Insider Trading, Earnings and Stock Based Compensation: A View to Speculation

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Abstract. We design a laboratory experiment to study the relation between earnings management and insider trading and their effects on the stock markets. The experiment simulates a market where one insider and three outsiders trade on the stocks of a company. We show that if the insider affects the stock price with her earnings announcements, then she will use this power and increase her capital gains. These earnings management practices not only induce price inefficiencies but also negatively affect the profits of the other traders. We also show that the managerial stock-based compensation worsens these effects, seriously increasing stock prices and manager's profitability. We conclude that the lack of transparency in earnings management and the perverse incentives of the managerial compensation policies have an important role in generating price inefficiencies, bubbles and financial crises.

Keywords: Insider trading, earnings management, stock-based compensation, laboratory experiment.

1 Introduction

This article we shed some light on the opportunistic behavior of the insiders who not only possess private information and use it in their trading, but also deliver this information to the market with clear incentives to profitably manipulate the information. For this purpose we conduct a laboratory experiment designed to show how an insider might behave if her actions are not properly supervised and penalized.

We consider markets with one insider and three outsiders that trade on the stocks of a firm without knowing the final price at which their orders will be closed. The only information the traders have is the determinants of the price (price function) and the earnings figure reported by the insider (who knows the real earnings figure as well). The final payoff (after 40 rounds) depends on the final wealth the participants have on their dealings and investments (i.e. their portfolios are finally valued at the final stock price). We consider two alternative treatments: The baseline (T0), where all traders receive a dividend payout (a fixed amount per stock in their portfolios) every five periods; and a second treatment (T1), where insiders also receive a

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stock-based compensation depending on the increase of the stock price every five periods (see Bergstressera and Philipponb, 2006, for alternative compensation schemes).

Our results show that under these basic assumptions insiders misreport earnings figures so as to drive the stock price for their own benefit. In treatment T0 to maximize capital gains and in T1 to maximize their bonuses. As a consequence, insiders' returns are higher than outsiders' returns but also insiders' returns significantly increase when the stock-based remuneration policy is implemented. Therefore, earnings management practices and stock-based compensation induce two serious inefficiencies to the market: they affect positively/negatively the insider/ outsider return and they distort the stock price, which sharply increases under stock-based compensation schemes.

2 Experiment

2.1 Setting

We create 10 different markets where the stocks of a firm are sold. At the beginning of the experiment each subject i is assigned an initial endowment of stocks (x_{it}) and money (m_{it}). Paticularly, they are initially endowed with 5 stocks and 100 experimental currency units (ECUs). The initial price of the firm's stocks (p_t) is 20 ECUs and thus subjects possess an initial wealth (ω_{it}) of 200 ECUs. In addition, subjects are also assigned to a group (market) of four people and a type (insider or outsider). Particularly, we refer to the insider as subject $i = 1$ and to the outsiders as subjects $i = 2,3,4$. These assignments remain during the entire experiment.

In each market there are one insider and three outsiders. The insider knows privately the information about the growth rate of firm's earnings (r_t), which is randomly chosen (with equal probability) from the following set $\{-20, -10, 0, 10, 20\}$ in each period. For example, if value 20 is drawn we assume that the earnings have risen 20 per cent in the current period. In every period, the insider has to report on the firm's earnings to the other three subjects in the market. This message ($\tilde{r}_t$) must also be a value of the set $\{-20, -10, 0, 10, 20\}$, but this reported value does not necessarily have to be the true one. Then, all four subjects in the market simultaneously make a decision about their trading orders. For the sake of simplicity, we restrict the operations to three possible cases: "buying a single stock of the firm", "selling a single stock of the firm" or "neither buying nor selling stocks". When making this decision, subjects do not know the closing price that buyers will have to pay and sellers will receive. This price is computed through the following equation:

$$p_t = p_{t-1} + 2(d_t - s_t) + \frac{1}{10}(\tilde{r}_t - r_t), \tag{1}$$

where d_t is the demand (number of subjects in the same market that are willing to buy a stock) and s_t is the supply (number of subjects in the same market that are willing to sell a share). Therefore, the price in period t is a function of its previous value, the excess of demand/supply and the surprises in the announced earnings with respect to the true ones. Therefore, three main assumptions are underlying the price formation.

First, prices follow a dynamic structure, which in case the number of agents in the market was very large and if earnings surprises were unpredictable would approximate a random walk (market efficiency hypothesis). Second, competitive forces in the market lead the prices up/down in case of excess of demand/supply. In spite of this assumption, in our game the market is not competitive since each subject has a certain market power and may affect the price movement to some extent. Third, subjects' expected earnings under truth-reporting are unbiased and thus this expectation does not significantly deviate from r_t. Then, if we interpret r_t as the expected earnings and assume rational expectations, a positive/negative surprise in the reported earnings triggers the share prices upwards/downwards.

Note that for the price function in equation (1) price movements in every period ($p_t - p_{t-1}$) are integers in the range [12,−12]. The upper/lower bound corresponds to the situation where all subjects are willing to buy/sell, the real earnings experiment a 20% decrease/increase and the insider reports a 20% increase/decrease of the earnings (e.g., $p_t - p_{t-1} = 12$ where $d_t = 4$, $s_t = 0$, $\tilde{r}_t = 20$ and $r_t = -20$).

After having received the subject's trading orders, the price is computed and the orders are closed at the corresponding price. Borrowing money to buy a share is not allowed and thus if a subject cannot pay the price after having chosen "buy a new stock" the computer reminds her that she does not have enough money and she is forced not to trade in this period. In this case the new price is recomputed assuming the new demand. In the same line, a subject can only decide to "sell a stock" if she has at least one stock in her account. These restrictions to the transactions help to stabilize the price throughout the experiment, because subjects cannot continue buying (selling) during more than 5 consecutive periods (approximately) since they do not have enough money (stocks) with which to trade.

The experiment lasts 40 periods and in every period subjects accumulate their wealth (the ECUs and the market value of their current stocks). Furthermore every 5 periods (i.e. in periods 5, 10, 15, 20, 25, 30, 35 and 40) agents received a dividend (D_{it}) of 2 ECUs for every share possessed at the end of the corresponding period (once the transactions of the period have been closed).

We considered two alternative treatments and a between-subjects design. In the baseline treatment (T0) subjects only receive the dividend remuneration and the capital gains from their market operations that are incorporated to their wealth. In the other treatment (T1) we additionally implement a stock-based remuneration policy for the insiders, which consists of an extra bonus every 5 periods (i.e. at the same time as the dividend payout). This bonus is gained only if the share price has increased during the last 4 previous rounds and in this case the insider bonus (b_{it}) is 5 times the price increase within this period. Therefore, a bonus is computed as

$$b_{it} = \begin{cases} 5(p_t - p_{t-4}) & if \;\; p_t - p_{t-4} > 0, \\ 0 & otherwise. \end{cases} \tag{2}$$

In period *t*=40 the final payoff of subject i (π_i) is computed as

$$\pi_i = m_{i40} + p_t x_{i40} + D_{i40} + b_{t40} \tag{3}$$

where $b_{i40} = 0$ in treatment T0 and for every subject $i = 2,3,4$ in treatment T1.

2.2 Procedures

We conducted the experiment, which was programmed within the z-Tree toolbox (Fischbacher, 2007), in the Laboratory for Research in Social and Economic Behavior (LINEEX), which is housed at the University of Valencia. For each treatment we organized a session with 40 subjects and thus a total of 80 undergraduates from various disciplines participated in the experiment. Participants were assigned into groups of four and received a role in the group: insider (one in every group) or outsiders (the other three of the group). These groups and roles remained unchanged during the entire experiment and their identities were never revealed. Then subjects were informed about their initial endowments (5 stocks and 100 ECUs) and the initial price of the stocks (20 ECUs), all the same in each market and for each subject.

Within each group the game was played for 40 periods and each period had two steps. In the first step the insider of each group received a message about the firm earnings that was randomly drawn. In both treatments we used the same sequence of earnings to ensure the comparability of the results. The real value of the earnings was never revealed to the outsiders of the group although they might infer ex post guesses based on the final stock price at the end of each period (since real earnings are part of the final price). With this private information the insider decided on the reported earnings figure that was publicly announced. In the second step each participant in the market decided privately and submitted their decision about either selling, buying or not participating in the market. With all the submitted orders and the reported and real earnings, the price was formed and the orders were satisfied accordingly. The results of the decisions on subjects' wealth and its components (stocks and liquidity) were recorded in a table, as well as the stock prices, reported earnings and their own trading decisions. This information was continuously updated and available on the screen during the experiment.

At the end of the experiment the total wealth of the subjects (the stocks valued at the final price of the game and the money possessed at the end of the experiment) was converted into Euros at a known exchange rate (50 ECUs = 1 Euro). Payment took place privately and the participants had to leave the laboratory immediately once they were paid. The maximum, minimum and average payoff was 22.38 (31.92), 12.54 (8.46) and 16.23 (17.07) Euros in treatment T0 (T1), respectively. A session lasted on average two hours and a half.

2.3 Hypotheses

We gather the hypotheses into two different categories:

(a) ***Hypotheses related to the earnings management and insider trading:***
In our framework insiders have access to private information about the firm performance and also have the privilege of disseminating the information to the market. Thus the first hypothesis under test is whether in this context insiders report the information truthfully. In this study we do not analyze either the ethics or the illegal considerations of misreporting (see Abdolmohammadi and Sultan, 2002). We neither consider possible controls or penalties on misreporting behavior or even collateral effects on reputation that might be introduced in alternative treatments.

Insiders, however, know that their misreporting may affect not only their own profitability but also that of their partners. In this case we wonder whether they behave honestly in this sense or they do not worry about such considerations and directly maximize their own profitability. We hypothesized this conjecture in H1.

H1: "Insiders systematically misreport information about earnings."

Assuming that H1 cannot be rejected, we go a step further and study whether manipulation is intended to affect market prices so insider's profits on their trading operations increase. For this purpose we revise the incentives' underlying equation (1). Given p_{t-1} and $d_t - s_t$, the best strategy for an insider that maximizes the profits in her trading operations is obtained by maximizing $|\tilde{r}_t - r_t|$ and thus reporting a 20% increase/decrease in earnings whenever earnings decrease/increase and, consequently, sell/buy an action when she expects an increase/decrease in the stock price. Of course the final effect on the stock price depends on the strategies of all players and their beliefs about the expected behavior of their opponents. Thus, it seems reasonable to test the hypothesis H2 about the information manipulation strategy of the insiders.

H2: "Insiders report high increases/decreases in earnings when earnings have decreased/increased and they intend to sell/buy stocks at a high/low price".

The insider strategic behavior hypothesized in H1 and H2 has negative externalities on others' profits, since outsiders decide about their trading based on false information and the insiders exploit their mistake-induced decisions profitably, then we are interested in testing hypothesis H3.

H3: "*Earnings management positively/negatively affects insiders'/outsiders' returns. Thus, in the case of earnings management, insiders' returns are higher than average outsiders' returns*".

(b) *Hypotheses related to stock-based compensation:*
Our experiment also explores the insiders' behavior under the implementation of a stock-based remuneration policy and its effects on insiders' profitability and the firm value. The resulting hypotheses are stated in H4 and H5.

H4: "The stock-based remuneration policies positively affect insiders' returns (even without considering the bonus). Thus, Insiders' returns are higher in the presence of this manager compensation scheme".

H5: "The stock-based remuneration policies positively affect firm value. Thus, share prices rise more in the presence of this manager compensation scheme".

Hypothesis H2 is based on the idea that the main source of insiders' profit comes from their trading. Nevertheless, their optimal strategy might not be the same if we include another alternative manager remuneration policy. For example, under our stock-based compensation scheme the strategy that maximizes bonuses consists of trying to increase the stock price (e.g., by reporting high earnings and buying stocks) until they get the bonus and doing the opposite strategy just when they have received it in order to maximize the next bonus. Therefore, for this particular stock-based compensation scheme the following hypothesis seems plausible:

H6: "Under stock-based compensation earnings management is driven by bonus maximization, then insiders report increases/decreases on earnings before/immediately after getting the bonus".

3 Results

Table 1 displays some statistics at the group (market) level in T0 (baseline treatment). These data give a clear idea about the behavior of both insiders and outsiders during the experiment and, particularly, at the end of it. The data are disaggregated at the group level and the data for the three outsiders of every group are averaged. Consistently with hypothesis H3, the insider's wealth is higher (599 ECUs) than the average wealth of the outsiders (549 ECUs) despite the fact that the average number of stocks for both subject types are the same (8). This fact gives an intuition about the speculation source of the extra gains of the insider. On the other hand the stock price has sharply increased in all markets from 20 ECUs to 60 ECUs on average, as a consequence of the higher number of purchases than sales orders (530 and 413, respectively) and the messages about reported earnings, which accounts for misleading information 82% of the time (see hypothesis H1). It is also revealing that the majority of the messages (63%) correspond to the optimal manipulation strategies under hypothesis H2 (i.e. "20% earnings increase" and "20% earnings decrease").

Table 1. Descriptive statistics at the group level in T0 (without bonus)

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Total*
Insider's wealth at the end of the experiement	572	495	441	387	694	784	466	831	620	700	599
Outsider's average wealth at the end of the experiment	486,67	511,33	419	439	827	558,33	432,33	748,67	519,67	548	549
Average insider's weath during the experiment	322,45	355,73	341,28	366,73	441,23	455,8	367,85	540,48	426,65	457,65	407,585
Average outsider's wealth during the experiment	317,23	370,72	342,03	399,78	511,5	357,46	344,48	499,13	375,84	397,47	391,564
Insider's stocks at the end of the experiment	9	9	10	0	5	11	8	9	9	10	8
Outsider's average stocks at the end of the experiment	8	9	8	10	8	7	9	7	7	6	8
Average insider's stocks during the experiment	7	7	8	4	6	9	8	9	7	8	7
Average outsider's stocks during the experiment	6	8	7	8	7	6	7	7	6	6	7
Price at the end of the experiment	56	50	40	40	94	63	40	82	66	68	60
Average price during the experiment	35,25	41,1	36,85	43,35	59,55	39,55	36,08	57,4	48,28	49,6	44,7
Total number of purchases	64	57	52	49	49	61	51	44	44	59	530
Total number of sales	52	41	39	39	40	48	35	33	35	51	413
Total number of non-trade situations	44	62	69	72	71	51	74	83	81	50	657
Number of restrictions to purchases due to liquidity constraints	6	17	6	14	40	6	16	17	3	6	131
Times where the insider reports earnings truthfully	4	6	5	8	6	5	18	6	8	9	75
Times where the insider reports a 20% earnings increase	12	11	13	15	32	19	5	24	13	14	158
Times where the insider reports a 20% earnings decrease	8	9	13	13	4	8	17	13	6	4	95

* The 10 first rows are the average across groups. The last 7 rows are the sum for the 10 groups.

Table 2 displays descriptive statistics at the group (market) level in T1 (i.e. implementing a stock-based compensation scheme). This data highlights the much higher (931.7 ECUs) average wealth of insider's than that of the outsiders (614.97 ECUs). This comparison does not include the gains corresponding to the extra bonus

(hypothesis H4). It is also noteworthy that these figures have increased considerably from treatment T0 as a consequence of the higher increase of the stock price (69 ECUs on average) (hypothesis H5). It is also revealing that in this case the insiders have on average more stocks (13) than the outsiders (8), while in the other treatment both had 8 stocks on average at the end of the experiment (this also explains the differences in profitability). It is also noteworthy that although the number of purchases has not increased in T1 (with respect to T0), the difference between purchases and sales is higher in this treatment. Furthermore, the misreporting behavior has been reduced from 82% of the cases to 73%, and also the leading message in T1 is a "20% earnings increase" (45% of all the cases). All of this is consistent with the optimal manipulation strategy in T1 (see hypothesis H6) directed to increase the stock price in order to maximize the bonus.

Table 2. Descriptive statistics at the group level in T1 (with bonus)

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	Total*
Insider's wealth at the end of the experiment (with bonus)	992	987	919	869	667	816	1011	555	1435	1446	969,7
Insider's wealth at the end of the experiment (without bonus)	967	927	874	854	622	751	1011	555	1380	1376	931,7
Outsider's average wealth at the end of the experiment	607,33	750,67	587	695,33	410,33	473,67	779	435	727,33	684	614,97
Average insider's wealth during the experiment (with bonus)	552,73	589,08	401,03	560,8	434,9	386,1	608,33	396,05	703,38	636,5	526,89
Average insider's wealth during the experiment (without bonus)	548,85	583,58	396,9	557,05	431,65	381,23	600,33	394,05	697	629,63	522,03
Average outsider's wealth during the experiment	396,78	480,61	332,42	465,52	321,17	285,38	524,26	338,44	427,28	394,98	396,68
Insider's stocks at the end of the experiment	13	10	13	10	13	16	11	13	13	14	13
Outsider's average stocks at the end of the experiment	8	8	9	9	5	9	8	9	6	7	8
Average insider's stocks during the experiment	10	7	9	8	9	10	7	9	10	11	9
Average outsider's stocks during the experiment	7	7	7	8	6	7	7	8	5	6	7
Price at the end of the experiment	69	84	62	72	45	41	87	40	103	91	69
Average price during the experiment	46	56,1	35,68	52,25	36,58	25,73	60,8	34,95	59,33	49,05	45,65
Total number of purchases	42	52	52	38	53	51	47	61	49	52	497
Total number of sales	26	37	33	22	44	28	33	42	38	38	341
Total number of non-trade situations	92	71	75	100	63	81	80	57	73	70	762
Number of restrictions to purchases due to liquidity constraints	5	23	10	22	9	3	14	12	3	43	144
Times where the insider reports earnings truthfully	18	7	16	17	9	14	3	7	9	8	108
Times where the insider reports a 20% earnings increase	16	21	21	12	16	14	17	7	35	20	179
Times where the insider reports a 20% earnings decrease	3	1	13	2	7	18	0	9	4	4	61

* The 10 first rows are the average across groups. The last 7 rows are the sum for the 10 groups.

4 Conclusions

In this paper, we have designed a laboratory experiment to study the behavior of insiders in relation to their earnings management and trading practices. The experiment simulates a market were one insider and three outsiders trade on the stocks of a company. Their benefits come from the capital gains of their trading but also from the dividends and the increase in the price of their portfolio. We also assume that the stock price depends on the excess of supply/demand, but also on the

difference between reported and real earnings of the firm (surprises). Under these basic assumptions if the insider reports the firm's earnings and the real earnings are not known by the outsiders (although ex post they may guess them from the realized prices) we show two main results. Firstly, insiders misreport the information for the purpose of affecting the price in the direction that allows them to increase their capital gains. Therefore, earnings management induces inefficiencies on the stock prices, but also the misleading information reduces the outsiders' profits, which are significantly lower than those of the insiders. Secondly, managerial stock-based compensation policies reinforce these results although the insiders' earnings management strategies are driven by bonuses rather than by capital gains maximization. This fact increases insiders' profits even discounting the effects of the bonuses but also raises stock prices.

The results are obtained in a very simple scenario, but highlight how managers behave if earnings management, insider trading and stock-based compensation are not accurately regulated and supervised. The lack of transparency in earnings management practices and the wrongly incentivized managerial compensation policies have an important role on generating price inefficiencies, bubbles and financial crises. In fact, the current economic-financial crisis is also (and perhaps above all) a crisis of confidence in corporations and securities markets. Recovering that confidence will inevitably require corporate information to be more credible and all the agents involved in the financial reporting process to be subject to scrutiny.

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References

1. Abdolmohammadi, M., Sultan, J.: Ethical Reasoning and the Use of Insider Information in Stock Trading. J. Bus. Eth. 37, 165–173 (2002)
2. Bergstressera, D., Philipponb, T.: CEO Incentives and Earnings Management. J. Fin. Econ. 80, 511–529 (2006)
3. Fischbacher, U.: Z-Tree: Zurich Toolbox for Ready-Made Economic Experiments. Exp. Econ. 10, 171–178 (2007)