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An investigation of insider trading profits in the Spanish stock market

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Abstract

This paper investigates the profitability and information content of insider trading in the Spanish stock market. Our results show that insiders earn excess profits when investing on corporate nonpublic information, while outsiders mimicking them fail to obtain those excess returns. The paper also investigates the relevance of a third party investing on the insider's behalf. The study further focuses on some methodological aspects, such as the need to take estimation periods that are not affected by other events or by other prediction periods, and the need to allow volatility during insider trading events to have interday memory.

JEL classification: G140; G120; C130; D820

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1. Introduction

Insider trading literature focuses on the examination of insiders trading on material, nonpublic corporate information, so as to gauge whether insiders earn larger profits than those they would obtain if they traded on the available public-information set. The rationale of this research lies in the debate over whether insider transactions produce more informative

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security prices, fostering market efficiency, or whether these large profits point on the contrary to the inefficiency of capital markets. Furthermore, research on insider trading also attempts to ascertain the extent to which noninsiders could achieve the excess returns earned by insiders. Previous papers have produced contradictory evidence regarding the profitability of insiders and the social effects of insider trading. Kerr (1980), Lin and Howe (1990) and Holderness and Sheehan (1985) support strong-form efficiency, while Jaffe (1974a), Seyhun (1986, 1988a) or Madura and Wiant (1995) identify abnormal performance attributable to insiders; some of the latter papers also produce evidence against the semistrong form of the efficient market hypothesis (hereafter EMH). However, the literature on insider trading mainly supports the view that while insiders manage to outperform the market, outsiders cannot obtain excess returns by merely imitating insiders' transactions.

The research on insider trading has been confined to a small number of financial markets. In addition to U.S. markets, studies on insider trading have been performed for the Canadian and Mexican stock markets (Baesel and Stein, 1989 and Bhattacharya et al. 2000, respectively) and, in Europe, only for the Oslo Stock Exchange (Eckbo and Smith, 1998) and the London Stock Exchange (Pope et al., 1990). Our research uses Spanish stock market data for the first time to examine the debate on the profitability and information content of insider trading and its benefits and drawbacks.

Insider trading is illegal in Spain. Under the assumption that the drawbacks of insider trading outweigh its benefits, both company and security market laws are designed to prosecute and penalize the use of private information by corporate insiders. Though more recent and less developed than U.S. rules, the comprehensive Spanish legislation on insider trading does promulgate the disclose-or-refrain rule. It is telling, however, that there is, no record of insider trading having been prosecuted in recent decades. That may cast doubts on the effectiveness of these laws, raising the question of whether insiders may be encouraged to invest on the basis of their private information.

There is little literature on the use of private information in Spanish stock markets. As a result, it is quite difficult to anticipate how insider trading may be affecting market efficiency.[1] Spanish markets are in need of a comprehensive research on the investment behavior of informed traders. With regard to the market microstructure literature, only a few papers such as Tapia (1996) and Rubio and Tapia (1996), analyze trading behavior in an asymmetric-information setting, suggesting that informed investors usually benefit from their trading. In the context of the event study methodology, Ocaña et al. (1997) and Del Brio et al. (2000) also suggest that insiders may be exploiting their private information. Taking a sample of take-overs and investment announcements, respectively, both detect that the market reacts during the preannouncement period, which may be attributable to the presence of private information in the market. However, in neither case are data on insider trades used. Another relevant but unexplored aspect of insider trading in Spanish markets is the debate on the desirability of the legalization of insider trading. As far as we know, only the legal literature on insider trading has focused on this issue.

From the foregoing it may be readily concluded that this paper has a big gap to fill. Firstly, it should yield conclusions as to the profitability and information content of insider trading in the Spanish market, since this has never been done before. Secondly, in view of the results, and bearing in mind that insider trading is prohibited under Spanish laws, the paper should

determine whether insider trading effects on the formation of security prices are beneficial or harmful, and evaluate the effectiveness of insider trading laws.

However, the scope of the current study goes beyond this debate. Some of the papers that provide evidence on the abnormal performance of inside traders commonly document the presence of model misspecification and other features that might be distorting their results. This paper investigates whether the results remain the same after controlling for some of these deficiencies. The paper thus gauges the sensitivity of the results to some improvements in the methodology: the use of daily data,[2] the selection of estimation periods that are not contaminated by other events or other prediction periods, the use of ARCH models to capture the stochastic behavior of financial asset prices, and the elimination of the intensive-trading criterion to select the insiders' transactions based on private information.[3] It is also documented how these methodological issues may contribute to increasing the robustness of results and conclusions. Furthermore, the paper analyses whether the measure of abnormal returns is sensitive to changes in the return-generating model.

In this paper, we show that Spanish insiders do benefit in their open-market transactions, as evidenced by the large excess returns detected on insider trading days. Profits thereafter turn significantly negative or disappear as more investors gain access to private information and its value decreases. This pattern reveals that uninformed investors do not succeed when imitating insider investment rules. Insider traders therefore manage to beat the market by timing their purchases and sales while outsiders mimicking them fail to obtain positive excess returns. The primary implications of these results are twofold: firstly, our results support the semistrong form of the EMH and provide evidence against its strong form. These results may thus shed new light on the discussion concerning the desirability of insider trading. The second implication of the study is methodological. Our results against strong-form efficiency are achieved after controlling for some of the methodological deficiencies that have traditionally been blamed for the failure to accept the EMH.

Other findings of the study could also be highlighted. One significant contribution of the paper is the distinction drawn between direct versus indirect insider transactions. We incorporate a new variable into the empirical research on insider trading: the transparency of the insider transaction. Our results show that insiders camouflage their trading by delegating it to a third person. In those cases, abnormal returns are not detected on the transaction date, but later on. Finally, when the sample is partitioned into sales and purchases, the results reveal that sales are more information-induced than purchases, since cumulative returns associated with sales are significant for the holding period.

The remainder of the paper is as follows. A brief overview of previous research is summarized in the next section. Sections 3 and 4 respectively describe the characteristics of the sample and methodology utilized. Section 5 presents and interprets the empirical results and the conclusions. Implications of the study are drawn in the final section, section 6.

2. Previous empirical evidence

The empirical research on insider trading has traditionally been broad in scope. Apart from its original goal, that is, the measurement of abnormal returns made during periods of heavy

insider trading, researchers have analyzed insider-trading patterns in various settings: (i) a comprehensive study of both legal and illegal insider transactions around some firm-related events, such as take-overs (Seyhun, 1990; Eysell and Arshadi, 1993), CEO turnover (Niehaus and Roth, 1999), equity issues (Gombola et al., 1999; Niehaus and Roth, 1999), dissemination of firms' forecast information (Penman 1982, 1985), dividend announcements (John and Lang, 1991), exchange listing (Webb, 1999), and so forth.; (ii) studies on the effects of the quality of information on the creation of stock prices (Seyhun, 1988a,b; Meulbroek, 1992; Veronesi, 2000); (iii) examination of insider trading as an investment pool, in the sense that it transmits new information that outsiders may use to delineate their investment strategies (Kerr, 1980; Rozeff and Zaman, 1988); (iv) discussion on the effects of the regulation of insider trading (Jaffe, 1974b; Haddock and Macey, 1987; Khanna et al., 1994); (v) and, more recently, the analysis of the intraday patterns of returns, volume and bid-ask spreads of both informed and uninformed traders, in the context of the market microstructure literature and the asymmetric information paradigm, following the research initiated by Kyle (1985).

However, two approaches to insider trading analysis are noteworthy. Each one uses a different set of insider transactions which determines the interpretations and implications of each approach. The first strand examines the set of insiders' corporate transactions reported by insiders themselves, while the second uses a set of illegal transactions cited in civil or administrative cases.

Regarding the first approach, we could mention some papers such as those of Jaffe (1974a,b), Pope et al. (1990), Madura and Wiant (1995), Penman (1982), Kerr (1980) and Eckbo and Smith (1998). They analyze the profits made by insiders on self-reported corporate transactions. Most of these papers confine themselves to the realm of the O.S.I.T. (Official Summary of Insider Trading), a monthly publication of the SEC (Security and Exchange Commission) that contains all insider transaction records at the N.Y.SE, or similar databases available for several stock markets. The theoretical framework used to interpret these findings is the EMH. If inside information is fully incorporated when setting security prices, it will not be useful for developing profitable trading strategies. Using the event study methodology, they test simultaneously the strong and the semistrong form of the EMH.

Although these studies mainly support semistrong form efficiency, many of them refute strong form efficiency, since they identify abnormal returns on insider trading days. In view of this situation, insider trading is blamed for introducing noise into stock prices, and the enforcement of insider trading laws is demanded. That is the case of papers such as Jaffe (1974a,b), Finnerty (1976), Seyhun (1986) or Madura and Wiant (1995), which report that insiders earn, on average, higher returns than one would expect if no private information were available. In contrast, Lin and Howe (1990) or Eckbo and Smith (1998) document that insiders cannot beat the market by trading on the basis of insider information. The divergences in the results of different studies are not *always* well documented, although they have occasionally been justified by the deficiencies in the methodology used, the time interval, or various market-specific characteristics.

It is worth noting that the conclusions of these papers critically depend on the assumption that insiders' financial performance is attributable to superior information rather than other factors such as insiders' superior skills. This shortcoming is palliated by the use of the intensive month criterion, conceived as a signal to identify those insider transactions based on private

information. However, there is usually one drawback, since as databases composed of monthly records are used, neither the transaction date nor the transaction price are provided.

The second approach focuses on illegal insider transactions detected and prosecuted by the SEC. The analysis of illegal insider trading allows researchers to achieve two goals. Firstly, to guarantee that the profitability of the analyzed transactions is effectively due to the possession of private information, as alleged by the SEC, and secondly to provide more robust results, since they usually contain the precise transaction date and price. However, its primary weakness lies in the fact that they have to assume that all the trading not undertaken by the prosecuted investors in their sample is attributable to noninsiders.

Holderness and Sheehan (1985), Meulbroek (1992), Cornell and Sirri (1992), and Chakravarty and McConnell (1997, 1999) are some of the papers on illegal insider trading. From their perspective, insider trading is associated with larger price movements than those of the surrounding days, when insiders do not trade. Hence, they conclude that insider trading leads to more informative stock prices and, consequently, it provides a foundation for the legalization of insider trading. However, it is worth noting that Chakravarty and McConnell (1999) refute their earlier evidence when analyzing the effects of what they call the uninformed buying and selling[4] on the process of security price formation. They show that price movements caused by insiders are not larger than those motivated by uninformed traders, and therefore, insider trading is not fostering market efficiency. If that is true, this latter line of research cannot be used as a basis for banning insider trading.

3. Sample description

Our sample consists of daily insider trading data collected from the Daily Historical Records of Insiders Transactions, compiled for this study by the Department of Studies of the Comision Nacional del Mercado de Valores (CNMV), which is the Spanish version of the SEC (Securities and Exchange Commission). Like the SEC, the CNMV requires officers, directors, and large shareholders[5] of all publicly held firms to report all their transactions in their firms' stocks. Unlike the SEC, the CNMV requires insiders to report their trading within fifteen days following the trade. As from that moment, the files remitted by the insider are available to the public. Among other personal and transaction-specific data, insiders are required to report both the date of the insider transaction and the reporting date. This information allows us to use *daily* data for nonillegal insider transactions and serves as a reference to the exact moment when the information on insiders' transactions reaches the market. However, most firms in our sample reported their operations once the deadline had expired, and thus it actually took an average of 32 days rather than 15.

The period of study was from January 1992 to December 1996, and the firms selected were all nonfinancial firms listed on the Madrid Stock Exchange (MSE) and the Spanish continuous market (CM). In total, 995 insider trades from 88 firms were analyzed, 589 of them buy transactions and 406 sale transactions. The breakdown by type of insider was 449 transactions carried out by corporate insiders and 548 by large shareholders. They were undertaken by 395 different insiders on 452 days, with an average of 2.21 operations per day per person.

Sample announcements satisfied three major screening criteria. Firstly, the use of daily data made it unnecessary to apply the intensive trading criterion to discriminate informed trading. What is more, we agree with Finnerty (1976) on the fact that this criterion incorporates a bias into the study and also unnecessarily reduces the sample size. Therefore, to assure that our sample consisted only of insider transactions motivated by the possession of private information, we dropped from the sample any transaction made for noninformational reasons. We thus eliminated transactions made as a consequence of inheritances, gifts, bonuses, acquisitions or disposals by conversion or exchange and excise of options and rights. Information on the motivation of insider trading was also extracted from the insiders' files remitted to the CNMV, where the insiders themselves report the reasons for their trading.

Second, in an attempt to adequately isolate the event, we chose estimation periods that were not affected by any other firm-related event, any other insider trade, or any other prediction period. That made it necessary to separate out confounding effects on the one hand, and to exclude from the sample all those transactions that were not separated by a 5-month period, on the other. In order to separate out confounding events, we eliminated all the insider trades concurrent with a relevant firm-related event. Given the high number of confounding events taking place every day, Foster (1980) suggests selecting only those confounding events whose impact on market prices had been documented in previous work, or those which seem to be related to any detected differential pattern in the sample firms. Thus, we considered the following as relevant events: mergers and take-overs, outstanding investment and divestment announcements, exclusions from negotiation, equity issues and dividend payoffs on days $(-3,+3)$ as in Markides (1992), along with bankruptcies and a firm's dissolution. Finally, in order to reduce the influence of asynchronous trading, we demanded a minimum quoting rate of forty-seven out of the eighty days in the estimation period.[6]

4. Methodology

4.1. Measuring abnormal returns

To determine whether insiders, and outsiders mimicking them, are able to earn abnormal returns, we applied the methodology of event studies. Hence, we tested whether abnormal returns on an insider trading day (or Day 0) and the surrounding period are significantly different from zero. To measure abnormal returns, prediction errors were calculated by subtracting expected or "normal" returns from current returns. Current returns are constructed as the logarithmic conversions of returns adjusted by dividends and subscription rights. Since databases on self-reported insider trading do not contain the transaction price, we used closing prices, thus reinforcing the need to adequately estimate the volatility in each period by a conditional autoregressive model.

To measure normal or expected returns, defined as the returns that would be expected if the insider had not possessed private information, we estimated two different expected-returns models over the eighty days prior to day –10 that compose the estimation period. The prediction or event period[7] runs from day -10 to day $+60$. Days from $+1$ to $+60$ constitute

the postevent period, which was selected according to the prevailing evidence on the market reacting to insider trading over the following two months.[8] We also analyzed days (−10, −1) as a pre-event period, in case any information were leaked prior to the insider trade.

Some modifications in the data were also made to adequately calculate the aggregated returns. There is further evidence that insiders obtain abnormal returns if stock prices rise abnormally after their purchase or if prices decline abnormally after their sale. Therefore, if we believe that both purchase and sale returns should be measured as positive abnormal returns in the overall sample, excess returns for insiders' sales should be multiplied by −1 for the purpose of aggregation, as in Jaffe (1974a). This aggregation procedure is also followed by Seyhun (1986), Rozeff and Zaman (1988), Brick et al. (1989), Lin and Howe (1990) and Pope et al. (1990), among others.

4.2. Return-generating models

Following Brenner (1979), we estimated two different expected-returns models to gauge the sensitivity of measured excess returns to changes in the model. As alternative benchmark models, we used the traditional market model (hereafter MM) and a modified market model adjusted by conditional-heteroskedasticity. This second model attempts to remove some of the deficiencies of the MM when describing the stochastic behavior of asset returns. Conditional heteroskedasticity has widely been found when working with high frequency financial data; therefore, efficient estimating methods must take such a phenomenon into consideration. In this sense, we modify the MM by incorporating an accurate measure of volatility through a GARCH model that also accounts for some specific characteristics of our study (i.e., large sample size, unknown transaction prices and relatively short estimation periods). We refer to this model as a constrained-ARCH or CARCH market model and it is constructed as a simplified GARCH(1,1) model to which we added some *ad hoc* restrictions in the same way as Engle (1982, Eq. (28). A further description of this model can be found in Appendix I.

4.3. Testing abnormal returns

For hypothesis testing purposes, we employed various statistics so as to guarantee the adequacy of the statistic to the model employed. To guarantee the robustness of the conclusions based on the MM, we employed the portfolio test (*t* test or $t_{\_MM}$) and a standardized test (W-test), as shown in Eqs. (1) and (2), respectively. Since the portfolio test equally weights all the returns in the sample, it fails to control whether the results are being biased by the high weight of one or a few observations in the sample. For this reason, Dodd and Warner (1983) proposed the W-test where abnormal returns are standardized by dividing them by their estimated standard deviation calculated over the estimation period.

$$portfolio\text{-}test \;=\; t_{\_MM} = \frac{AR_t}{\sqrt{\frac{1}{N_t}\sum_{i=1}^{N_t}\hat{\sigma}_i^2}} \xrightarrow[N_t\to\infty]{} N(0,1) \tag{1}$$

where $AR_t = \frac{1}{N_t}\sum_{i=1}^{N_t}(Y_{it} - \hat{Y}_{it})$ stands for the average abnormal return for day t, that is, the mean of prediction errors of the firms in each period t, where t ranges from –10 to +60; $\hat{\sigma}_i^2$ represents the estimated variance for each firm obtained in estimation period and N_t is the number of events for each day t in the event period.

$$W_{\_MM} = \frac{1}{\sqrt{N_t}}\sum_{i=1}^{N_t} SA_{it} \xrightarrow[N_t\to\infty]{} N(0,1) \tag{2}$$

where $SA_{it} = \frac{Y_{it} - \hat{Y}_{it}}{\hat{\sigma}_{ei}}$ is the standardized prediction error for firm i on day t, and $\hat{\sigma}_{ei}$ is the estimated standardized deviation of prediction error for each firm obtained in the estimation period, as defined in Eq. (3).

$$\hat{\sigma}_{ei} = \hat{\sigma}_i \sqrt{1 + \frac{1}{T_i} + \frac{(X_t - \overline{X})^2}{\sum_{t=1}^{T_i}(X_t - \overline{X})^2}} \tag{3}$$

Observe that T_i represents the number of days of the estimation period for event i.

To test the significance of the returns drawn by the CARCH market model, we also applied the standardized test of Dodd and Warner (1983). In order to consider the effects of heteroskedasticity, the W-test in Eq. (2) should be modified by incorporating the estimated conditional variances of each period, otherwise the results may be misleading and the conclusions could be invalidated. We refer to this W-test as $W_{\_CARCH}$ and to the W-test in Eq. (2) as $W_{\_MM}$.

$$W_{\_CARCH} = \frac{1}{\sqrt{N_t}}\sum_{i=1}^{N_t} \frac{Y_{it} - \hat{Y}_{it}}{\hat{\sigma}_{eit}} \xrightarrow[N_t\to\infty]{} N(0,1) \tag{4}$$

where $\hat{\sigma}_{eit}$ is defined as the estimated standardized conditional deviation of prediction error for each firm obtained in the estimation period, and is constructed as $\hat{\sigma}_{ei}$ in Eq. (3), but substituting $\hat{\sigma}_i$ for the estimated conditional standard deviation for each period t ($\hat{\sigma}_{it}$), as shown in Eq. (5).

$$\hat{\sigma}_{it} = \sqrt{\sum_{i=1}^{N_t}\left[\hat{\alpha}_{i0} + \hat{\alpha}_{i1}\sum_{j=1}^{20}(Y_{it-j} - \hat{Y}_{it-j})^2\right]} \tag{5}$$

5. Results

5.1. Results on the profitability and information content of insider trading in the Spanish market

This paper offers evidence that is inconsistent with strong form efficiency, which states that all information, public or private, is fully reflected in stock prices. This result is demonstrated by the average abnormal returns (ARs) plotted in Fig. 1, and the t-values

($t_{\_MM}$, $W_{\_MM}$ and $W_{\_CARCH}$) displayed in Table 1, which indicate that ARs on Day 0 are significantly different from zero, at the 1 and 5% levels. It is clear that abnormal returns are detected when insiders trade (on Day 0). Insiders are therefore able to forecast abnormal performance in Spanish stock markets, which corroborates previous evidence attained for other markets suggesting that insiders do possess and exploit special information, as stated in section 2, above.[9] These results are also confirmed by the analysis of the cumulative daily average returns (CARs). Table 2 shows the magnitude of the CARs and their associated statistics over different time intervals. All the statistics reveal the presence of abnormal performance in the period $(-1, +1)$, reinforcing our evidence on insiders beating the market on the event day. For the rest of the intervals, however, the statistics reflect the absence of abnormal performance, supporting semistrong form efficiency in Spanish stock markets.

In fact, abnormal performance was neither experienced on the days immediately after the announcement[10], nor right after Day 15, the deadline set by the CNMV for insiders to report their trading. Actually, the first market reaction starts from Day 39 onwards. This feature, apparently arbitrary, is based on the fact that it takes an average of 32 days for the insiders in our sample to remit their reports to the CNMV. As soon as the information on insiders investing in their own firms' shares arrives at the market, outsiders react by investing in the same direction as the insider. A buy (sale) insider transaction is interpreted as good (bad) news and the market responds with an upward (downward) reaction. Therefore, on days 39 and 43, outsiders obtain abnormal returns by buying shares previously bought by insiders and selling shares previously sold by insiders. The abnormal returns obtained on these days are even larger than those obtained by insiders on Day 0. However, the increasing public nature of such information makes it less valuable as more and more investors attempt to profit by it, thus provoking a decrease in market prices (as stated in Sharpe, 1981). For the firms in our sample, this fall in prices takes place on Day 51, when outsiders get negative excess returns at the 1% level of significance, as drawn by the $W_{\_CARCH}$ statistic. Therefore, the outsiders' mimicking strategy turns unprofitable, since on Day 51 the stock market discounts the previously realized gains. The opportunities for outsiders to obtain abnormal performance are eliminated, as shown by the nonsignificant cumulative abnormal profitability for the whole holding period $(+1, +60)$, as well as for the holding periods in which the information is made public—$(+15, +32)$ as well as $(+32, +60)$. We, therefore, strongly reject the hypothesis that insider trades do indeed convey information useful for outsiders, contrary to the results obtained in other stock markets, according to which outsiders may benefit from insider trading for up to two months after the event.

In conclusion, the null hypothesis of zero abnormal returns on Day 0 is strongly rejected at the 1% significance level with the $W_{\_CARCH}$ and the 5% level for the rest of the statistics. This represents clear evidence[11] that insiders obtained greater profitability than outsiders. However, trading rules based on publicly available information concerning insider trading are entirely unprofitable. Outsiders mimicking insiders' strategies only achieve abnormal returns on certain days, but these returns are systematically driven to zero after the decrease in prices on Day 51.

Furthermore, given that insider trading is illegal in Spain, the results of this paper can also be interpreted as an evaluation of the effectiveness of insider trading regulation. Despite the control set by market and company laws to prevent insider trading and to guarantee the transparency and fairness of financial markets, corporate insiders are still able to benefit from

their private information, earning abnormal returns. Therefore, the effectiveness of insider trading in Spain is called into question.

5.2. Sensitivity of the results to changes in the return-generation model

The results also have some methodological implications regarding their sensitivity to changes in the return-generating models. Fig. 1 displays the average prediction errors drawn by both the MM and the CARCH market model. It can be seen that return size is very similar and the conclusions drawn by the different models are very close. However, the values of the test statistics summarized in Table 1 show large differences among the three statistics for specific dates. From these values, we can conclude that the *t* test basically underestimates the variance of the returns, favoring the acceptance of the null hypothesis. This fact emphasizes the need to consider the intraday volatility when measuring insider transactions, mainly for samples of self-reported insider trading, where transaction prices are unknown. In this sense, we should highlight the nice properties of a constrained ARCH(p) model in obtaining more efficient estimates when working with short estimation periods. The CARCH model proposed in this paper is capable of reliably describing the density function of high frequency financial assets, more accurately capturing the non-normality of the series shown in their thicker tails, and, therefore, the abnormal performance. Nevertheless, we can conclude that although the sensitivity of our tests to changes in the model is not very high, the estimation of various models has increased the robustness of our results.

5.3. Other samples

For further analysis, we adopted two different approaches that could give us some insights into the current behavior of Spanish insiders. We refer to the separation of the overall sample according to the type of transaction (purchases vs. sales), and its transparency, measured by the direct or indirect nature of the operation. In other words, we distinguished whether the transaction was undertaken by insiders themselves, or by a third person or enterprise on the insider's behalf.

The breakdown of insider trading into sales and purchases allowed us to test, for the Spanish markets, whether insider purchases are more information-based than insider sales, as stated by Pratt and DeVere (1970), Nunn et al. (1983) or Rozeff and Zaman (1988). Our results do not support this proposition, as proved by the higher values of the statistics for the interval $(0, +1)$ for sales than for purchases, as shown in Table 3. On the contrary, they are consistent with Lin and Howe (1990) and Eckbo and Smith (1998) who sustain that sales are more informative than purchases. It is remarkable that the cumulative returns associated with sales are significant for the interval $(-10, +60)$, proving that insider sales are informative to uninformed investors.

Regarding the postevent market reaction, it is worth noting that the disaggregated analysis of purchases versus sales shows that the negative abnormal performance on Day 51 is only motivated by the subsample of purchases. Brick et al. (1989) describe a similar situation for a sample of large firms.[12] They find that outsiders who purchased stocks, previously bought by insiders, received negative excess returns. To explain this fact, they evoke previous papers such as Banz (1981) or Reinganum (1981), who consider that negative excess returns may be expected when returns of high market value firms are evaluated. According to these papers, the negative

abnormal returns associated with purchases may be the sum of a positive effect associated with positive inside information and a negative effect associated with high market value of equity.

More interesting are the results attained when we separate indirect versus direct transactions. Stock market regulation usually allows insiders to operate through a third person. In fact, insiders quite commonly delegate their trading to a trust, family member, enterprise or other intermediary, as described by Penman (1982). Our research aims to determine whether this "delegated" trading may be affecting strong-form efficiency in a different way than direct insider trading. For this purpose, we separated the overall sample regarding the degree of transparency of insider transactions. We defined an indirect transaction as that trade where the insider tries to preserve his anonymity by delegating his trading to some of the intermediaries cited above. In this situation, it is the third person that orders the transaction and communicates it to the CNMV. This procedure guarantees that no information on the identity of the true insider is provided. A direct trade is then defined as that operation where the insider trades on his own behalf, providing information on the identity of the true investor.

The effects on market efficiency of partitioning insider trading into direct versus indirect transactions have been unexplored so far. Our results are shown in Fig. 2, which plots the values of $W_{\_CARCH}$ for the event period. It suggests that direct insiders exhibit large positive excess returns on Day 0, while they are negative and not significant for indirect trades. However, positive abnormal returns are associated with indirect insider trades in the interval $(+4, +5)$. The postevent market reaction for indirect transactions also differs from that for direct trades. No positive abnormal returns are detected on days 39 or 43 for indirect insider trades, and the negative reaction on Day 51 just disappears. This clearly indicates a different performance pattern of insider trading depending on its degree of transparency, suggesting that indirect transactions are more concealing.

The analysis of the postevent reaction gives rise to two contradictory explanations. Firstly, the positive reaction four days after the event for indirect insider trades may be interpreted as a sign of the insiders' attempt to camouflage these transactions. This attempt to distort the trading date could be corroborated by the fact that the market reaction to indirect transactions follows a completely different pattern, while the evolution of the returns for direct trades throughout the event period is just the same as for the overall sample.

A second explanation[13] could be that Spanish stock markets are able to detect indirect insider trading on Day 4. If so, the information content of indirect transactions is less confounding for outsiders than that of the overall sample, and, thus, share prices are able to impound the private information reflected in indirect insider trades, perhaps due to the flow of information from the insider to his tippees. In this sense, it is remarkable that the negative abnormal return on Day 51 disappears when analyzing indirect transactions.

5.4. Nonoverlapping estimation periods

When a multievent study[14] is carried out, it is commonly found that the estimation period of a particular event is affected either by another event or by the prediction period of an earlier event (we refer to the former case as an event-overlapping phenomenon and to the latter as period-overlapping). When this is the case, it cannot be guaranteed that the estimates are not affected by other large shocks in stock prices.[15]

In an attempt to avoid such phenomena**,** this paper emphasizes the need to isolate the estimation periods from any events or prediction periods. For this purpose, one of the first screens applied in the construction of the sample was to select for each firm only those insider trades that were separated by at least 5 months. Since the prediction period should necessarily cover two months, our estimation periods are composed of no more than 80 observations. However, we tested what would have happened if we had taken an estimation period as long as those commonly used in the event study literature. Our objective was to identify potential errors presented in other event studies due to the selection of longer "contaminated" estimation periods. For this purpose, we re-estimated the former 995 regressions, taking a longer estimation period (up to 180 days), which meant provoking an overlap in several events and periods. The results are shown in Table 4. It displays the values of the different statistics employed for those days where abnormal performance is detected at the 1% and 5% level of significance, either by using a "contaminated" estimation period (hereafter, CEP) that lasts 180 days, or using a clean one (80-day estimation period).

It is clear from the results shown in Table 4 that the use of a CEP produces biased statistics. As a matter of fact, $t_{\_MM}$ and $W_{\_MM}$ detect abnormal performance on some dates where it was not detected with a clean one, bringing to light the fact that the contaminating shocks increase the magnitude of ARs in those periods. Nevertheless, when volatility is adequately measured, the opposite effect is provoked. The use of $W_{\_CARCH}$ allows us to capture the increase in variance motivated by the presence of other shocks during the estimation period, thus reducing $W_{\_CARCH}$ values, that is, the higher volatility due to the use of a CEP favors the acceptance of the null hypothesis. These findings have important implications on date 0, since only the portfolio test detects abnormal performance with a CEP, while the rest of the statistics fail to identify it. Moreover, only the CARCH market model with a clean estimation period identifies abnormal performance at the 1% level of significance.

In conclusion, the use of a CEP produces misleading results either favoring the rejection of the null hypothesis when it holds or favoring its acceptance when it does not hold for conditional variance tests. Therefore, the documented differences confirm our opinion that multievent studies should be wary of the presence of other similar events in the estimation and prediction periods.

6. Conclusions and implications of the study

The rationale of this study consists in analyzing both the profitability and the information content of insider trading in Spanish stock markets. Our results suggest that the strong form of the EMH does not hold, since insiders earn returns that exceed risk-adjusted benchmarks. In fact, the picture emerging is a semistrong efficient market, where insiders are able to beat the market by investing using their private information on a firm's prospects, while outsiders cannot earn abnormal profits by using the publicly available information concerning insider trades compiled by the CNMV.

Our results question the effectiveness of Spanish insider trading laws, since it is clear that current laws do not prevent insiders from behaving opportunistically. Therefore, our results recommend a regulatory change in Spanish laws so as to outlaw fraud in security trading.[16]

Notes

1. Although the strong-form of the EMH has not been paid too much attention, the literature on testing the semistrong form of EMH (see Gomez et al., 2000**,** for a complete review of the literature) is relatively extensive. These papers conclude that Spanish markets are semistrong efficient and that public information is adequately reflected in market prices after any kind of announcement.
2. Burnett et al. (1995) produce evidence on the differences of abnormal returns attributed to the return measurement interval (monthly or daily). Daily returns have only been employed for the study of illegal insider trading, while the use of monthly data are the rule rather than the exception when analyzing open-market transactions. Exceptions are the studies on bank insider trading such as Madura and Wiant (1995) and Jordan (1999), and studies such as Bhattacharya et al. (2000) for the Mexican market.
3. This criterion discriminates private-information based transactions in the sample by observing the trading intensity of insiders in a calendar month for a given firm, and it is based on the idea that more aggressive trading by insiders is a sign of the presence of private information in the market. Under this assumption, the intensive criterion compares the number of purchases and sales made by insiders each month in a particular firm. When there is an excess of purchases over sales, or vice versa, then that month will be classified as "purchase month" or "sale month," respectively. When the number of purchases cancels out the number of sales, then the month is classified as nonintensive and it exits the sample. The comparison between the number of purchases and sales to determine an intensive month varies among authors (three sales and no purchases, three sales more than purchases, etc.).
4. They produce an interesting study using intraday data, where the definition of uninformed buying and selling depends on the Lee and Ready (1991) algorithm, which is based on the comparison between transaction prices and intraday bid-ask spreads. This approach, although very appealing, could not be applied to open-market insider trading (in the sense of nonillegal insider transactions), since neither the transaction time nor its price are known.
5. Unlike large shareholders in the U.S., who should own at least 10% of a firm's equity, a major stockholder in Spain is defined as any unaffiliated shareholder who holds 5% or more of a firm's equity.
6. As opposed to the rest of the procedures available to reduce the effects of thin trading (use of the market model modified by Scholes and Williams (1977) or CHMSW (1983) estimators), the minimum quoting rate criterion was selected because it allowed us to estimate more sophisticated models, such as ARCH models, without worrying about the effects of thin trading, and also because our sample was large enough to allow the impact of the reduction in the number of selected events. We set 47 trading days as the minimum quoting rate because it is in accordance with the average quoting rate for firms listed on the Madrid Stock Exchange and the Spanish Continuous Market.
7. The event period lasts for two months after the event day, and the ten days prior to the event constitute the pre-event period, which means that we have already used up

seventy days. Since transactions have been distanced 5 months (an interval of a hundred and fifty days), the estimation period cannot be longer than the eighty previous days.

8. In fact some authors report abnormal returns up to eight months later. However, the prevailing evidence supports a period of two months.
9. However, an anonymous referee suggested an alternative explanation, more in line with papers by Meulbroek (1992) or Bhattacharya et al. (2000), who consider that the abnormal returns on the transaction date could be also interpreted as a canny ability of Spanish markets to detect insider trading before its public announcement. However, we base our interpretation on previous papers such as Jaffe (1974a), Seyhun (1986), Lin and Howe (1990) and most of the researchers on insider trading.
10. Also note that significant abnormal returns were not detected on the days immediately before the event in the pre-event period $(-10, -1)$ either, which confirms the "confidential or private" nature of insider transactions, for which information leakage is not conceived.
11. Moreover, this evidence is even stronger since any possible bias in the selection of the sample is working in favor of the acceptance of the null hypothesis. Actually, we should recall that there is a group of insiders' transactions not considered in the sample selection. We refer to the transactions made by those investors who may not be reporting them to the securities exchanges commissions or may not report their true magnitude. Other circumstances indicate that estimations of insiders returns are usually undervalued, that is: private information may warn insiders not to operate during certain periods; they may operate through third persons or tippees that are not obliged to inform the SEC; or they may trade in options or other assets rather than shares. Consequently, it is possible that the abnormal returns attained so far are just understated estimates of their real returns.
12. Unlike Brick et al. (1989), we use a methodology that does not weight all transactions equally, thus corroborating the existence of this different pattern between sales and purchases.
13. An anonymous referee, to whom we are deeply indebted, suggested this explanation.
14. We define a multievent study as that event study where the number of events associated with one firm in a calendar year is higher than one.
15. To select event-overlapping or period-overlapping estimation periods is a common practice in the insider trading literature, namely, when researchers select two consecutive intensive months in their samples. It occasionally provokes considerable variations in the magnitude of returns and, consequently, in the value of test statistics.
16. In fact, the CNMV, aware of the need to require better quality information of insiders' transactions, has taken steps in this direction by approving R.D. 1370/2000 in July 2000.
17. It is widely known that a GARCH(1,1) may be rewritten as an ARCH(∞).
18. The GARCH(1,1) model assigns decreasing weights to all past observations.
19. Observe that the unconditional density is not normal since it has thicker tails than the standard normal. (See Bollerslev, 1986).
20. Observe that the computation of the test statistics associated with the CARCH model requires a careful selection of the conditional estimated variance for each period and event, as shown in Eqs. (4) and (5).

Appendix I. Market model with ARCH effects

This appendix provides details of the construction of the CARCH market model proposed in this paper.

In order to account for conditional heteroskedasticity we will adopt a simplified version of a GARCH(1,1). This study requires estimating the MM with ARCH effects for each of the 995 events, and to systematically compute the test statistics for each day in the event period. The simplification, in line with Engle's (1982, Eq. (28) proposals, are twofold: on the one hand, an ARCH(20) is considered instead of using an ARCH(∞)[17], and on the other hand, all the weights of the squared errors are constrained to the same value[18]. Observe that this process, which we call "Constrained ARCH" or CARCH, captures the time dependence of the variance reasonably well, assuming that the nearest squared errors of the time series influence the volatility of the period, but not the information beyond the 20th lag of the variable. Theoretically, this formulation agrees with the process by which information is impounded in stock prices, as described by DeBond and Thaler (1985); empirically, there are only slight differences between the estimates obtained by a GARCH(1,1) and a CARCH model.

Therefore, the market model adjusted to heteroskedasticity, or CARCH market model, may be written as in equation A.1,

$$Y_{it} = \beta_{i1} + \beta_{i2}X_t + u_{it}, \tag{A.1}$$

where Y_{it} and X_t stand for the return of the asset and the market respectively; β_{i1} and β_{i2} are the parameters of the model, and u_{it} represents a random variable distributed[19] as N(0,σ_{it}^2), where σ_{it}^2 behaves as the CARCH process described in equation A.2:

$$\sigma_{it}^2 = \alpha_{i0} + \alpha_{i1}\sum_{j=1}^{20} u_{it-j}^2, \text{ where } \alpha_{i0} \geq 0 \text{ and } 0 \leq \alpha_{i1} \leq 1 \tag{A.2}$$

Hence, the density function of Y_{it} conditioned on the known information set at t can be written as in equation A.3.

$$f(Y_{it}/Y_{i,t-1},\ldots,X_t,X_{t-1},\ldots,\beta_{i1},\beta_{i2},\alpha_{i0},\alpha_{i1}) = \frac{e^{-1/2\ (Y_{it}-\beta_{i1}-\beta_{i2}X_t)^2/\alpha_0+\alpha_1\sum_{j=1}^{20}(Y_{it-j}-\beta_{i1}-\beta_{i2}X_{t-j})^2}}{\sqrt{2\pi}\sqrt{\alpha_0+\alpha_1\sum_{j=1}^{20}(Y_{it-j}-\beta_{i1}-\beta_{i2}X_{t-j})^2}} \tag{A.3}$$

Therefore, this study requires the systematic joint estimation of this density and the calculation of the prediction errors and test statistics[20] for each of the 995 events in our sample. The CARCH model was estimated by the maximum likelihood procedure, which implies implementing the nonlinear optimization techniques of BHHH (1974) and Newton.

Appendix II. Tables and figures

Table 1
T values for the abnormal returns drawn by the MM and the CARCH market model

Date	t_{-MM}	W_{-CARCH}	W_{-MM}
−10	0.47	0.56	0.66
−9	−0.53	−0.19	−0.20
−8	0.16	0.02	0.18
−7	0.16	0.17	0.11
−6	−0.27	−0.21	−1.12
−5	−0.86	−0.77	−1.12
−4	1.69	1.15	−0.20
−3	0.40	0.23	−0.09
−2	−0.58	−0.37	0.37
−1	−0.65	−0.37	−0.24
0	2.06	2.51	1.95
1	1.16	1.00	1.50
2	1.02	1.01	2.18
3	0.42	0.35	0.35
4	0.47	0.43	−0.10
5	0.36	0.27	0.08
6	0.36	0.21	−0.01
7	0.34	0.40	0.63
8	0.76	0.74	1.15
9	−1.04	−0.94	−0.97
10	−0.59	−0.39	−0.33
11	−0.45	−0.45	−1.38
12	−0.45	−0.17	−0.20
13	−1.51	−0.88	−1.50
14	−1.81	−1.25	−1.19
15	−0.28	−0.25	0.22
16	0.01	0.02	−0.09
17	−0.57	−0.52	−0.35
18	0.05	−0.02	−0.39
19	0.30	0.07	0.60
20	0.54	0.30	0.69
21	−0.89	−0.58	−0.71
22	2.19	1.52	2.47
23	0.73	0.57	−0.17
24	−0.62	−0.44	−0.45
25	1.02	0.53	1.05
26	−1.18	−0.81	−0.73
27	−1.05	−0.78	−1.15
28	0.78	0.48	−0.02
29	0.90	1.29	1.35
30	0.47	0.50	0.27
31	−0.16	−0.11	−0.28
32	0.56	0.55	−0.26
33	0.24	0.01	1.17
34	−0.63	−0.44	−0.17
35	−1.02	−1.03	−1.13
36	1.28	1.42	1.83
37	1.24	1.48	1.46
38	−0.40	−0.48	−0.79

(continued on next page)

Table 1 *(continued)*

Date	$t_{\_MM}$	$W_{\_CARCH}$	$W_{\_MM}$
39	2.50	2.49	4.66
40	1.25	0.90	1.52
41	−0.10	−0.08	−0.73
42	−0.31	−0.28	−0.93
43	2.63	2.96	1.76
44	0.73	0.94	−0.61
45	−0.36	−0.26	−0.80
46	0.11	0.09	0.36
47	−0.39	−0.19	−0.60
48	0.16	0.16	−0.80
49	−0.04	0.11	0.08
50	−0.71	−0.71	0.05
51	−2.04	−2.21	−1.88
52	−0.11	0.12	0.37
53	0.73	0.72	0.43
54	0.57	0.50	0.14
55	−1.43	−0.97	−1.85
56	0.32	0.29	0.12
57	−0.71	−0.59	−1.27
58	0.15	0.18	0.12
59	0.15	0.36	0.37
60	−0.44	−0.46	−0.72

Table 2
Values for the CARs and their associated statistics

INTERVALS	MARKET MODEL	CARCH MM
(0, +1)	3.30E-03	3.23E-03
	(5.37)	(4.20)
(+1, +15)	−2.66E-04	1.97E-04
	(−0.07)	(0.05)
(+15, +32)	2.92E-03	2.30E-03
	(0.88)	(0.67)
(+32, +60)	5.99E-03	7.70E-03
	(0.86)	(1.07)
(+1, +60)	8.03E-03	9.67E-03
	(0.95)	(1.12)
(−10, +60)	9.65E-03	1.21E-02
	(1.07)	(1.32)

We aggregated average abnormal returns over various time intervals so as to draw inferences in the event's impact across firms and over time. The associated t-values based on tests of the standardized cumulative abnormal returns drawn by the CARCH market model are shown in parentheses below the CARs. Both statistics tested whether CARs are equal to zero in the selected periods. We measured CARs for the interval (0, +1). The interval (+1, +15) was taken in order to control whether the market knew about insider trading before the insiders themselves informed the CNMV (since 15 days is the deadline set by the CNMV). We also analysed interval (+15, +32) in case there was an immediate reaction as soon as the deadline expired, and interval (+32, +60) in case the reaction occurred effectively after day 32. Finally, we took the period (+10, +60) in order to analyse the profitability obtained in the whole event period, and period (+1, +60) to analyse the post-event period.

Table 3
Significant CARS and their associated statistics for the purchases and sales subsamples

INTERVALS	CARS_PURCHASES	CARS_SALES
(0, +1)	1.28E-03	3.73E-03
	(0.37)	(3.56)
(+1, +15)	4.43E-03	−5.76E-03
	(0.85)	(−0.83)
(+15, +32)	3.73E-04	5.00E-03
	(0.84)	(0.72)
(+32, +60)	3.79E-03	1.29E-02
	(0.36)	(1.47)
(+1, +60)	9.11E-03	9.95E-03
	(0.74)	(0.76)
(−10, +60)	−9.08E-04	3.04E-02
	(−0.06)	(2.05)
(+50, +52)	−9.40E-03	4.53E-03
	(−2.10)	(1.47)

CARs are calculated using the CARCH market model. The associated t-values, based on tests of the standardized cumulative abnormal returns drawn by the CARCH market model, are shown in parentheses below the CARs. The sample is composed of 589 purchases and 406 sales.

Table 4
Effects of overlapping

DATES	t_MM clean	t_MM-contaminated	W_MM clean	W_MM contaminated	W_CARCH clean	W_CARCH contaminated
0	2.05	2.42	1.95	—	2.51	—
22	2.19	2.35	2.47	2.76	—	—
36	—	—	1.83	1.90	—	—
37	—	1.79	—	1.90	—	—
39	2.50	3.09	4.66	4.50	2.50	2.24
43	2.63	3.08	1.76	1.96	2.96	2.15
51	−2.04	−2.39	−1.88	−2.13	−2.21	—

Significant t-values are provided for those days where different models detect abnormal returns. MM_contaminated means the market model estimated for 180 days, versus MM_clean, which refers to the MM estimated for 80 days. Analogously, CARCH_clean and CARCH_contaminated refer to a CARCH market model estimated for 80 and 180 days, respectively.

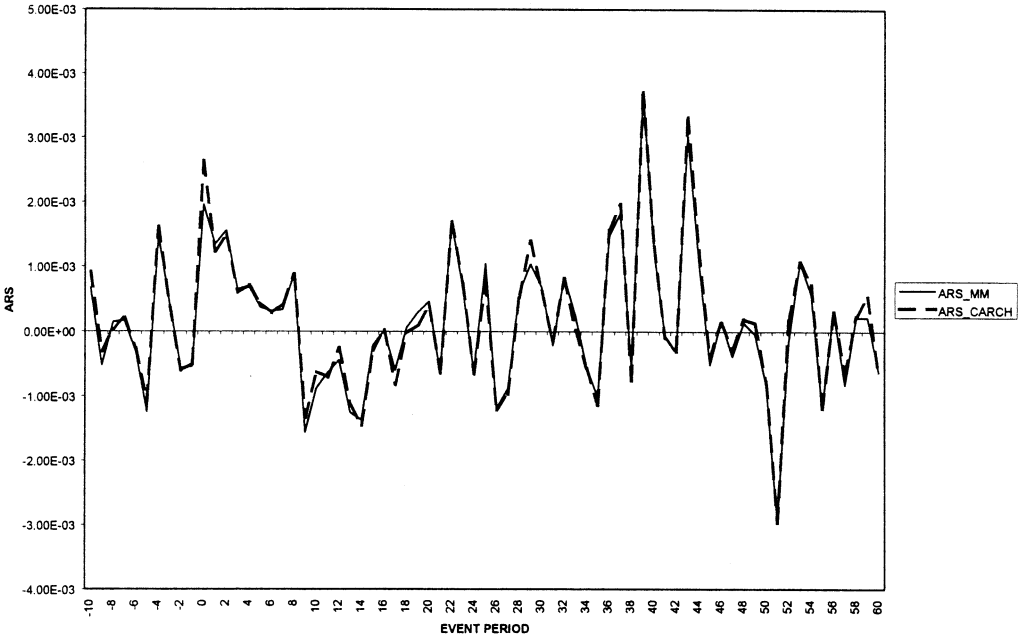

Fig. 1. Abnormal returns drawn by the MM and the CARCH model for the event period (−10, +60).

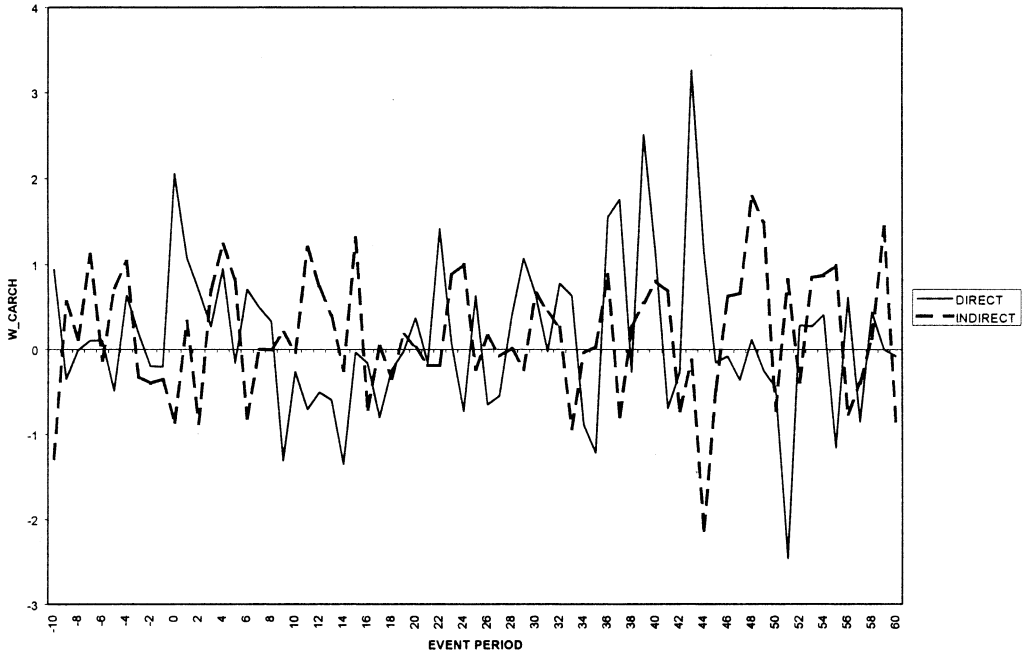

Fig. 2. Abnormal returns drawn by the CARCH market model for direct and indirect transactions.

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