

## Do Insiders Earn More in Stock Markets? An Experiment

*Muhammad Azeem Qureshi\**

### Abstract

*Academicians as well as practitioners have long been debating insider information. Controlled laboratory experiment may be one way to estimate possible gains of an insider vis-à-vis a common investor given certain level of market efficiency. This paper reports the results of such a laboratory experiment using System Dynamics method; carried out to see effects of insider information on the profitability of the insiders versus that of the uniformed common investors. This study confirms that in a market, which has the ability to reflect the company inside information in market prices in one day, insiders cannot outperform the un-informed investors. However, another study with participant having investment knowledge or the practitioners from the stock markets may be carried out to know whether such a knowledge or expertise makes a difference. Another study could be carried out for those markets that could reflect inside information with a larger time lag.*

### Introduction

This study reports the results of a laboratory experiment based on System Dynamics (SD) method<sup>1</sup>; carried out to see the effects of insider information on the profitability of the insiders versus that of the uniformed common investors. Academicians as well as practitioners have long been debating insider information. There are many opponents as well as advocates of insider information. Insiders are not only the corporate insiders, but anyone who obtains material, non-public information from a corporate insider, or from issuer, or who steals such information from another source. Information is material if a substantial likelihood exists that a reasonable investor would consider it important in making his or her investment decisions (Meulbroek-1992). The regulators of the stock exchanges are concerned about the full disclosure of information; the insiders normally would be expected to possess about their company, including any facts that would materially affect the market's valuation of firm's worth if they were publicly known. The belief that insider trading is pervasive and harmful to the uninformed investors, contributed to the legislation in many capital markets and countries.

\* Mr. Qureshi is associated with Bahauddin Zakariya University, Pakistan.

<sup>1</sup> For further details on SD method please visit <http://www.ifi.uib.no/sd/sdinfo.html>

However, Plott and Sunder (1982) reported the findings of their experiment as, profits of insiders were virtually indistinguishable from non-insiders and efficiency levels converged to near 100 percent. If we assume the findings of this experiment as correct then a question arises why the world markets and their regulators have laws to curb this activity. The conflict between the empirical evidence and the results of Plott and Sunder (1982) experiment initiated this experiment.

The scheme of this paper is such that section 2 will give a brief literature review, section 3 will present the issue and hypothesis statement, section 4 will discuss the methodology and market design, section 5 will give an account of the underlying model, section 6 will provide discussion of results, and section 7 will present conclusion and possible future research.

### **Literature Review**

Security prices are believed to reflect all relevant information of the company. It is a common knowledge of investment that if the security prices reflect all relevant information, it will enhance the allocative efficiency of the capital markets (Meulbroek-1992). Literature in finance is overwhelmed with the studies focusing asymmetric information, agency costs and incentive signaling problems involving firm management (for a comprehensive literature review on agency problem see Harris and Raviv-1991) wherein a manager is believed to know the firm's true value. Such information could be used by the insiders to generate more profits than an average investor.

Manne (1966), Carlton and Fischel (1983) and other proponents of insider trading, as reported by Meulbroek (1992), assert that it improves capital market's efficiency by improving the accuracy of stock prices. Specifically, insider trading promotes quick price discovery, which motivates many investors to collect the same information. French and Roll (1986) concluded that most stock price movement occurs in response to informed trading. While, Keown and Pinkerton (1981) took a strong note by stating that 40 to 50% of the price gain experienced by a target firm's stock occurs before actual takeover announcement. Such an advocacy; against wide spread insider trading and its possible role in inefficient allocation of capital that may impede market development; initiated legislation against insider trading.

Finnerty (1976) has noted that various studies (for example by Pratt and DeVere-1970, and Finnerty-1977) have shown that the average insider has performed better than the market. While Lakonishok and Lee (2001), and Jeng et al. (2000) reported that the insider trades were less informative at large firms than trades at small firms. However, the experiment of Plott and Sunder (1982) concluded that the profits of insiders were virtually indistinguishable from non-insiders.

### **Methodology and Market Design**

We use system dynamics based interactive learning environment (ILE) methodology for

this experiment. The underlying model and interfaces have been created in Powersim®. The market comprises of a single security and three investors (the subjects). Two different groups of subjects, that is a total of six subjects, were involved in the experiment. The subjects were M Phil students of System Dynamics at University of Bergen. We decided to use only students as participants in this experiment for two reasons. First, students are cheap to hire and, due to their low opportunity cost, it is easy to establish salience and dominance in their payoff with a low cost. Second, the students are easy to find and enroll in the environment we are living in. Nevertheless, many experiments have used students as their subjects for similar reasons. This however, we admit is a limitation of this experiment too. To overcome this limitation we propose to carryout further experiment with the subjects having investment knowledge, and/or experience in stock market investment.

The objective of the participants was to increase their net worth of their assets they would possess at the end of the experiment. No transaction costs or taxes were assumed for this experiment. We also assumed no opportunity cost for the participants. Each participant was given an initial endowment of \$100,000 and 5,000 shares. The tradable lot is assumed to be 100 shares. The time horizon of the experiment is 30 transaction periods. The participants received NOK 50 for their participation in the experiment along with NOK 5 for each thousand dollar of profit they would have gained at the end of the 30 transaction periods. The whole payoff was fake money. No penalty was imposed on the poor performance to induce them into trade. This payoff process has its own limitations and needs improvements. No specific assumptions were made on the risk attitude of the participants, and they were free to use their own risk preferences in making their decisions, as our objective was to have general findings about profits of insiders assuming these would have been independent from the specific risk attitude of the participants.

The experiment was conducted on the local computer network. The computers were so placed that each participant was unable to look at the screen of any other participant. Any oral communication was also prohibited between participants during the experiment. The participants were briefed about the experiment and their role and their questions seeking explanations were addressed to.

The design of the market was such that the security yields only the capital gains as in Plott and Sunder (1982). This makes the price as dominating force to determine the consequent buy/sell activity. The demand/supply from the participant would affect the market price to reflect the market response to a bull and bear situation. The company's inside information would also be translated into market price after one day. That is we assume that market is not efficient rather it represents weak form efficiency. However, in future experiments we intend to test different forms of efficiency. Plott and Sunder (1982) do not explicitly assume form of efficiency of their market. Moreover, they assume that each participant is given sufficiently large working capital at the beginning of each period so that capital is not a constraint. However, in reality capital is a common constraint for the investors, and to account for that we allow an initial endowment of shares and money as their initial wealth, which the participants are required to maximize by the end of the experiment. Further, we assume that the stock supply in the market was unlimited. This was assumed because of the



reason for a common investor, normally with limited investible funds, the floating stock is much higher than his/her capacity to invest. In this way we assume that the market is efficient. We take this assumption on the basis of our observation that assumption made by Plott and Sunder (1982) that there was a fixed supply of securities do not fit into empirical observation that the floating stock is normally higher than investment capacity of few individuals. Moreover, with this assumption of fixed supply they assume inefficient market as against to that we assume efficient market in terms of floating stock.

One of the participants would get insider information as a message during the experiment, while the two others would not get any inside information. The participants were provided with the information about the current market price, the current demand and supply from the participants, and a price forecast. However, the price forecast for the uninformed participant was a trend generated from the historic prices (which was multiplied by 1.05 and 0.95 to show them upper and lower bound), while the price forecast for the informed participant was generated from the likely price because of the current demand/supply situation (which was multiplied by 1.02 and 0.98 to show them upper and lower bound). The insider was given clearly a better set of information. Further, the insider in Group 1 was explicitly given to understand as to perform the role of an insider, whereas the insider in Group 2 did not explicitly know this fact.

### Underlying Model and Interface

The underlying model is very simple, and the model and participants interface are created in Powersim®. The model and interface are depicted below.

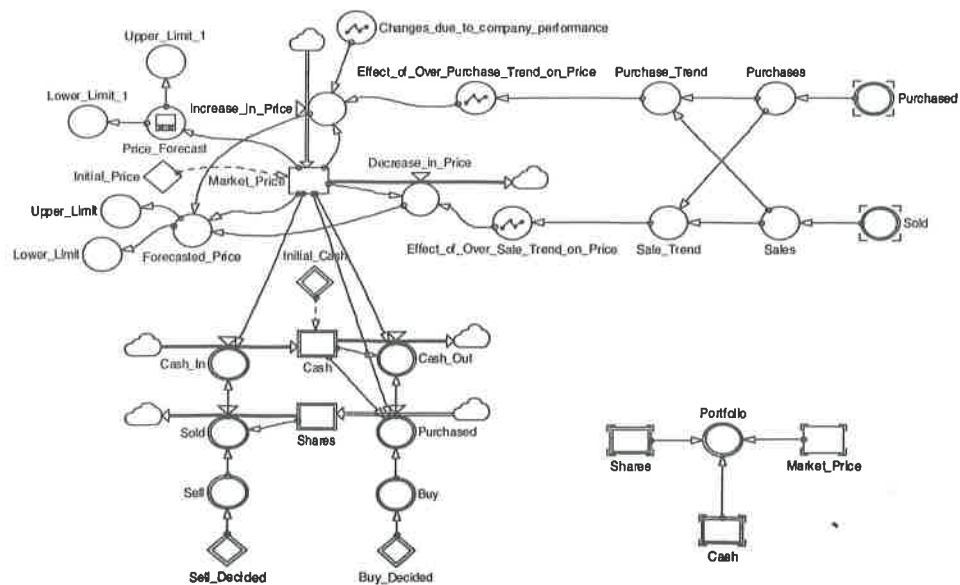


Figure 1: The Model

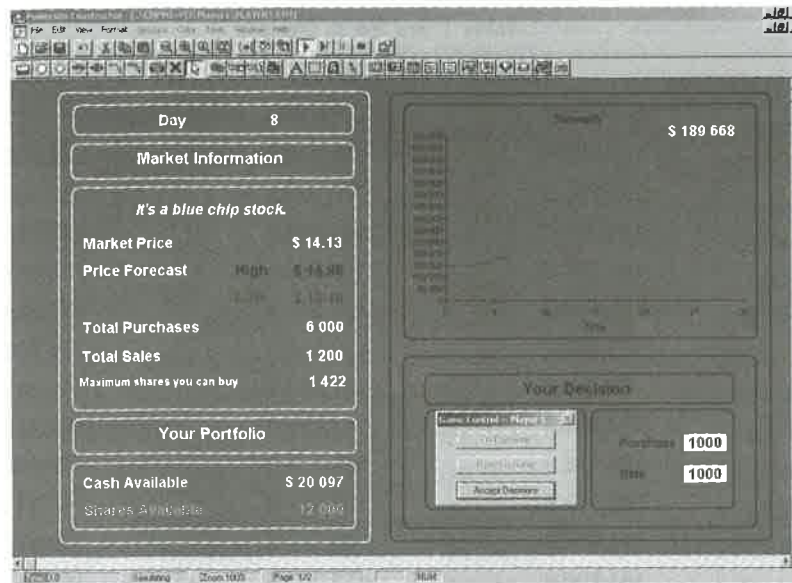


Figure 2: The Interface

The above model simply helps the players to buy and sell, conditioned by the cash and stocks they have. The players are neither allowed to short sell, nor borrow money. The model calculates the price depending upon the demand and supply in the market and the company information.

### Results

Before running actual experiment, a pilot experiment was also run to calibrate the model. The experiment results of the two groups are reproduced below:

**Table 1: Net Worth Group 1**

| <b>Group 1 Net Worth (\$)</b> |                  |                           |                  |
|-------------------------------|------------------|---------------------------|------------------|
| <b>Time</b>                   | <b>Insider</b>   | <b>Uninformed Players</b> |                  |
| 0                             | 150,000.0        | 150,000.0                 | 150,000.0        |
| 1                             | 150,000.0        | 150,000.0                 | 150,000.0        |
| 2                             | 149,720.0        | 149,900.0                 | 149,796.0        |
| 3                             | 157,223.2        | 153,651.0                 | 153,697.7        |
| 4                             | 156,109.3        | 153,566.0                 | 153,269.3        |
| 5                             | 165,852.1        | 153,566.0                 | 159,950.0        |
| 6                             | 174,251.6        | 157,299.0                 | 164,243.1        |
| 7                             | 174,251.6        | 157,299.0                 | 164,243.1        |
| 8                             | 182,176.9        | 163,515.0                 | 167,506.4        |
| 9                             | 182,643.6        | 163,881.0                 | 167,707.8        |
| 10                            | 184,290.8        | 165,671.0                 | 168,477.6        |
| 11                            | 181,800.4        | 159,742.0                 | 165,987.3        |
| 12                            | 181,800.4        | 166,354.0                 | 171,806.3        |
| 13                            | 181,800.4        | 167,382.0                 | 172,916.2        |
| 14                            | 196,414.1        | 196,610.0                 | 191,621.7        |
| 15                            | 196,414.1        | 187,705.0                 | 186,813.2        |
| 16                            | 201,024.5        | 196,926.0                 | 191,331.4        |
| 17                            | 199,389.1        | 190,384.0                 | 187,733.5        |
| 18                            | 208,922.1        | 201,279.0                 | 195,087.5        |
| 19                            | 208,922.1        | 188,005.0                 | 185,353.2        |
| 20                            | 222,224.2        | 223,477.0                 | 207,080.0        |
| 21                            | 228,035.4        | 233,162.0                 | 210,857.2        |
| 22                            | 226,611.4        | 232,055.0                 | 210,398.4        |
| 23                            | 228,485.4        | 233,304.0                 | 210,737.5        |
| 24                            | 232,793.7        | 236,997.0                 | 211,435.0        |
| 25                            | 234,719.2        | 238,647.0                 | 211,838.5        |
| 26                            | 236,660.8        | 240,312.0                 | 212,337.7        |
| 27                            | 238,618.5        | 241,990.0                 | 212,934.4        |
| 28                            | 241,934.9        | 244,990.0                 | 214,103.0        |
| 29                            | 238,045.9        | 240,064.0                 | 211,925.2        |
| 30                            | 239,443.3        | 241,834.0                 | 212,800.9        |
| <b>Mean</b>                   | <b>198,405.8</b> | <b>192,889.3</b>          | <b>184,644.8</b> |
| <b>Mean Profit</b>            | <b>32.27%</b>    | <b>28.59%</b>             | <b>23.10%</b>    |

Table 2: Net Worth Group 2

| Group 2 Net Worth (\$) |                  |                   |                  |
|------------------------|------------------|-------------------|------------------|
| Time                   | Insider          | Uninformed Player |                  |
| 0                      | 150,000.0        | 150,000.0         | 150,000.0        |
| 1                      | 150,000.0        | 150,000.0         | 150,000.0        |
| 2                      | 161,600.0        | 159,280.0         | 155,800.0        |
| 3                      | 167,343.7        | 167,177.6         | 162,261.6        |
| 4                      | 170,170.6        | 172,831.5         | 163,001.0        |
| 5                      | 191,884.9        | 208,117.1         | 198,871.5        |
| 6                      | 184,666.8        | 191,876.3         | 188,262.0        |
| 7                      | 183,347.6        | 187,259.3         | 175,549.6        |
| 8                      | 183,163.8        | 186,707.9         | 174,814.4        |
| 9                      | 182,981.3        | 186,251.8         | 174,084.6        |
| 10                     | 182,768.3        | 185,683.7         | 172,948.5        |
| 11                     | 182,627.9        | 185,262.6         | 171,825.4        |
| 12                     | 193,294.7        | 190,595.9         | 193,158.9        |
| 13                     | 192,459.8        | 190,262.0         | 190,487.3        |
| 14                     | 191,799.9        | 190,262.0         | 187,187.5        |
| 15                     | 191,914.4        | 190,319.2         | 187,760.0        |
| 16                     | 192,108.3        | 190,610.2         | 188,729.7        |
| 17                     | 192,600.0        | 191,224.8         | 189,836.0        |
| 18                     | 192,897.8        | 191,582.1         | 190,312.5        |
| 19                     | 193,503.1        | 192,288.3         | 191,119.6        |
| 20                     | 205,194.6        | 199,595.5         | 202,811.1        |
| 21                     | 203,806.2        | 199,595.5         | 200,589.7        |
| 22                     | 203,585.5        | 198,270.9         | 200,589.7        |
| 23                     | 203,928.7        | 202,389.5         | 200,932.9        |
| 24                     | 205,298.2        | 204,672.0         | 201,617.7        |
| 25                     | 205,519.3        | 205,556.2         | 201,986.1        |
| 26                     | 206,299.4        | 223,498.4         | 209,006.9        |
| 27                     | 206,299.4        | 223,498.4         | 209,006.9        |
| 28                     | 206,299.4        | 217,700.5         | 207,998.6        |
| 29                     | 206,299.4        | 216,356.4         | 202,622.2        |
| 30                     | 206,299.4        | 260,473.1         | 206,015.8        |
| <b>Mean</b>            | <b>189,998.8</b> | <b>193,845.1</b>  | <b>187,070.6</b> |
| <b>Mean Profit</b>     | <b>26.67%</b>    | <b>29.23%</b>     | <b>24.71%</b>    |

If we look at the above results the final net worth of insiders in both the groups was less than that of one of the uninformed participants. However, the mean net worth of the insider of Group 1, who explicitly knew of being the insider, is higher than both the uninformed participants in that group. This insider earned a mean profit of 32.27% as against the mean profit of the uninformed participants of 28.59% and 23.10%. The mean net worth of insider of Group 2, who was not explicitly given to know of being an insider, is less than the mean net worth of one of the participants of the same group. This insider earned a mean profit of 26.67% as against the mean profit of the uninformed participants of 29.23% and 24.71%.

We have performed trend analysis using Minitab and obtained following trend lines for the participants, where the participants are indicated by P as under

**P1** is uninformed, **P2** is well-informed insider, and **P3** is uninformed participant.  
**P4** is uninformed, **P5** is un-informed insider, and **P6** is uninformed participant.

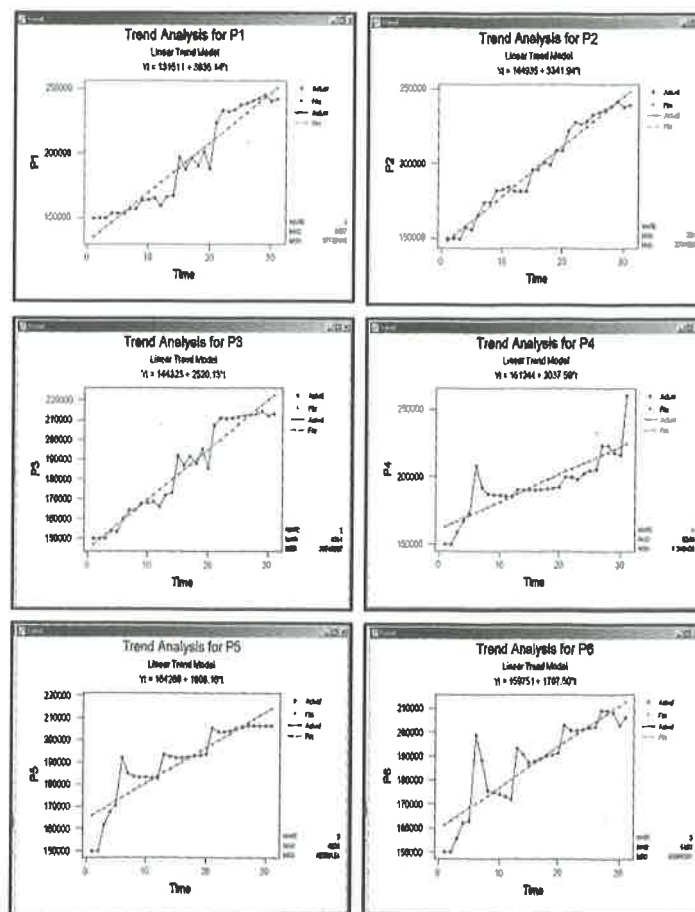


Figure 3. Trend Analysis



The trend line models fit to the data for the Group 1 are given below.

Well-informed insider  $Y_t = 144,935 + 3341.94*t$ ; MAPE=2.00

Uninformed participant  $Y_t = 131,511 + 3836.14*t$ ; MAPE=4.43

Uninformed participant  $Y_t = 144,323 + 2520.13*t$ ; MAPE=2.27

While, the trend line models fit to the data for the Group 2 are given below.

Well-informed insider  $Y_t = 164,268 + 1608.16*t$ ; MAPE=2.73

Uninformed participant  $Y_t = 161,244 + 2037.59*t$ ; MAPE=4.19

Uninformed participant  $Y_t = 159,751 + 1707.50*t$ ; MAPE=3.02

MAPE, or Mean Absolute Percentage Error, measures the accuracy of fitted time series values. It expresses accuracy as a percentage. The MAPE values for insiders are clearly better than the uninformed participants, indicating better trend line fit. One explanation for low variation around trend line could be that the insiders took well-informed decisions and were exposed to lesser risk. However, the fitted trend lines when extrapolated do reject the null hypothesis, which is the profit of insiders is higher than the un-informed agents. However, using these trend lines we obtained the periodic net worth of all participants as depicted below.

**Table 3. Periodic Net Worth**

| Net Worth |              |           |           |           |           |           |           |
|-----------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Group     | Participants | 5 days    | 10 days   | 15 days   | 20 days   | 25 days   | 30 days   |
| 1         | Insider      | 161644.70 | 178354.40 | 195064.10 | 211773.80 | 228483.50 | 245193.20 |
|           | Un-informed  | 150691.70 | 169872.40 | 189053.10 | 208233.80 | 227414.50 | 246595.20 |
|           | Un-informed  | 156923.65 | 169524.30 | 182124.95 | 194725.60 | 207326.25 | 219926.90 |
| 2         | Insider      | 172308.80 | 180349.60 | 188390.40 | 196431.20 | 204472.00 | 212512.80 |
|           | Un-informed  | 171431.95 | 181619.90 | 191807.85 | 201995.80 | 212183.75 | 222371.70 |
|           | Un-informed  | 168288.50 | 176826.00 | 185363.50 | 193901.00 | 202438.50 | 210976.00 |

It indicates that the well-informed insider of the Group 1 performed better till day 25, but towards end finished somewhat below the un-informed participant. Further, the purchase and sales activity carried out by the participant could also reveal some interesting insights. The sale purchase data is given below.

**Table 4. Trading Volumes**

| Group | Participant | Purchase | Sale   |
|-------|-------------|----------|--------|
| 1     | Insider     | 40,500   | 38,000 |
|       | Un-informed | 28,000   | 19,500 |
|       | Un-informed | 7,100    | 7,400  |
| 2     | Insider     | 14,500   | 19,500 |
|       | Un-informed | 44,000   | 30,500 |
|       | Un-informed | 12,000   | 16,000 |

Two of the participants were aggressively active; three were moderately active and remaining one remained docile. Whenever, increase in price due to company performance was made to be known to the insiders, at day 3, 10, and 18, they were expected to buy immediately with whatever the cash they may have. However, insider of Group 1 sold 6000 and 4200 shares on day 3 and 10 respectively and purchased 3000 shares on day 18. While, insider of Group 2 purchased on all these days but nominal quantities of 1000, 3000 and 1000 respectively. This indicates that had the participants have had investment knowledge or expertise and/or induced to trade; they could have generated better profits.

The weaknesses of this study identified are that there should have been some inducement to actively involve participants in trading. This could have been made possible by having some discount rate charged to the unused cash balance.

### Conclusion

This study confirms that in a market, which has the ability to reflect the company inside information in market prices in one day, insiders cannot outperform the un-informed investors. However, another study with participant having investment knowledge or the practitioners from the stock markets may be carried out to know whether such a knowledge or expertise makes a difference. Another study could be carried out for those markets that could reflect inside information with a larger time lag.

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