.

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

When we split our sample in two subsamples periods, the main result is that in the last three years, disclosure has the expected sign and becomes significant independently of the variable we use to proxy liquidity. That is the relationship between disclosure and liquidity on the

second sub-period (1998-2000) does not depend on the use of either ex–ante or *ex–post* liquidity measures (Relative Spreads and Depth vs. Amihud measure). However this is not true for the first sample period.

To try to understand the cause of this behaviour of the relevant variables before and after year 1998, we have to remember that during the last years of the nineties, the MSE has increased its presence in international investors' portfolios and also has increased its general level of activity. If we look at aggregated activity measures such as marketwide effective volume or number of transactions, we can observe that both variables experiment important changes. For example for the aggregated MSE, the yearly effective volume for the 1998-2000 period is three times as big as for 1994-1997 period. The same is true for the average volume per session. This substantially bigger level of activity in the MSE after 1998 can explain the differences in our estimates for the two sub-sample periods. Moreover we can also notice that the Amihud illiquidity measures almost doubled from 1997 to 1998, while the inverse prices stays fairly constant for the whole sample.

Regarding the control variables, the coefficients do not change neither sign nor significance. When we look at split samples, the only differences are related with the effect of volatility measure on Depth variable and price inverse on Amihud measure.

Our results confirm the existence of a positive and significant relationship between disclosure and liquidity in the context of a driven by orders market.

However our results on the two sub-samples (1994-1997 and 1998-2000), show that this positive relationship between disclosure and liquidity is influenced by the overall level of activity of the market.

Given the very high correlation between size and effective volume, we decided to run an alternative specification that includes the Turnover variable instead of size and effective volume. We define turnover as the logarithm of effective volume divided by size

$$TURNOVER_{jt} = \log\left[{}^{EFFEC_{jt}}\!\!\diagup_{SIZE_{jt}}\right]$$

Hence we run the following regression:

$$\begin{aligned} LIQ_{it} = \alpha_i + \beta_1 DISC_{1,t-1} + \beta_2 TURNOVER_{it} + \\ + \beta_3 VOLAT_{it} + \beta_4 INVP_{it} + \varepsilon_{it} \end{aligned} \qquad [2]$$

Again we used GLS panel data estimation corrected for heteroskedacity and serial correlation. The results are included in Table 6.

TABLE 6
Panel Data GLS Estimation: Alternative Specification

$$LIQ_{it}=\alpha_i+\beta_1 DISC_{i,t-1}+\beta_2 TURNOVER_{it}+\beta_3 VOLAT_{it}+\beta_4 INVP_{it}+\varepsilon_{it}$$

(robust p-value in brackets)

Dependent Variable	n	Intercept	DISC	TURNOVER	VOLAT	INVP	Chi squared *p-value*
Panel A: Full sample							
Spread	661	3.8261*** *(0.0000)*	-1.6481*** *(0.0000)*	-0.3114*** *(0.0000)*	0.4534*** *(0.0000)*	-63.66*** *(0.0000)*	50031.49 *0.0000*
Depth	680	0.8679 *(0.2940)*	3.1860*** *(0.0020)*	0.4814*** *(0.0000)*	-3.5351*** *(0.0000)*	4357.06*** *(0.0000)*	694.82 *0.0000*
ILLIQ	663	3.2285*** *(0.0000)*	-1.8023*** *(0.0000)*	-0.3719*** *(0.0000)*	0.5967*** *(0.0000)*	-50.77** *(0.0380)*	647.84 *0.0000*
Panel B: 1994-1997							
Spread	386	3.9516*** *(0.0000)*	-1.4032*** *(0.0000)*	-0.3970*** *(0.0000)*	0.7228*** *(0.0000)*	-113.10*** *(0.0000)*	7538.59 *0.0000*
Depth	386	-7.2431*** *(0.0000)*	4.6849*** *(0.0000)*	1.6121*** *(0.0000)*	-3.8873*** *(0.0000)*	3880.91*** *(0.0000)*	249.6 *0.0000*
ILLIQ	386	1.2159*** *(0.0020)*	-0.1701 *(0.5110)*	-0.2223*** *(0.0000)*	0.5237*** *(0.0000)*	-49.0156* *(0.0760)*	60.67 *0.0000*
Panel C: 1998-2000							
Spread	240	3.1086*** *(0.0000)*	-1.3584*** *(0.0000)*	-0.2137*** *(0.0000)*	0.0775*** *(0.0000)*	176.2713*** *(0.0000)*	130294.8 *0.0000*
Depth	268	-21.4999*** *(0.0000)*	31.7169*** *(0.0000)*	0.3677*** *(0.0000)*	0.5291*** *(0.0030)*	10463.63*** *(0.0000)*	8150.77 *0.0000*
ILLIQ	244	4.7010*** *(0.0000)*	-2.6827*** *(0.0000)*	-0.4584*** *(0.0000)*	0.5370*** *(0.0000)*	333.5012*** *(0.0000)*	79308.12 *0.0000*

LIQ is one of the three liquidity measures. *Spread* is the yearly average of daily relative bid-ask spreads. *Depth* is an aggregate measure of the shares available in the best level of the limit order book. It is calculated as the yearly average of daily depth. ILLIQ is the Amihud (2002) measure and captures the price impact as the response associated with one euro of trading volume. DISC is the lagged index of annual report disclosure quality. TURNOVER is the logarithm of effective volume divided by size. 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*. INVP is calculated as the inverse of the average price of a firm during a year.

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

The main difference under this alternative specification is that the disclosure coefficient for the Depth liquidity measure becomes significant. The intuition behind this result is related to the role played by the overall level of activity in the market. As shown by Harris and Raviv

(1993), higher levels of activity increase liquidity and these volume shocks do not represent changes in information asymmetry.

Finally we have split the sample in two sub-samples, one containing the companies that belong to the IBEX35© index and another one containing those companies that do not. The results (not reported) show that this split does not cause major differences in the effect of disclosure on liquidity. Only in the case of the depth measure, for the IBEX companies we found a negative effect of disclosure which is contrary to the rest of our results[12].

6. 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 Madrid 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. This market is particularly interesting because it is a pure *driven by orders* market as opposed to the US market which is a *driven by prices* or hybrid market.

Our results show that more transparency increases liquidity (reduces the relative spread, increases the depth and reduces illiquidity measure of Amihud) and they are in in line with the findings of Heflin, *et al.* (2005) that disclosure affects positively market liquidity once we control for trade size. However we have extended their analysis by taking into account a different institutional context and a different liquidity measure that provides a representation of the price impact once we have normalized trade volume to one euro.

This measure, proposed by Amihud (2002), represents an ex-post liquidity measure. Hasbrouck (2002) shows that it is the best among the usual proxies employed to capture Kyle´s lambda. Moreover Martinez, *et al.* (2005) and Acharya and Pedersen (2005) among others

[12] In order to save on the number of tables in the article we have decided to not include these tables in the article. Results are available from the authors upon request.

find that it is the only aggregated liquidity factor that is priced in different markets and asset pricing contexts.

So we can interpret our results concerning the Amihud (2002) illiquidity measures as another parsimonious way of reconciling the multidimensional problem in terms of spread and depth and conclude that disclosure has a positive effect on liquidity.

Moreover, following the recent work by Nikolaev and Van Lent (2005) and Petersen (2007), we were able to show the importance of using an appropriate estimation technique when using panel data.

An important issue left for future research is the use of an *ex-post* liquidity measure such as the Amihud illiquidity measure to study disclosure and liquidity in a driven by prices market such as the NYSE. The presence of market specialists that can intervene when a transaction is ready to be executed could in principle create differences between the *ex-ante* and the *ex-post* liquidity effects.

Appendix A1

TABLE A1.1
Descriptive Statistics: yearly values

	Years	1993	1994	1995	1996	1997	1998	1999	2000
Relative Spread (%)	N		119	121	129	146	154	130	133
	mean		1.7838	1.6115	1.3123	1.1561	1.1423	0.9531	1.0252
	Min		0.1683	0.1360	0.1587	0.1449	0.0960	0.0782	0.0729
	Max		13.8221	11.3416	7.2972	8.7593	13.5092	2.4780	3.3599
	St.Dev.		1.7824	1.7635	1.2635	1.0868	1.2747	0.6026	0.7269
	5th		0.2246	0.2101	0.2078	0.2173	0.1970	0.1315	0.1579
	25th		0.6112	0.4979	0.4877	0.5341	0.5473	0.4179	0.4279
	50th		1.1617	1.0176	0.9400	0.8335	0.8776	0.8717	0.8880
	75th		2.5629	1.9342	1.6835	1.4313	1.3599	1.3373	1.4542
	95th		4.9109	4.3970	3.5244	3.2662	2.7336	2.1283	2.3318
Depth	N		113	120	121	130	146	152	144
	mean		14.7365	6.2018	9.3388	11.6506	15.1978	15.2052	8.7822
	Min		0.1069	0.1090	0.1042	0.0577	0.0453	0.1724	0.1358
	Max		646.6012	179.7503	269.4548	294.5601	1274.7450	1601.0300	691.4396
	St.Dev.		69.1017	18.9033	31.6886	35.7130	105.9831	129.9510	60.1304
	5th		0.3610	0.2934	0.2705	0.3977	0.4125	0.5310	0.3828
	25th		0.9966	0.8692	0.9568	0.8305	0.9776	1.0104	0.7395
	50th		1.9024	1.8500	1.8553	1.9796	1.8514	1.5329	1.1149
	75th		5.2816	5.0036	5.2313	5.3144	5.0447	3.3888	2.0616
	95th		21.5195	16.2223	30.4351	48.5871	40.2659	24.4352	11.6667
ILLIQ	N		110	115	119	126	135	124	124
	mean		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	Min		0.0008	0.0005	0.0007	0.0005	0.0011	0.0011	0.0000
	Max		26.5120	28.7187	22.0728	47.6770	11.4105	10.9427	11.7955
	St.Dev.		2.9955	3.6351	2.8362	4.4281	1.9345	1.6795	1.7479
	5th		0.0032	0.0013	0.0019	0.0030	0.0036	0.0037	0
	25th		0.0255	0.0129	0.0155	0.0262	0.0623	0.0741	0.0352
	50th		0.1527	0.1071	0.1818	0.1196	0.2748	0.3557	0.2468
	75th		0.5439	0.4204	0.6256	0.4839	0.9744	1.1237	1.3614
	95th		4.5558	2.9350	4.4626	3.1652	5.0360	5.1371	4.2628
DISC	N	130	136	132	138	142	124	102	
	mean	0.5505	0.5447	0.5920	0.5925	0.6040	0.6231	0.5795	
	Min	0.2333	0.2381	0.2250	0.2500	0.2000	0.1700	0.1800	
	Max	0.9333	0.9286	0.9250	0.9500	0.9600	0.9500	0.9600	
	St.Dev.	0.1350	0.1499	0.1564	0.1598	0.1614	0.1599	0.1566	
	5th	0.3333	0.3333	0.2857	0.325	0.325	0.32	0.32	
	25th	0.4667	0.4405	0.4750	0.4500	0.5100	0.5350	0.4700	
	50th	0.5333	0.5476	0.6000	0.6000	0.6200	0.6500	0.5800	
	75th	0.6333	0.6429	0.7000	0.7000	0.7400	0.7350	0.6900	
	95th	0.8000	0.8	0.8333	0.825	0.85	0.82	0.85	
LNEFFEC	N		113	120	121	130	146	152	144
	mean		17.8499	17.5162	17.6502	18.2320	18.8039	18.6237	18.5822
	Min		13.3514	13.0601	12.1857	12.8100	14.3431	13.6688	13.9232
	Max		22.1221	22.2185	22.6258	23.5607	23.9784	24.2499	24.8304
	St.Dev.		1.9770	2.0853	2.0995	2.0159	1.8749	2.1210	2.3735
	5th		14.2301	13.8791	14.3090	14.9505	15.7834	15.3695	14.6702
	25th		16.9153	16.1191	16.2731	16.9288	17.5890	17.0985	16.9294
	50th		17.7724	17.4057	17.4638	18.1340	18.7317	18.5929	18.2782
	75th		19.3526	19.1686	19.4044	19.8140	20.0248	20.0728	20.2402
	95th		21.1549	20.9152	21.3106	21.6452	22.3516	22.7408	22.9637

TABLE A1.1
Descriptive Statistics: yearly values *(continued)*

	Years	1993	1994	1995	1996	1997	1998	1999	2000
	N		105	108	114	125	119	128	133
	mean		10.6837	10.5980	10.7259	11.1022	11.3560	11.1260	11.2913
	Min		6.2765	6.0149	5.9890	5.8129	7.4174	5.0844	7.6636
	Max		14.3107	14.2569	14.6117	15.2023	15.7118	15.8906	16.3182
LNSIZE	St.Dev.		1.5843	1.6416	1.6982	1.6342	1.6065	1.7334	1.7314
	5^{th}		8.3704	8.0115	7.8345	8.4756	8.9304	8.5508	8.7371
	25^{th}		9.5115	9.5010	9.6175	10.0322	10.2287	9.8552	9.9739
	50^{th}		10.4702	10.5824	10.7304	11.1115	11.2734	11.0080	11.1657
	75^{th}		11.6850	11.6947	11.9585	12.0768	12.3641	12.1055	12.2801
	95^{th}		13.4080	13.2386	13.8193	13.8579	14.4471	14.3756	14.5211
	N		113	119	121	130	138	142	138
	mean		0.0009	0.0011	0.0012	0.0012	0.0007	0.0007	0.0008
	Min		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Max		0.0068	0.0113	0.0132	0.0169	0.0112	0.0151	0.0108
INVP	St.Dev.		0.0014	0.0018	0.0023	0.0025	0.0015	0.0017	0.0015
	5^{th}		0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
	25^{th}		0.0002	0.0002	0.0002	0.0001	0.0001	0.5800	0.0001
	50^{th}		0.0004	0.0004	0.0004	0.0003	0.0002	0.6900	0.0003
	75^{th}		0.0009	0.0009	0.0011	0.0008	0.0006	0.0005	0.0007
	95^{th}		0.0047	0.0055	0.0064	0.0057	0.0035	0.0032	0.0033
	N		122	123	129	139	142	135	137
	mean		1.7254	1.9648	2.3254	2.4331	1.6408	1.1569	1.5807
	Min		0.0000	0.3753	0.3779	0.9109	0.0072	0.0000	0.0000
	Max		7.8587	6.4599	4.4095	5.3758	3.0353	3.4305	4.2225
VOLAT	St.Dev.		1.0731	1.0188	0.8077	0.6663	0.4455	0.4438	0.5981
	5^{th}		0.4902	0.8669	1.3280	1.5902	1.0542	0.6336	0.8494
	25^{th}		1.2125	1.2748	1.7673	1.9495	1.3130	0.9337	1.2089
	50^{th}		1.5751	1.6917	2.1376	2.3063	1.6255	1.1059	1.4679
	75^{th}		2.0042	2.3612	2.8114	2.7759	1.9170	1.2861	1.9074
	95^{th}		3.1428	3.8693	3.8757	3.5730	2.3519	1.8738	2.7020
	N		98	102	108	119	117	127	132
	mean		7.3746	7.1545	7.1037	7.2495	7.6992	7.6464	7.2926
	min		4.1418	3.3491	2.6303	3.1876	4.0817	2.7912	2.6475
	Max		9.6333	9.3820	9.4486	9.5491	10.7170	17.1286	11.0432
TURN	St.Dev.		1.2271	1.2785	1.3053	1.2923	1.4261	1.6223	1.4414
	5^{th}		4.6518	4.6212	4.1971	4.4625	4.6932	5.0409	4.1944
	25^{th}		6.7426	6.5734	6.4411	6.5052	6.8728	7.0676	6.5681
	50^{th}		7.7174	7.4437	7.4509	7.4643	7.9188	7.7194	7.5646
	75^{th}		8.1472	7.9663	7.9269	8.1870	8.6438	8.4243	8.2138
	95^{th}		8.9232	8.8798	8.8330	9.0569	9.7353	9.3195	9.1002

Appendix A2. Disclosure scoring: description

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).

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Resumen

El objetivo del artículo es estudiar la relación entre divulgación de información y liquidez. La evidencia empírica previa se ha centrado únicamente en el mercado estadounidense y ha utilizado técnicas de estimación por mínimos cuadrados ordinarios, incluso en presencia de datos de panel. Nuestro estudio analiza un mercado (Bolsa de Madrid) con características institucionales particulares y hace uso de la metodología apropiada de datos de panel. Los resultados proporcionan evidencia empírica acerca de la existencia de una relación positiva entre divulgación y liquidez. Además, esta relación se mantiene tanto cuando se consideran diferentes arquitecturas de mercado como con el uso de diferentes medidas de liquidez.

Palabras clave: Divulgación, liquidez, microestructura de mercado.

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