# INSIDER TRADING AND MARKET BEHAVIOUR AROUND TAKEOVER ANNOUNCEMENTS IN THE SPANISH MARKET ♣

José E. Farinós, C. José García* and Ana Mª Ibáñez

Department of Corporate Finance

University of Valencia

---

♣ This research was supported by CICYT project SEC2000–0773 and by *Conselleria de Cultura, Educació i Esport* (*Generalitat Valenciana*) project GV04B-210.

* Corresponding author: Facultat d'Economia, Av. dels Tarongers s/n, 46022 Valencia, Spain. Tel.: 34-963828369. Fax: 34-963828370. E–mail: constantino.garcia@uv.es.

# INSIDER TRADING AND MARKET BEHAVIOUR AROUND TAKEOVER ANNOUNCEMENTS IN THE SPANISH MARKET


**ABSTRACT**

As microstructure models assume informational asymmetries among investors, the possibility of insider trading is a reason for liquidity suppliers to incorporate the adverse selection component in the bid–ask spread. In this way, the effect that takeover announcements have on target firm returns becomes a strong motive for trading with insider information. In this paper, we investigate whether liquidity suppliers value the possibility of trading with informed agents and whether market behaviour reflects this. Our results suggest that although liquidity suppliers feel more probably the fact of trading with insiders before the takeover announcement, this does not lead to significant changes in liquidity.



**Keywords:** takeover, microstructure, insider trading, bid–ask spread, adverse selection cost.

**JEL classification:** *G*14; *G*34; *D*82.

## 1. INTRODUCTION

This research studies new information arrival to the market under the hypothesis of agents with different information levels. From this point of view, market microstructure theory developed in the asymmetrical information area suggests that the empirical analysis of transaction costs, and specifically its components, allows valuing the existence of informed traders and the process through which information is incorporated into prices.

Given the well–documented effect of takeover announcements in the price of target firms, we assume that this sort of event may eventually generate abnormal revenues when trading on private information. In consequence, we explore whether the market values that possibility, and, if it does, we investigate which market observable variables may reveal to the liquidity supplier that he might be trading with informed agents.

Mergers and takeovers have been much studied in recent years. Early studies focused on value generation[1] and on the relation between market reaction and factors like premium paid, block size purchased, or acquired firm underpricing.[2]

Later, as microstructure theory developed, several studies [Conrad and Niden (1992), Jennings (1994), Foster and Viswanathan (1995), Smith *et al*. (1997), Farinós and Fernández (1999) and Farinós *et al*. (2000)] have investigated firm acquisition and agent behaviour around the event through variables like those that spread, depth, price volatility and/or volume traded.

A brand of market microstructure theory that focuses on the existence of asymmetrical information develops the adverse selection cost hypothesis. Trading with unknown informed traders forces liquidity supplier to adjust the bid–ask spread in order to compensate the loses in which incurs every time he trades with informed agents, with the gains in transactions with liquidity traders.[3] That is why if the liquidity supplier feels he may be trading with informed traders, we expect to find before the takeover announcement increases in the adverse selection cost. Moreover, informed trader activity should significantly change some of the stock market observable features, like price, liquidity and/or trading activity.

Our research develops in three steps. First, we investigate the presence of the adverse selection cost in the quoted spread and whether it suffers from changes around the takeover announcement that may proxy the existence of insider trading. Results from this analysis show an increased weight of the adverse selection cost in the quoted spread over the pre–event period in contrast to a non–event period and to a sample of control firms.

Second, we perform a time series univariate analysis in order to examine changes in liquidity, trading activity, and return through several observable variables of the stock market activity around the takeover announcement. Results show statistically

---

[1] See Jensen and Ruback (1983) for a summary of empirical results. García and Ferrando (1992), Fernández and García (1995), Fernández and Gómez (1999), Fernández and García (2000) and García and Ibáñez (2001) investigate value generation around takeover announcements in the Spanish market.

[2] See, for example, Firth (1980), Asquith *et al.* (1983), Malatesta and Thompson (1985) and Sundarsanam (1996).

[3] Liquidity trader is defined as the agent who trades motivated for any reason except private information.

abnormal behaviour in trading activity and returns, which are consistent with those achieved in previous studies. However, liquidity changes are not statistically significant over the five pre–event days, that is, liquidity behaviour does not reflect the valuation of a higher possibility of informed trading previously found. Therefore, trading activity does not exhibit a clear link with liquidity. In consequence, we finally perform a cross–sectional regression analysis of spread and depth (our liquidity proxy measures) to further examine which variables explain liquidity changes. Results not only reveal a negative (positive) relationship between spread (liquidity) and trading activity – but also that a portion of the spread changes is explained by the event itself.

This research contributes to the literature in two ways. First, variations in insider trading around takeover announcements is analysed specifically through the decomposition of bid–ask spread using daily data contrary to others related studies [Conrad and Niden (1992)], where only whole bid–ask spread changes are considered. Second, although the empirical evidence of bid–ask spread components in driven–price markets (i.e. US markets) is wide, the evidence regarding the importance of bid–ask spread components in driven–order markets is scarce. Thus, it is important to report additional empirical results in order to improve our knowledge about the microstructure of driven–order markets.

The remainder of the paper is organised as follows. In Section 2, we consider the problem and our objective. Section 3 describes our data sets. Methodology and results form the several analyses performed are presented in sections 4, 5 and 6. Section 7 concludes.

## 2. ASYMMETRIC INFORMATION AND BID–ASK SPREAD

One of the main contributions in the study of the financial markets of the microstructure theory has been the incorporation of agents with different levels of information. The quoted bid–ask spread (either from the market maker or from the order book) would reflect the presence of agents with private information in the markets.[4]

Literature splits the bid–ask spread into three components: *inventory holding costs* (price risk and opportunity cost of holding a sub–optimal portfolio of securities), *order processing costs* (costs of arranging trades, recording, and clearing a transaction), and *adverse selection costs* (costs which arise if investors trade on the basis of superior information).

As the liquidity supplier always loses to insider traders, if the probability of trading with informed traders increases then he widens the bid–ask spread to compensate his losses for dealing with insider traders, and thus increasing the revenues from liquidity traders. Alternately, the liquidity supplier could protect himself by decreasing depth or both enlarging the bid–ask spread and decreasing depth simultaneously. Anyhow, liquidity will be only reduced in the last case.

A takeover announcement reveals, presumably, a piece of information unknown to most market participants. A tested result of this information arrival is a statistically

[4] It is important to take into account that in continuous auction markets, like the Spanish market, the market maker figure does not exist. However, there are several references [i.e. Biais *et al.* (1995)] that point out the presence of agents that supply liquidity in continuous auction markets in the same way as market makers do. We can find in the implicit spread of the order book the same argument that the market maker introduces for compensation because of the existence of better-informed agents.

and economically effect on the target firm price, which gives insiders a strong incentive to trade on inside information prior to the takeover announcement.

Under the hypothesis of asymmetric information around takeover announcements, adverse selection cost increases are expected before the event–day, which would lead, *ceteris paribus*, to bid–ask spread increases. On the contrary, in the post–event period asymmetric information reductions are expected and, consequently, bid–ask spread decreases as a consequence of, *ceteris paribus*, adverse selection cost decreases. In this way, takeover announcement becomes a very interesting event for studying the activity of insiders in the stock market.

The suspicion of insider trading in this sort of event has been in the air since early studies. Hence, Asquith (1983) and Asquith *et al*. (1983) find abnormal returns before the acquisition announcement and conclude that they appear because of trading on inside information just before the acquisition.[5] Nevertheless, Sanders and Zdanowicz (1992), in examining target firm abnormal return and trading activity, do not document any evidence of pre–announcement insider trading.

Other papers [Conrad and Niden (1992), Jennings (1994), Foster and Viswanathan (1995), Smith *et al*. (1997) and Farinós *et al*. (2000)] investigate the effects of takeover announcements on target firm from the market microstructure point of view through variables like bid–ask spread, trading activity and the adverse selection component of the spread –if high frequency data were available [Jennings (1994) and Foster and Viswanthan (1995)].

Results do not offer definite conclusions. Conrad and Niden (1992) detect an increase in volume primarily driven by an increase in the number of transactions during the pre–announcement period – while order size does not change significantly in the same period.[6] They also document that spread and trading activity are positively related, which is consistent with the presence of adverse selection. However, as this result does not hold during the event window, they do not find evidence of insider trading around the acquisition announcement. On the contrary, Foster and Viswanathan (1995) results are consistent with a situation where informed agents trade before the corporate acquisition announcement. On the other hand, Jennings (1994) finds weak evidence for spread increases and depth decreases prior to the announcement. Nevertheless, Jennings (1994) finds post–event increases in spread and depth, although spread rapidly decreases to normal levels. Finally, results achieved by Farinós *et al*. (2000) in the Spanish market do not support the presence of insiders before the event.[7]

Under the hypothesis of informed agents trading in the market, we expect changes in trading activity that will depend on the sort of relationship with liquidity. This relation can be understood through Easley and O’Hara (1987; 1992), Harris and Raviv (1993), Admati and Pfleiderer (1988) and McInish and Wood (1992). Easley and O’Hara (1987; 1992) argue that if order size and volume traded, respectively, represent a direct signal of the use of insider information for the market maker, then a positive relation between spread and those variables is expected. On the contrary, Harris and

[5] Jensen and Ruback (1983) suggest, conversely, that this behaviour only reflects the offer market anticipation.

[6] These authors, following Easley and O`Hara (1987), employ order size as a proxy for private informed trading.

[7] From our point of view, results from Jennings (1994) and Foster and Viswanathan (1995) are more conclusive as they use a more direct measure for asymmetric information.

Raviv (1993) and Admati and Pfleiderer (1988) predict a negative relation between spread and trading activity. Harris and Raviv (1993) consider that higher trading volumes reflect a lack of agreement among market participants; so high volume periods will correspond to limit order arrivals at both sides of the spread and, contrary to the Easley and O'Hara hypothesis, increases in volume would be associated with increases in liquidity – but without the use of inside information. However, Admati and Pfleiderer (1988) suggest that discretional liquidity traders concentrate their orders when transaction costs are low. Finally, McInish and Wood (1992) maintain the hypothesis of a negative relation between trading activity and transaction costs arguing that greater trading activity can lead to lower spread due to economies of scale in trading cost.

Although empirical studies show a statistically significant relation between spread and trading activity, there is no unanimity about its sign. Hence, Copeland and Galai (1983) find in a trading and size cross–section analysis that, for high volume firms, spreads are narrower. Results by Lee *et al.* (1993) in time series analysis support the Easley and O'Hara hypothesis as they find a negative relation between liquidity and volume traded, although McInish and Wood (1992), Rubio and Tapia (1996) and Farinós *et al*. (2000) findings support, conversely, a negative relation.

## 3. DATA SETS

We have daily stock market data for all the firms that have been listed on the Spanish electronic stock market [*Sistema de Interconexión Bursátil Español* (SIBE)] for the period January 1990 to December 2002. Specifically, this data set includes daily closing prices, daily average prices, daily average of the best bid (ask) quotes, daily number of transactions, daily volume (number of shares) traded, average of the number of shares offered at the best bid (ask) quotes.[8,9]

From this database we have defined the following variables for firm *i* on day *t*:

- Average number of shares traded per transaction, or order size ($OS_{it}$):

$$OS_{it} = \frac{V_{it}}{NT_{it}} \qquad [3.1]$$

where $V_{it}$ is the volume traded and $NT_{it}$ is the number of transactions.

- Quoted bid–ask spread, either in absolute terms ($SA_{Qit}$), expression [3.2], or in proportional terms ($S_{Qit}$), expression [3.3].

$$SA_{Qit} = ask_{it} - bid_{it} \qquad [3.2]$$

$$S_{Qit} = \frac{ask_{it} - bid_{it}}{(ask_{it} + bid_{it})/2} \qquad [3.3]$$

- Mid–point of the spread ($MPS_{it}$), expression [3.4],

$$MPS_{Qit} = \frac{ask_{it} + bid_{it}}{2} \qquad [3.4]$$

[8] This database was provided by *Sociedad de Bolsas, S.A.*

[9] Splits have been taken into account in preparing the data time series.

• Depth ($D_{it}$), defined as the daily average number of shares offered at the best ask price plus the daily average number of shares offered at the best bid price.

In a specialist (driven–price) market, market makers continuously offer shares with prices at which they buy (bid price) and sell (ask price). Nevertheless, although the market maker is a figure that does not exist in continuous auction (driven–order) markets, like the Spanish market, spread and liquidity variables can be approximated through the order book, as limit orders in the order book can be assimilated to prices and volumes quoted by the market maker.[10]

We have chosen a bi–dimensional approximation to improve liquidity measurement through spread and depth. Therefore, we hypothesise, as Lee *et al*. (1993) and Rubio and Tapia (1996), that liquidity suppliers can reduce their loses from informed traders either increasing the spread and/or decreasing depth.

Given our objective, we prepared a second database consisting of all the target firms from takeovers conducted in the Spanish market for the period 1990–2002. The total number of takeover announcements was 262. This data set was obtained from the Spanish Security Exchange Commission (*Comisión Nacional del Mercado de Valores* – CNMV) annual reports. We also obtained the exact date of the takeover communication to the CNMV (offer date) from these reports.

Once the offer date was identified for each takeover, we searched the financial press for any previous rumour or leak in order to price the market information arrival. Given the Spanish *Equity Market Law* of 1998, the CNMV orders one firm trading halt when considers that a relevant piece of information could affect firm's market value (for instance, the CNMV always orders the trading halt of firms involved when a takeover is officially announced).[11] Thus, we only considered a rumour about a takeover if the CNMV halts firms involved trading. Consequently, the event–day ($t_S$) will coincide with the halt date either because of a rumour appeared in press (if it exists) or because of the official acquisition communication to the CNMV.

For a takeover announcement to be included in the final sample, we imposed several conditions:

- We have selected those target firms for which stock market data was available in the period that comprises 220 days before the event–day and 10 days after the resume-trading day ($t_R$). The application of this criteria excluded 117 takeover announcements.[12]
- No other contaminating event must exist in the five days prior to the event–day and after the resume–trading day that may affect target firm price, like dividend payments, equity issues or stock splits. Four takeover announcements were excluded.

---

[10] See footnote 4.

[11] Article 33 of the Spanish *Equity Market Law*.

[12] Most of the 117 takeover announcements excluded were over firms that do not trade in the SIBE (which is an electronic, continuous auction market), but in the parquet, which is a market where the order book does not exist.

- We have required that no other takeover announcement took place on a target firm, neither as a bidder nor as a target, in the 220 days before the event–day. We found eight takeover announcements that overlap.
- We have eliminated the 78 exclusion takeovers.
- We have eliminated target firms that exhibit extreme values in variables. We lost one takeover announcement.

These requirements reduced considerably our sample. The final number of takeover announcements included in the sample was 54.

## 4. ADVERSE SELECTION COST ESTIMATION

In this first analysis, we investigate the existence of the adverse selection cost in the Spanish stock market and its behaviour around the takeover announcement as a proxy of a more intensive insider trading activity.

Among the empirical models developed to estimate the spread components, and given the available sort of data for the entire sample period,[13] we focus on models based on price auto–covariance since they allow the use of daily data without the need for knowing the sign of the transaction made. Early bid–ask spread component estimators [Stoll (1989) and Glosten (1987)] suffer from an important problem as they hypothesise that the expected security value is constant over time. This assumption leads to a bias in the realised spread estimation[14] induced by return autocorrelation –problem that is resolved by George *et al.* (1991). However, this last estimator is also biased as it assumes that spread is constant over time. To allow for time variability in the spread, Kim and Ogden (1996) suggest the mid–point of the spread as a better proxy for the security true price. Bid–ask spread components are estimated by Kim Ogden (1996) through expression [4.1].

$$S_i = \beta_0 + \beta_1 \sqrt{\overline{S}_{Qi}^2} + \varepsilon_i \,, \qquad [4.1]$$

where $S_i$ is an estimation of the realised spread and $\sqrt{\overline{S}_{Qi}^2}$ is the unbiased estimator of the quoted spread proposed by Kim and Ogden (1996) defined by expression [4.2], where $T$ is the number of observations,

$$\overline{S}_{Qi}^2 = \frac{1}{T}\sum_{t=1}^{T} S_{Qit}^2 \,. \qquad [4.2]$$

Realised spread ($S_i$) is estimated by expression [4.3] through $RD_{it}$ autocovariance

$$S_i = 2\sqrt{-Cov(RD_{it}, RD_{i,t-1})} \,, \qquad [4.3]$$

where $RD_{it}$ is defined to be the difference between daily returns computed from transaction price ($R_{it}$) and daily returns based on mid–point of the spread ($R_{Mi,t}$), which is employed as an estimation of returns based on unobservable true prices.

[13] Intraday data are only available in the Spanish stock market starting on 1996.

[14] Realised spread is defined as the liquidity supplier's expected gain from a consecutive security purchase and sale. The existence of the adverse selection cost means that realised spread is lower than quoted spread.

Under the hypothesis of inventory cost absence, $\beta_I$ in model [4.1] is an unbiased estimator of the proportion that order processing cost represents on realised bid–ask spread and, therefore, (1-$\beta_I$) becomes the unbiased estimator of the proportion for the adverse selection component.

To investigate the takeover announcement impact on the adverse selection cost, we estimate the proportions of bid–ask spread components by performing a cross–sectional regression of model [4.1] to each of the following periods:

- A reference (uncontaminated) period that comprises the interval [$t_S$-220, $t_S$-21].
- A pre–announcement (event–contaminated) period that comprises the interval [$t_S$-10, $t_S$-1].
- A post–announcement period that comprises the interval [$t_R$, $t_R$+9].

Results from cross–sectional regressions are shown in Table 1. Results show that the weight of the order processing cost component estimate ($\beta_I$) on bid–ask quoted spread decreases remarkably in the contaminated period –but increases after the takeover announcement. In contrast, the estimate of adverse selection cost component proportion (1-$\beta_I$) changes from 45.67% in the reference period[15] to 70.89% in the contaminated period. In the post–announcement period, the adverse selection cost component weight on the quoted spread is 28.23%.[16]

---------TABLE 4.1--------

In order to verify that variations in the bid–ask spread components in Table 4.1 are event–related, we re–run all the regressions using a proper benchmark. Thus, each event firm is matched with a control firm chosen based on market value. Results for the adverse selection component (1-$\beta_I$) are 47.55%, 45.99% and 41.64% for each of the above analysed periods, respectively. Moreover, we test if the order processing cost component ($\beta_I$) estimation for the event sample is significantly different from its estimation for the control firm sample in each period. We only found a significant coefficient difference for the pre–announcement period [$t_S$-10, $t_S$-1].

The adverse selection cost behaviour found in Table 4.1 is consistent with the hypothesis that liquidity suppliers feel as more likely to trade with informed agents before the takeover announcement. As a result, the liquidity supplier weights more heavily the adverse selection component, leading to a major price discovery process. On the contrary, market behaviour after the takeover announcement may be interpreted by liquidity suppliers as an informed trading reduction, what would be reflected in a low adverse selection cost weight in the whole bid–ask spread (i.e. similar to the control sample level). That is, the more public information issued the less price informativeness.

[15] This result is consistent with the adverse selection cost estimated by Acosta *et al*. (2000) using Lin *et al*. (1995) model, which employs intraday data, for 132 listed firms in the Spanish stock market (SIBE) in March of 1998.

[16] These results are robust to changes in sample size. Hence, we found similar results in previous drafts of this paper performed with 27 takeover announcements for the period 1990–1998 and 39 takeover announcements for the period 1990–2000.

From spread split in Table 4.1, we study the abnormal behaviour around the event–day of the quoted spread components. For this analysis, we compute the aforementioned variables by monetary unit in the estimation window ($h \in [t_S\text{-}220;\ t_S\text{-}21]$), pre–announcement window ($h \in [t_S\text{-}5;\ t_S\text{-}1]$) and post–announcement window ($h \in [t_R;\ t_R\text{+}4]$) as expression [4.4] shows.

$$\begin{aligned} OPC_{it} &= S_{Qit} \times \beta_{1,h} \\ ASC_{it} &= S_{Qit} \times (1-\beta_{1,h}) \end{aligned} \qquad [4.4]$$

where the order processing cost ($OPC_{it}$) and the adverse selection cost ($ASC_{it}$) for firm *i* on day *t* are expressed per monetary unit and have been computed multiplying their respective quoted relative bid–ask spread ($S_{Qit}$) by the estimated weight of each component (Table 4.1) on the three windows analysed.

We compute the takeover announcement effect on the order processing cost and the adverse selection cost during the event window for firm *i* ($\Delta X_{it}$) as follows:

$$\Delta X_{it} = \frac{X_{it}}{\overline{X}_i} - 1, \qquad [4.5]$$

where $X_{it}$ is the observed value of each variable for firm *i* on the event window day *t* and $\overline{X}_i$ is the reference value on the uncontaminated period for firm *i*, calculated as the average of each variable in the estimation period [$t_S$-220, $t_S$-21]. Finally, we compute the cross–sectional average for each variable and event window day. Heteroskedasticity has been corrected with White methodology.

---------TABLE 4.2--------

Table 4.2 exhibits adverse selection cost and order processing cost abnormal behaviour around takeover announcements. In splitting the quoted spread into its components, we find a significantly unexpected positive behaviour of the adverse selection cost component before the takeover announcement. This may be interpreted as liquidity suppliers valuing a higher probability of trading with informed agents before the announcement. On the contrary, the order processing cost component shows significantly unexpected negative behaviour prior to the takeover announcement.

After the takeover announcement, the significant reductions in the adverse selection cost lead us to suppose that new information arrival decreases informational asymmetries, approaching the equity true value to the transaction price. On the other hand, we interpret the significant increase of the order processing cost on the resume day as investors overpaying for immediacy (specially purchasers) once information has been issued.[17]

## 5. TAKEOVER ANNOUNCEMENT EFFECT ON TARGET FIRM LIQUIDITY, RETURN AND TRADING ACTIVITY

Section four results show that liquidity supplier values as more likely the existence of insider traders before the takeover announcement. In this section, we study

[17] Significance in the abnormal behaviour of the order processing cost disappears after the resume day (period [$t_R$+1; $t_R$+4]) probably because the price increase on the resume day ($t_R$) removes any opportunity of gain with the takeover premium. This argument is consistent with the abnormal return behaviour around the takeover announcement that Table 5.1 exhibits.

the behaviour of several observable market activity features (specifically returns and trading activity measured through volume traded, number of transactions and order size) from the perspective of a more intense insider trading.

Additionally, we analyse liquidity (measured jointly through quoted spread and depth) in order to detect changes caused by adverse selection cost behaviour changes found in section four. As Foster and Viswanathan (1995), we consider that liquidity supplier can protect himself from insiders either increasing the spread either decreasing depth. Therefore, we expect liquidity reductions before the takeover announcement and post–announcement increases.

In the variable computation, we first transform closing price, mid–point of the spread, number of transactions, volume traded, order size, absolute and relative quoted spread and depth to their natural logs and, then, we compute their first differences.[18,19]

We test abnormal behaviour around the takeover announcement as follows. First, we compute daily changes of variables during ten days around the announcement date (day -5 through +4 relative to the halt–trading day ($t_S$) and the resume–trading day ($t_R$) respectively; that is, the period [$t_S$-5; $t_R$+4]) to a reference value computed as the simple average of the variable (equation [5.1]) in the estimation period [$t_S$-220, $t_S$-21],

$$\overline{X}_i = \frac{\sum_{t=t_S-21}^{t_S-220} X_{it}}{200} \qquad [5.1]$$

where $X_{it}$ is the growth rate observed of the corresponding variable for firm $i$ on day $t$ and $\overline{X}_i$ is the variable expected value. Second, we compute the unexpected variable value ($UV_{it}$) as equation 11 shows:

$$UV_{it} = X_{it} - \overline{X}_i \ . \qquad [5.2]$$

Finally, we compute a cross–sectional average for each variable every day of the event window. Moreover, we accumulate these average unexpected variations during the pre–event and post–event period relative to the announcement day. Heteroskedasticity has been accounted for in both cases through methodology proposed by White.

--------------TABLE 5.1----------------

Results for return variable (Panel B from Table 5.1) are consistent with those achieved by previous studies.[20] Hence, there is a significant abnormal return (computed with closing prices) increase of 3.11% in the pre–announcement period, though it is concentrated in the two previous days to the halt. Anyway, the greatest increase in price is related to the resume–trading day (6.77%), once the information has been issued.

[18] Employing first differences in variables, rather than levels of these variables, allows us to control for serial correlation in the levels. Log transformation is performed as the logged variables as more normally distributed.

[19] Returns are calculated with both closing price and mid–point of the spread. Under the hypothesis of symmetrical spreads, the mid–point of the spread would reflect the fundamental value of the equity, but closing prices incorporate transaction costs.

[20] Abnormal returns in this research are quite similar to those achieved in other studies related in the Spanish market like García and Ferrando (1992), Fernández and Gómez (1999), Fernández and García (2000) and García and Ibáñez (2001).

Note that when returns are computed with the mid–point of the spread, conclusions remain unchanged.

Regarding trading activity variables,[21] volume and number of transactions show significant abnormal increases in the pre–announcement period of 56.73% and 43.19%, respectively (Panel B from Table 5.1). These results may be interpreted as informed agents trading in the market not through abnormally large orders [Easley and O'Hara (1987)] but increasing the number of trades executed.

After the event–day, order size, volume and number of transaction variables show significant positive abnormal changes on day $t_R$. Negative abnormal changes for volume and number o transactions persist on the subsequent days –which are significant in some cases (Panel A from Table 5.1). However, the cross–sectional mean accumulative abnormal change for the entire post–announcement period (Panel B from Table 5.1) is not significant.[22] On the contrary, order size variable experiences a significant accumulative abnormal increase for the same period. Anyhow, these increases may not be linked with insider trading as information about the takeover has already been issued. The halt period length or the amount of information issued in the market may explain these changes.

Liquidity, measured through spread and depth, shows (Panel A and B from Table 5.1) inconclusive results, as we do not find jointly statistically significant changes in the pre–announcement period. However, a significant positive abnormal change in liquidity is observed in the overall post–event period, although none of the daily changes is statistically significant. Probably, this result may be caused by an informational asymmetry reduction. Hence, Panel B from Table 5.1 exhibits a significant spread decrease (30.61% when computed as quoted spread and 36.70% when computed as relative spread) jointly with a significant depth increase of 50.49%.

Results from transaction cost, measured through quoted and relative bid–ask spread, do not reflect the behaviour found in the adverse selection cost analysis from Section 4. This apparent inconsistency may be explained because of the compensatory effect that order processing cost has over the whole bid–ask spread, masking, consequently, the adverse selection cost behaviour. In this way, notice that the behaviour of spread components on the resume day after the takeover announcement leads to a non–significant change of the bid–ask spread that day. Anyhow, depth behaviour is not consistent with a liquidity provider protecting himself from informed traders, questioning the negative relation between spread and depth argued and tested by Lee *et al.* (1993).

## 6. CROSS–SECTIONAL ANALYSIS OF THE SPREAD BEHAVIOUR AROUND TAKEOVER ANNOUNCEMENTS

Due to the results achieved in the above section, we explore the relation between trading activity and transaction costs, and liquidity by extension, in the Spanish market. Specifically, we further examine if the event itself affects liquidity, if trading activity

[21] On interpreting these results, we must bear in mind that variables express abnormal daily changes. Therefore, abnormal negative changes preceded by wide positive changes do not have to imply, necessarily, that the level of those variables decreases under their normal or expected value.

[22] This behaviour is consistent with the argumentation of note 17.

changes are related to changes in spread and depth, and, finally, if these changes have a different effect on spread and depth in the event–period.

Schwartz (1988) identifies four classes of variables as determinants of the bid–ask spread: activity, risk, information and competition. By extension, and under the hypothesis of an inverse relationship between depth and spread [Lee *et al*. (1993)], depth should exhibit a relation with Schwartz's variables conversely to that among spread and Schwartz's variables.

We perform a cross–sectional regression analysis of spread and depth daily change during the period [$t_S$-220, $t_R$+4], examining both non–event and event periods by stacking the data across firms and days (equation [6.1]). We use number of transactions, volume traded and order size as proxies of trading activity in the independent regression variables. Moreover, in order to reflect the information arrival impact, we employ dummy variables to test for event–related shifts in the intercept and the slope coefficients on changes in the trading activity variables. Hence, the event–window is split into four subperiods that comprise (i) day $t_S$-5 through day $t_S$-2 (*PRE*), (ii) the day prior to the announcement date (*PRD*), (iii) the first trading day after the announcement (*POD*) and (iv) day $t_R$+1 through day $t_R$+4 (*POE*). Risk is measured through a volatility measure, defined as the squared return ($R^2_{it}$) computed with the mid–point of the spread.[23] Additionally to risk, we incorporate the stock value through the mid–point of the spread ($P_{MPS,it}$) in order to better control for spread shifts discussed in inventory cost microstructure papers.[24] Finally, we do not consider Schwartz's competition determinant since, from our point of view, in order–driven systems like the Spanish market, competition is not a relevant variable as there are no restrictions to the introduction of limit orders.

We estimate equation [6.1] individually for each of the three trading activity measures in order to measure the order flow and avoid multicoliniality problem in variables. Equation [6.1] is estimated in first initial differences to control for serial correlation in liquidity, price, and order flow measures.

$$\begin{aligned}\Delta\ln(L_{it}) = {} & \alpha + \beta_{TA}\Delta\ln(TA_{it}) + \beta_R\Delta\ln(P_{MPS\,it}) + \beta_{R^2}R^2_{it} + \\ & + \beta_1 PRE + \beta_2 PRD + \beta_3 POD + \beta_4 POE + \\ & + \beta_5 PRE\times\Delta\ln(TA_{it}) + \beta_6 PRD\times\Delta\ln(TA_{it}) + \\ & + \beta_7 PRD\times\Delta\ln(TA_{it}) + \beta_8 POD\times\Delta\ln(TA_{it}) + \omega_t\end{aligned} \qquad [6.1]$$

where $L_{it}$ is, alternatively, the absolute spread, the relative spread and the depth of firm *i* on day *t*, $TA_{it}$ is the trading activity variable realised value (volume, number of transactions and order size) of firm *i* on day *t*; *PRE* , *PRD*, *POD* and *POE* are dummy variables with value one in the aforementioned periods and zero otherwise, and, finally, $\omega_t$ is an error term, $u_t+\gamma\omega_{t-1}$, where $\gamma$ is the AR(1) parameter, and $u_t$ is a i.i.d. variable with zero mean and constant variance.

Full sample OLS coefficients from cross–sectional regression [6.1] are shown in Panel A from Table 6.1.[25] We split the sample in two subsamples by firm size and re–

[23] We use the mid–point of the spread to compute returns but not closing prices since returns based on closing prices are biased because of transaction costs.

[24] See Tinic and West (1972) and Demsetz (1968).

[25] We do not show results for relative spread as they are identical to those achieved with the absolute spread.

run cross–sectional regression [6.1] for large firms (Panel B) and small firms (Panel C).[26,27] In this way, we detect whether firm size leads to a differential behaviour given the evidence in the Spanish market that quoted spread is firm size related [Rubio and Tapia (1996)].[28] We control heteroskedasticity through White's methodology.

---------TABLE 6.1--------

Two results show up. Firstly, we find either for the full sample or the two subsamples that the sign of the relation between liquidity and trading activity is robust to the trading activity measure used; and secondly, that the sign of the relation between quoted spread (depth) and trading activity is negative (positive) and statistically significant in all cases, except between spread and order size for the small firm subsample. These findings are consistent with theories from Harris and Raviv (1993) and Admati and Pfleiderer (1988), and the arguments about economies of scale in trading cost of McInish and Wood (1992); that is, a positive relation between liquidity and trading activity.

The relation found among price and risk variables (included in order to control for inventory cost) and bid–ask spread exhibits the expected sign and it is significant in all cases. Nevertheless, the extension of this relationship to depth, and therefore to liquidity, is not significant for the risk variable. In the case of the price variable, it is not significant only for the small firm subsample.

Regarding information, the significant changes found in the bid–ask spread reflect, in contrast to those achieved in the spread univariate analysis (Panel A from Table 5.1), an increase in the day immediately prior to the announcement for the full sample ($\beta_2$ in Panel A from Table 6.1). Interestingly, in splitting the sample by firm size, we only find the same result for the small firm subsample (Panel C from Table 6.1), suggesting that insider trading is more severe in small firms. In the post–event period, once the information has been issued, we do not detect in general terms a significant relationship among the information dissemination dummy variables and the spread.

On the other hand, we do not detect a clear differential effect of trading activity on liquidity before the takeover announcement. Thus our results do not support the concern of trading activity as a proxy of insider trading in the Spanish market. Hence, we find few significant coefficients for *PRE* and *PRD* dummy variables, and those significant show a negative sign ($\beta_5$ and $\beta_6$ in Panel A, B and C). There is not any remarkably differential relation in the post–event period either.

Concerning depth, we do not find the expected relationship with the information related variables that allows to generalise to depth the relationships established in the literature for the bid–ask spread and that, at the same time, allows us to obtain definitive conclusions about liquidity. Anyhow, it is worth to mention the significant increases of depth around the takeover announcement caused by the information arrival and the sort of event studied.

---

[26] In June of each year, we use the median firm size of all the firms traded in the Spanish market in order to categorise as large or small each sample firm.

[27] Given the small number of firms in the subsamples, results must be interpreted cautiously.

[28] We thank a referee for this suggestion.

Results achieved in this section about the relationship between information and liquidity suggest that, once we control for trading activity, risk and price, (i) the event itself does not induce liquidity unequivocal changes (when liquidity is proxied jointly through spread and depth); that (ii) the bid–ask spread behaviour prior to the announcement indicates some grade of liquidity supplier protection; and that (iii) changes in trading activity do not seem to be a signal of insider trading in the Spanish market.

## 7. CONCLUSIONS

In this paper, we employ one of the major corporate event, a takeover announcement, in order to investigate whether the Spanish stock market values the possibility of informed trading and, if it does, if it may reflect in some market activity observable features (i.e. liquidity, return, trading activity). Although the Spanish stock market is relatively small in relation to US markets where this topic has been largely investigated, insider trading around takeover announcements is a recurrent problem as the CNMV has promoted several official investigations in suspecting irregularities around corporate takeovers.[29] Anyway, the Spanish market for corporate control is relatively important (262 takeover announcements is the period 1990–2002) in relation to the size of the Spanish stock market (about one hundred listed firms on average in the same period). However, the characteristics of the Spanish market determine the sample size and the characteristics of the data employed in this research. Hence, we use daily data and a sample of 54 takeover announcements for the period January 1990 to December 2002.[30]

The main result of this research is the estimation and analysis of the bid–ask spread components (adverse selection cost and order processing cost), which show that liquidity suppliers in the Spanish market values the possibility of trading with informed agents. Specifically, the adverse selection cost behaviour around the takeover announcement is consistent with a higher valuation of the possibility of insider trading before the takeover announcement. This result is confirmed when we model transaction costs in cross–section.

The statistically significant abnormal returns we found before the takeover announcement reflect the existence of informed agents trading around the takeover announcement. Nevertheless, we do not find the expected decrease in liquidity, as depth does not experience significant negative changes before the announcement. On the other hand, the positive relation detected in this research between trading activity and liquidity do not allow to interpret the abnormal increases in trading activity around the takeover announcement as a proxy of insider trading.

Evidence found suggests that (i) informed agents take advantage of their asymmetric information in order to gain high abnormal returns before the information is issued and that (ii) liquidity supplier reacts to this informed agent behaviour increasing the adverse selection cost of the bid–ask spread. However, our results are based on the premise that informed agents trade through market orders and, consequently, limit

[29] That is the case, for example, of the takeover over *Asturiana de Zinc* (see the financial journal *Expansión* –January 26 2002) or the takeover over *Enaco* (see the financial journal *Cinco Días* –March 14 2002).

[30] Intraday data are only available in the Spanish stock market starting on 1996, so the use of this sort of data would extremely reduce our sample size.

orders are nor informative. Probably, data will reflect more clearly the existence of informed agents if the informativeness of limit orders could be taken into account. This assures further investigation on this topic.

## REFERENCES


Acosta, J., M.P. Osorno and M.G. Rodríguez, 2000, Los costes de selección adversa en el mercado bursátil español, VIII Foro de Finanzas, Madrid.

Admati, A. and P. Pfleiderer, 1988, A theory of intraday patterns: volume and price variability, *The Review of Financial Studies* 1, 3–40.

Asquith, P., 1983, Merger bids, uncertainty, and stockholder returns, *Journal of Financial Economics* 11, 51–83.

Asquith, P., R. Brunner and D.W. Mullins, 1983, The gains to bidding firms from mergers, *Journal of Financial Economics* 11, 121–139.

Biais, B., P. Hillion and C. Spatt, 1995, An empirical analysis of the limit order book and the order flow in the Paris Bourse, *Journal of Finance* 50, 1655–1689.

Conrad, J. and C. Niden, 1992, Order flow, trading costs and corporate acquisition announcements, *Financial Management*, winter, 22–31.

Copeland, T.E. and D. Galai, 1983, Information effects on the bid/ask spread, *Journal of Finance* 38, 1457–1469.

Demsetz, H., 1968, The cost of transacting, *Quarterly Journal of Economics* 82, 33–53.

Easley, D. and M. O'Hara, 1987, Price, trade size, and information in securities markets, *Journal of Financial Economics* 19, 69–90.

Easley, D. and M. O'Hara, 1992, Time and the process of security price adjustment, *Journal of Finance* 2, 577–605.

Farinós, J.E. and M. Fernández, 1999, La incidencia de una OPA sobre la actividad negociadora y la estimación del riesgo sistemático de las empresas objetivo, *Revista Española de Financiación y Contabilidad* 100, 381–401

Farinós, J.E., García, C.J. and A.M. Ibáñez, 2000, Efectos del anuncio de una OPA en la liquidez y en la actividad negociadora de las empresas objetivo, *Revista Europea de Dirección y Economía de la Empresa* 9,13–27.

Fernández, A.I. and S. Gómez, 1999, Un estudio de las Ofertas Públicas de Adquisición en el mercado de valores español, *Investigaciones Económicas* 23, 471–495.

Fernández, M. and C.J. García, 1995, El efecto de la publicación de una OPA sobre la rentabilidad de las acciones, *Revista Española de Economía* 12, 219–240.

Fernández, M. and C.J. García, 2000, La compra de volúmenes significativos de acciones en el mercado español, *Investigaciones Económicas* 24, 237–267.

Firth, M., 1980, Takeovers, shareholder returns, and the theory of the firm, *The Quarterly Journal of Economics* 94, 235–260.

Foster, F.D. and S. Viswanathan, 1995, Trading costs of target firms around corporate takeovers, In *Advances in Financial Economics*, vol. I, 37–57. JAI Press Inc.

García, C.J. and M. Ferrando, 1992, Tomas de poder: efectos sobre la rentabilidad de las acciones, *Revista Europea de Dirección y Economía de la Empresa* 1, 115–124.

García, C.J. and A.M. Ibáñez, 2001, Ganancias anormales en las OPAs: una comparación con modelos generadores de rendimientos, *Revista Española de Financiación y Contabilidad* 109, 723–742.

George, T J., G. Kaul and M. Nimalendran, 1991, Estimation of the bid–ask spread and its components: A new approach, *The Review of Financial Studies* 4, 623–655.

Glosten, L., 1987, Components of the bid/ask spread and the statistical properties of transaction prices, *Journal of Finance* 42, 1293–1308.

Harris, M. and A. Raviv, 1993, Differences of opinion make a horse race, *Review of Financial Studies* 3, 473–506.

Jennings, R., 1994, Intraday changes in target firms' share price and bid–ask quotes around takeover announcements, *Journal of Financial Research* 2, 255–270.

Jensen, M.C. and S.R. Ruback, 1983, The market for corporate control. The scientific evidence, *Journal of Financial Economics* 11, 5–56.

Kim, S.–H. and J.P. Ogden, 1996, Determinants of the components of bid–ask spread on stocks, *European Financial Management* 1, 127–145.

Lee, M.C., B. Mucklow and M.J. Ready, 1993, Spreads, depths, and the impact of earnings information: An intraday analysis, *Review of Financial Studies* 6, 345–374.

Lin, J.C., G. Sanger and G.G. Booth, 1995, Trade size and components of the bid–ask spread, *Review of Financial Studies* 8, 1153–1183.

Malatesta, P.H. and R. Thomson, 1985, Partially anticipated events: A model of stock price reactions with an application to corporate acquisitions, *Journal of Financial Economics* 14, 237–250.

McInish, T.H. and R.A. Wood, 1992, An analysis of intraday patterns in bid/ask spreads for NYSE stocks, *Journal of Finance* 47, 753–764.

Rubio, G. and M. Tapia, 1996, Adverse selection, volume, and transactions around dividend announcements in a continuos auction system, *European Financial Management* 2, 39–69.

Sanders, R.W. and J.S. Zdanowicz, 1992, Target firm abnormal returns and trading volume around the initiation of change in control transactions, *Journal of Financial and Quantitative Analysis* 1, 109–129.

Schwartz, R.A., 1988, *Equity Markets* (Ed. Harper and Row, New York).

Smith, B.F., R. White, M. Robinson and R. Nason, 1997, Intraday volatility and trading volume after takeover announcements, *Journal of Banking and Finance* 21, 337–368.

Stoll, H.R., 1989, Inferring the components of the bid–ask spread: Theory and empirical tests, *Journal of Finance* 44, 115–134.

Sundarsanam, S., 1996, Target shareholder, takeovers and target valuation, *Journal of Business, Finance and Accounting* 23, 295–314.

Tinic, S. and R. West, 1972, Competition and pricing of Dealer Services in the over the counter market, *Journal of Financial and Quantitative Analysis*, June, 1707–1727.

# TABLE 4.1

**Quoted spread components estimation.** Sample consists on 54 target firm takeover announcements for the period January 1990 to December 2002. Components of the quoted spread are estimated through the following cross–sectional regression:

$$S_i = \beta_0 + \beta_1 \sqrt{\bar{S}^2_{Qi}} + \varepsilon_i ,$$

where $S_i$ is an estimation of the realised spread and $\sqrt{\bar{S}^2_{Qi}}$ is the unbiased estimator of the quoted spread proposed by Kim and Ogden (1996) and defined as $\bar{S}^2_{Qi} = \frac{1}{T}\sum_{t=1}^{T} S^2_{Qit}$, where $T$ is the number of observations. Realised spread ($S_i$) is estimated through $RD_{it}$ autocovariance:

$$S_i = 2\sqrt{-Cov(RD_i, RD_{i,t-1})} ,$$

where $RD_{it}$ is defined to be the difference returns based on transaction price ($R_{it}$) and returns based on the mid–point of the spread ($R_{Mi,t}$) employed as an estimation of returns based on unobservable true prices. Heteroskedasticity is accounted through White robust standard errors ($p$–values are in parentheses).

| | **[$t_S$-200, $t_S$-21]** | **[$t_S$-10, $t_S$-1]** | **[$t_R$, $t_R$+9]** |
|---|---|---|---|
| $\beta_0$ | 0.0028 | 0.0044 | 0.0027 |
| | (0.01) | (0.01) | (0.25) |
| $\beta_1$ | 0.5433 | 0.2911 | 0.7178 |
| | (0.00) | (0.01) | (0.02) |
| *Adjusted* $R^2$ *(%)* | 87.42 | 14.43 | 36.11 |
| *F–statistic* | 369.42 | 9.94 | 30.39 |
| | (0.00) | (0.00) | (0.00) |

## TABLE 4.2

**Adverse selection cost and order processing cost abnormal behaviour around the takeover announcement.** Adverse selection cost and order processing cost are computed by monetary unit from spread split in Table 4.1 in the estimation window ($h \in [t_S$-220; $t_S$-21]), pre–announcement window ($h \in [t_S$-5; $t_S$-1]) and post–announcement window ($h \in [t_R$; $t_R$+4]) as follows:

$$OPC_{it} = S_{Qit} \times \beta_{1h}$$

$$ASC_{it} = S_{Qit} \times (1 - \beta_{1h})$$

where $S_{Qit}$ is the quoted relative bid–ask spread and $\beta_{1h}$ is the Kim and Ogden (1996) order processing cost estimated. We compute daily unexpected values during the event window for the relative quoted spread and its components for firm *i* ($\Delta X_{it}$) as follows:

$$\Delta X_{it} = \frac{X_{it}}{\overline{X}_i} - 1$$

where $X_{it}$ is the observed value of each variable for firm *i* on the event window day *t* and $\overline{X}_i$ is the variable expected value for firm *i*, calculated as the average of each variable in the estimation period [$t_S$-220, $t_S$-21]. Finally, we calculate the cross–sectional average for each variable and event window day. Heteroskedasticity is accounted through White robust standard errors (*p*–values are in parentheses).

| | ASC | OPC |
|---|---|---|
| $t_S$-5 | 0.4345 | -0.5050 |
| | (0.00) | (0.00) |
| $t_S$-4 | 0.4403 | -0.5030 |
| | (0.00) | (0.00) |
| $t_S$-3 | 0.3577 | -0.5315 |
| | (0.00) | (0.00) |
| $t_S$-2 | 0.3355 | -0.5391 |
| | (0.00) | (0.00) |
| $t_S$-1 | 0.3959 | -0.5183 |
| | (0.00) | (0.00) |
| $t_R$ | -0.3717 | 0.3424 |
| | (0.03) | (0.06) |
| $t_R$+1 | -0.5922 | -0.1287 |
| | (0.00) | (0.24) |
| $t_R$+2 | -0.6019 | -0.1495 |
| | (0.00) | (0.11) |
| $t_R$+3 | -0.5884 | -0.1207 |
| | (0.00) | (0.19) |
| $t_R$+4 | -0.5227 | -0.0198 |
| | (0.01) | (0.92) |

## TABLE 5.1

**Daily and accumulated average abnormal changes of variables around the takeover announcement.** Panel A shows daily abnormal average changes for closing prices ($R_{CP}$), mid–point of the spread ($R_{MPS}$), order size (*OS*), volume traded (*V*), number of transaction (*NT*), absolute quoted spread ($SA_Q$), relative spread ($S_Q$), and depth (*D*). These variables are calculated as the simple average of the unexpected variable value ($UV_{it}$):

$$UV_{it} = X_{it} - \overline{X}_i ,$$

where $X_{it}$ is the growth rate observed of the corresponding variable for firm *i* on day *t* and $\overline{X}_i$ is the variable expected value computed as follows in the estimation period [$t_S$-220, $t_S$-21].
Panel B exhibits the event impact through accumulated average abnormal changes ($UAV_{K,L}$) during the pre– ([K, L] = [$t_S$-1; $t_S$-5]) and post– ([K, L] = [$t_R$; $t_R$+4]) announcement period.
Heteroskedasticity is accounted through White robust standard errors (*p*–values are in parentheses).

| | $R_{CP}$ | $R_{MPS}$ | *OS* | *V* | *NT* | $SA_Q$ | $S_Q$ | *D* |
|---|---|---|---|---|---|---|---|---|
| **Panel A: Cross-sectional daily average abnormal changes** | | | | | | | | |
| $t_S$-5 | 0.0023 | 0.0057 | 0.0734 | 0.1414 | 0.0683 | 0.0081 | 0.0022 | 0.0453 |
| | (0.52) | (0.01) | (0.47) | (0.40) | (0.52) | (0.93) | (0.98) | (0.57) |
| $t_S$-4 | -0.0001 | 0.0027 | -0.2555 | -0.1360 | 0.1197 | 0.0397 | 0.0370 | -0.0300 |
| | (0.98) | (0.36) | (0.01) | (0.39) | (0.26) | (0.53) | (0.63) | (0.70) |
| $t_S$-3 | -0.0012 | -0.0004 | 0.2353 | 0.1946 | -0.0405 | -0.0632 | -0.0628 | -0.0636 |
| | (0.71) | (0.90) | (0.10) | (0.32) | (0.72) | (0.60) | (0.32) | (0.49) |
| $t_S$-2 | 0.0070 | 0.0077 | 0.1135 | 0.1779 | 0.0643 | -0.0618 | -0.0695 | 0.1140 |
| | (0.05) | (0.04) | (0.41) | (0.33) | (0.56) | (0.37) | (0.32) | (0.27) |
| $t_S$-1 | 0.0231 | 0.0186 | -0.0149 | 0.2343 | 0.2492 | 0.1160 | 0.0979 | 0.2590 |
| | (0.00) | (0.00) | (0.93) | (0.36) | (0.12) | (0.21) | (0.30) | (0.02) |
| $t_R$ | 0.0677 | 0.0739 | 0.3395 | 1.0939 | 0.7546 | -0.0415 | -0.1065 | 0.8692 |
| | (0.00) | (0.00) | (0.02) | (0.00) | (0.00) | (0.74) | (0.42) | (0.00) |
| $t_R$+1 | 0.0010 | 0.0035 | -0.0799 | -0.3401 | -0.2599 | -0.3225 | -0.3258 | -0.2670 |
| | (0.73) | (0.27) | (0.39) | (0.03) | (0.02) | (0.00) | (0.00) | (0.12) |
| $t_R$+2 | -0.0019 | -0.0020 | 0.2400 | -0.2458 | -0.4856 | 0.0070 | 0.0087 | 0.1475 |
| | (0.35) | (0.90) | (0.01) | (0.04) | (0.00) | (0.93) | (0.91) | (0.14) |
| $t_R$+3 | 0.0042 | 0.0002 | -0.0504 | -0.0847 | -0.0341 | 0.0321 | 0.0317 | -0.1365 |
| | (0.12) | (0.90) | (0.62) | (0.58) | (0.69) | (0.68) | (0.68) | (0.12) |
| $t_R$+4 | -0.0037 | -0.0038 | -0.1304 | -0.2953 | -0.1646 | 0.0009 | 0.0046 | -0.1070 |
| | (0.03) | (0.14) | (0.21) | (0.03) | (0.03) | (0.99) | (0.95) | (0.24) |
| **Panel B: Cross-sectional mean accumulative abnormal changes** | | | | | | | | |
| [$t_S$-5;$t_S$-1] | 0.0311 | 0.0337 | 0.1361 | 0.5673 | 0.4319 | 0.0405 | 0.0072 | 0.2910 |
| | (0.00) | (0.00) | (0.39) | (0.03) | (0.01) | (0.71) | (0.95) | (0.01) |
| [$t_R$;$t_R$+4] | 0.0674 | 0.0705 | 0.3142 | 0.1668 | -0.1463 | -0.3061 | -0.3670 | 0.5049 |
| | (0.00) | (0.00) | (0.03) | (0.47) | (0.26) | (0.02) | (0.01) | (0.01) |

## TABLE 6.1

**Cross–section analysis of quoted spread and depth changes.** The OLS estimations of the cross–sectional determinants of changes in target quoted spread and depth during non–event period and around the takeover announcement have been performed through equation [6.1] –see main text–. The remaining variables are defined as in Table 5.1. Heteroskedasticity is accounted through White robust standard errors.

| Trading Activity Variable | Dependent Variable: Quoted Spread | | | Dependent Variable: Depth | | |
|---|---|---|---|---|---|---|
| | NT | OS | V | NT | OS | V |
| **Panel A: Full Sample** | | | | | | |
| $\alpha$ | 0.0003 | 0.0004 | 0.0004 | 0.0008 | 0.0003 | 0.0006 |
| $\beta_{TA}$ | -0.0570[a] | -0.0200[a] | -0.0286[a] | 0.1403[a] | 0.2505[a] | 0.1718[a] |
| $\beta_{PRICE}$ | -3.7371[a] | -3.8845[a] | -3.7998[a] | 0.7243[a] | 1.1175[a] | 0.6439[b] |
| $\beta_{RISC}$ | 7.7950[a] | 7.4716[a] | 7.8131[a] | -0.7327 | 0.4491 | -1.0289 |
| $\beta_1$ | -0.0027 | -0.0053 | -0.0034 | -0.0212 | -0.1926 | -0.0245 |
| $\beta_2$ | 0.2396[a] | 0.2279[a] | 0.2497[a] | 0.2809[a] | 0.3022[a] | 0.2734[a] |
| $\beta_3$ | -0.0170 | 0.0645 | 0.0451 | 0.7600[a] | 0.5374[a] | 0.5975[a] |
| $\beta_4$ | -0.0384 | -0.0277 | -0.0239 | -0.0905[c] | -0.0720[b] | -0.0398 |
| $\beta_5$ | -0.0187 | -0.0044 | -0.0098 | 0.0209 | -0.0371 | -0.0107 |
| $\beta_6$ | -0.0507 | -0.1957[a] | -0.0969 | 0.0975 | 0.0184 | 0.0259 |
| $\beta_7$ | 0.0790 | -0.1176 | -0.0043 | -0.1877 | 0.2074 | -0.0475 |
| $\beta_8$ | 0.0053 | 0.0850 | 0.0389 | -0.1959 | 0.1388 | -0.0105 |
| *Adjusted $R^2$* | 0.1953 | 0.1928 | 0.1948 | 0.2004 | 0.2961 | 0.2855 |
| *F-statistic* | 230.61[a] | 227.02[a] | 229.90[a] | 268.60[a] | 399.80[a] | 379.83[a] |
| **Panel B: Large Firms** | | | | | | |
| $\alpha$ | 0.0017 | 0.0018 | 0.0018 | 0.0002 | -0.0008 | -0.0004 |
| $\beta_{TA}$ | -0.0982[a] | -0.0296[a] | -0.0458[a] | 0.2101[a] | 0.2600[a] | 0.2093[a] |
| $\beta_{PRICE}$ | -3.4026[a] | -3.6756[a] | -3.5517[a] | 1.1578[b] | 1.7661[a] | 1.1551[a] |
| $\beta_{RISC}$ | 6.3025[a] | 6.0139[a] | 6.2689[a] | -1.2957 | 0.1186 | -1.0132 |
| $\beta_1$ | 0.0146 | 0.0106 | 0.0107 | 0.0283 | 0.0347 | 0.0264 |
| $\beta_2$ | 0.0236 | 0.0581 | 0.0726 | 0.1640 | 0.2553[c] | 0.1533 |
| $\beta_3$ | 0.2215 | 0.2218 | 0.2481 | 0.3112[c] | 0.3555[b] | 0.3005[c] |
| $\beta_4$ | -0.0683 | -0.0441 | -0.0392 | -0.0284 | -0.0502 | -0.0167 |
| $\beta_5$ | 0.0214 | 0.0966[c] | 0.0495 | -0.0188 | -0.0139 | -0.0313 |
| $\beta_6$ | 0.1016 | -0.1058 | -0.0159 | 0.1340 | 0.0565 | 0.0697 |
| $\beta_7$ | -0.1850 | -0.2821[a] | -0.1360[c] | 0.4313[b] | 0.3373 | 0.1818 |
| $\beta_8$ | -0.0161 | 0.1919 | 0.0989 | 0.0363 | 0.0650 | 0.0343 |
| *Adjusted $R^2$* | 0.1976 | 0.1914 | 0.1957 | 0.2258 | 0.3089 | 0.3275 |
| *F-statistic* | 109.95[a] | 105.72[a] | 108.68[a] | 130.68[a] | 199.79[a] | 217.57[a] |
| **Panel C: Small Firms** | | | | | | |
| $\alpha$ | -0.0010 | -0.0009 | -0.0009 | 0.0012 | 0.0011 | 0.0012 |
| $\beta_{TA}$ | -0.0352[a] | -0.0129 | -0.0181[a] | 0.1028[a] | 0.2431[a] | 0.1486[a] |
| $\beta_{PRICE}$ | -3.9669[a] | -4.0694[a] | -3.9984[a] | 0.2489 | 0.5840[b] | 0.1778 |
| $\beta_{RISC}$ | 9.3686[a] | 9.1117[a] | 9.3511[a] | 1.0500 | 0.8067 | -0.0527 |
| $\beta_1$ | -0.0188 | -0.0188 | -0.0170 | -0.0686[c] | -0.0703[c] | -0.0730[b] |
| $\beta_2$ | 0.3979[a] | 0.3850[a] | 0.3914[a] | 0.3416[a] | 0.3385[a] | 0.3379[a] |
| $\beta_3$ | -0.2992[c] | -0.1487 | -0.2695 | 1.3787[b] | 0.7586[a] | 1.1062[b] |
| $\beta_4$ | -0.0130 | -0.0054 | -0.0090[c] | -0.1337[c] | -0.0964[c] | -0.0547 |
| $\beta_5$ | -0.0453 | -0.0745 | -0.0510 | 0.0341 | -0.0483 | -0.0021 |
| $\beta_6$ | -0.0651 | -0.2448[a] | -0.1115[a] | 0.0865 | 0.0062 | 0.0176 |
| $\beta_7$ | 0.2004[b] | 0.1303 | 0.1204[c] | -0.5208[c] | 0.0186 | -0.2705 |
| $\beta_8$ | 0.0068 | 0.0135 | 0.0003 | -0.2791 | 0.1880[b] | -0.0319 |
| *Adjusted $R^2$* | 0.1964 | 0.1956 | 0.1968 | 0.1942 | 0.2883 | 0.2645 |
| *F-statistic* | 124.08[a] | 123.49[a] | 124.40[a] | 122.30[a] | 204.82[a] | 182.01[a] |

[a, b, c] Significantly different from zero at the 1%, 5% and 10% level, respectively.