Stock Market Manipulation – Theory and Evidence*

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Abstract

In this paper we present a theory and some empirical evidence of stock price manipulation in the U.S. We consider what happens when a manipulator can trade in the presence of other traders who seek out information about the stock's true value. In a market without manipulators, these information seekers unambiguously improve market efficiency by pushing prices up to the level indicated by the informed party's information. In a market with manipulators, the information seekers play a more ambiguous role. More information seekers imply greater competition for shares, improving market efficiency, but also increasing the possibility for the manipulator to enter the market. This suggests a strong role for government regulation to discourage manipulation while encouraging greater competition for information. We then provide evidence from SEC actions in cases of stock manipulation. We find that potentially informed parties such as corporate insiders, brokers, underwriters, large shareholders and market makers are likely to be manipulators. More illiquid stocks are more likely to be manipulated and manipulation increases stock volatility. We show that stock prices rise throughout the manipulation period and then fall in the post-manipulation period. Prices and liquidity are higher when the manipulator sells than when the manipulator buys. In addition, at the time the manipulator sells, prices are higher when liquidity is greater and when volatility is greater. These results are consistent with the model and suggest that stock market manipulation may have important impacts on market efficiency.

1 Introduction

"In multiple instances, the large orders [the defendant] placed were filled in smaller blocks at successively rising prices. All of these transactions, the Commission alleges, were part of a manipulative scheme to create the artificial appearance of demand for the securities in question, enabling unidentified sellers to profit and inducing others to buy these stocks based on unexplained increases in the volume and price of the shares."

– Securities and Exchange Commission[1]

Both for developed and emerging stock markets, the possibility that the markets can be manipulated is an important issue for both the regulation of trading and the efficiency of the market. Manipulation can occur in a variety of ways, from insiders taking actions that influence the stock price (e.g., accounting and earnings manipulation such as in the Enron case) to the release of false information or rumors in Internet chat rooms. Moreover, by purchasing a large amount of stock, a trader can drive the price up. If the trader can then sell shares and if the price does not adjust to the sales, then the trader can profit. Of course, we should expect that such a strategy will not work. Selling shares will depress the stock price, so that, on average, the trader buys at higher prices and sells at lower prices. This is the unraveling problem, and would seem to rule out the possibility of what Allen and Gale (1992) term trade-based manipulation.

In this paper, we examine various forms of stock market manipulation and their implications for stock market efficiency. Allen and Gale (1992) have shown that trade-based manipulation is possible when it is unclear whether the purchaser of shares has good information about the firm's prospects or is simply trying to manipulate the stock price for profit. We examine this question in a setting in which there are active information seekers (think of arbitrageurs) trying to ferret out information about the firm's prospects. Not surprisingly, we find that the presence of manipulators reduces market efficiency. More surprisingly, we find that more information seekers may worsen market efficiency when there are manipulators present. Thus, the possibility of stock price manipulation may substantially curtail the effectiveness of arbitrage activities, and, in some cases, render arbitrage activities counterproductive. In these situations, the need for government regulation is acute. In particular, enforcement of anti-manipulation rules can improve market efficiency by restoring the effectiveness of arbitrage activities.

[1]See SEC v. Robert C. Ingardia (United States District Court for the Southern District of New York)

We then establish some basic facts about stock market manipulation by analyzing SEC litigation releases from 1990 to 2001 on stock market manipulation cases. There are 142 cases of stock market manipulation that we are able to identify. Our analysis shows that most manipulation cases happen in relatively inefficient markets such as the OTC Bulletin Board and the Pink Sheets that are small and illiquid. There are much lower disclosure requirements for firms listed in these markets and they are subject to much less stringent securities regulations and rules. We find that manipulated stocks are less liquid than a matched sample of non-manipulated stocks, supporting the notion that average volume is low for manipulated stocks. However, during the manipulation period, liquidity, returns, and volatility are higher for manipulated stocks than for the matched sample. The vast majority of manipulation cases involve attempts to increase the stock price rather than to decrease the stock price, consistent with the idea that short-selling restrictions make it difficult to manipulate the price downwards. We also find that "potentially informed parties" such as corporate insiders, brokers, underwriters, large shareholders and market makers are likely to be manipulators. Since they are close to the information loop, it is much easier for them to pose as the informed party in a manipulation scheme.

Using these data, we then examine the empirical implications of the model. Because they constitute the vast majority of cases, we focus on situations in which the manipulator first buys shares and then sells them. We show that stock prices rise throughout the manipulation period and then fall in the post-manipulation period. In particular, prices are higher when the manipulator sells than when the manipulator buys. After the manipulation ends, prices fall. These results are consistent with the model. There are some evidence that liquidity is higher when the manipulator sells than when the manipulator buys. Strikingly, at the time the manipulator sells, prices are higher when liquidity is greater. This result is consistent with returns to manipulation being higher when there are more information seekers in the market. Also, at the time the manipulator sells, prices are higher when volatility is greater. This result is consistent with returns to manipulation being higher when there is greater dispersion in the market's estimate of the value of the stock. All of these results are consistent with the model.

There are several caveats to note about these results. First, we only have data for manipulation cases in which the SEC brought an enforcement action. We therefore miss cases in which 1) manipulation is possible but does not occur, 2) manipulation happens but is not observed, and 3) manipulation happens, the SEC investigates, but does not bring an action. Thus, it can be argued that our results only apply to poor manipulators in the sense that they were caught. While this point is true for our descriptive results, it does not affect the empirical tests of the model because we only test cross-sectional implications that would hold for manipulators. In particular, one would have to argue that a manipulator who manipulates a more liquid or more volatile stock is more likely to be caught than one who manipulates less liquid and less volatile stocks. This seems somewhat implausible since it would be easier to hide trades in more liquid and more volatile stocks.

Second, we have a relatively small number of cases of manipulation. Even given the noisiness and imprecision of the data, we are able to find fairly striking results on the characteristics of manipulation cases. One might argue, however, that manipulation is relatively unimportant in U.S. stock markets. We disagree for several reasons. First, because we can only focus on cases in which the SEC has acted, we do not have a clear picture on how prevalent manipulation is. In particular, given concerns that the SEC's enforcement budget is quite limited, the small number of cases may only be a reflection of budget constraints. Second, even if manipulation is a small issue in U.S. markets, manipulation may be a much larger issue for emerging stock markets. Third, given the number of recent manipulation cases involving the use of the Internet, the Internet may be an important channel that makes manipulation through information dissemination easier. Fourth, we believe that our results for manipulation cases may also be useful for thinking about similar issues when it comes to larger cases of fraud such as Enron or Worldcom.

Our theoretical and empirical analysis highlights the importance of the role played by government regulators in achieving market efficiency. An efficient market requires the presence and the trading of many information seekers. Yet the presence of more information seekers makes successful manipulation more likely, thereby reducing market efficiency. To the extent that active enforcement of securities rules and regulations raises the costs of manipulation to the manipulator, this can deter the manipulator from entering the market, even as the number of information seekers increases. In this case, the presence of more information seekers will simply serve to increase market efficiency. Hence, we argue there is an important role for government to actively enforce securities regulations and rules and to combat manipulative activities.

This paper proceeds as follows. In Section 2, we discuss related literature. In Section 3, we present a model of stock price manipulation. In Section 4, we describe our data and present some basic empirical results. Section 5 presents the empirical tests of the model. Section 6 concludes.

Some technical details are provided in the Appendix.

2 Related Literature

In the market microstructure literature, it is generally agreed that traders with more information about the value of firms (such as corporate insiders) can profit from trading (Glosten and Milgrom (1985), Easley and O'Hara (1987), and Kyle (1985, 1989)). What about trading strategies that are deemed manipulative by uninformed traders? Most of the above theoretical asymmetric information models assume the existence of liquidity traders who must trade to meet liquidity needs. Informed traders are able to profit from them since they cannot choose when to trade.

Allen and Gorton (1992) argue that it is much more difficult to justify forced purchasing by liquidity traders who have a pressing need to buy securities. The natural asymmetry between liquidity purchases and liquidity sales leads to an asymmetry in price responses. If liquidity sales are more likely than liquidity purchases, there is less information in a sale than in a purchase because it is less likely the trader is informed. The bid price then moves less in response to a sale than does the ask price in response to a purchase. This asymmetry of price elasticities can create an opportunity for profitable price manipulation. A manipulator can repeatedly buy stocks, causing a relatively large effect on prices, and then sell with relatively little effect.

In our model, we do not rely on the asymmetry of price elasticities to motivate the possibility of manipulation. Instead, we assume, consistent with Allen and Gorton's (1992) observation, that liquidity traders are willing to sell at prices higher than the current or prevailing price. Moreover, there is no forced buying by liquidity traders in our model. The buying of shares in our model comes from arbitrageurs or information seekers, whose presence allows for the possibility of manipulation.

Allen and Gale (1992) also examine trade-based manipulation. They define trade-based manipulation as a trader attempting to manipulate a stock simply by buying and then selling, without taking any publicly observable actions to alter the value of the firm or releasing false information to change the price. They show that a profitable price manipulation is possible, even though there is no price momentum and no possibility of a corner. The key to this argument is information asymmetry. Traders are uncertain whether a large trader who buys the share does so because he knows it is undervalued (including the possibility of a takeover), or because he intends to manipulate the price. It is this pooling that allows manipulation to be profitable. Our model has a similar result.

We differ from Allen and Gale (1992) in that we incorporate information seekers or arbitrageurs into our model and ask what effect they have on the possibility of manipulation.

In a dynamic model of asset markets, Jarrow (1992) investigates market manipulation trading strategies by large traders in a securities market. A large trader is defined as any investor whose trades change prices. A market manipulation trading strategy is one that generates positive real wealth with no risk. Market manipulation trading strategies are shown to exist under reasonable hypotheses on the equilibrium price process. Profitable speculation is possible if there is "price momentum," so that an increase in price caused by the speculator's trade at one date tends to increase prices at future dates. Our model can be viewed as providing a mechanism by which price momentum occurs–our information seekers trade based on what they observe about the large trader's buying activity.

There also exist a large number of papers that examine theoretically and empirically price manipulation in a number of different settings. For example, Kumar and Seppi (1992) investigate the susceptibility of futures markets to price manipulation. Jordan and Jordan (1996) examine Salomon Brothers' market corner of a Treasury note auction in May 1991. Felixson and Pelli (1999) examine closing price manipulation in the Finnish stock market. Mahoney (1999) examines stock price manipulation leading up to the Securities Exchange Act of 1934. Vitale (2000) examines manipulation in the foreign exchange market. Gerard and Nanda (1993) examine the potential for manipulation in seasoned equity offerings. Jarrow (1994) studies the impact that derivative security markets have on market manipulation.

3 Model

We consider a simple model of stock price manipulation. There are four types of investors in our model. First, there is an informed party (superscripted I) who knows whether the stock value in the future will be high (V_H) or low (V_L). We can think of the informed party as being an insider in the firm who has good information about the firm's prospects.

Second, there is a manipulator (superscripted M), who we assume knows that the stock value will be low. The manipulator tries to drive the price of the stock up and then profit by selling at the higher price. In our model, we consider two scenarios. First, the manipulator can take some action such as spreading rumors or engaging in wash sales to increase the stock price. This activity, while generally prohibited, constitutes most cases we observe of stock price manipulation. Second, the manipulator can buy shares and then profit by trying to sell them later at a higher price. The issue for the manipulator is whether such a strategy is sustainable. In general, such a strategy would suffer from the unraveling problem–in meeting the manipulator's demand, the price is driven up so the manipulator buys at a higher price while when clearing the manipulator's supply, the price is driven down so the manipulator sells at a lower price. Allen and Gale (1992) show that this need not happen in general and it may be possible for the manipulator to sustain positive profits. We apply their insights in our context and show that profitable manipulation is possible and, in addition, we show its impact on market efficiency. In our model, the manipulator may also be an insider, but one who does not have good information about the firm's future prospects.

Third, there are N symmetric information seekers (superscripted A_i, $i \in N$). Information seekers seek out information about whether the future stock price will be high or low. One can also think of them as being arbitrageurs. In our model, we limit our information seekers to several types of information. They can observe past prices and volume and they are susceptible to rumors that may be spread. They do not know the identities of buyers and sellers and therefore they are susceptible to the possibility of wash sales. They have no access to fundamental information themselves. Instead, they try to infer from prices, volumes, and rumors whether an informed party is buying the stock, or whether they should be buying the stock as well.

Fourth, there exists a continuum of noise or uninformed traders (superscripted U). These traders do not update or condition on any information. They simply stand ready to sell shares, so their role is to provide liquidity to the market. We model the uninformed traders as providing a supply curve to the market that determines the market price:

$$P(Q) = a + bQ, \tag{1}$$

where P is the market price of the stock, Q is the quantity demanded, and b is the slope of the supply curve. We assume that initially all shares are held by the uninformed traders.[2] If no one wishes to purchase the stock, then the price of the stock is simply a. For completeness, we assume that the total shares outstanding are:

$$\frac{V_H - a}{b}. \tag{2}$$

[2] This is the case for trading based manipulation. In the cases of wash sales and the release of false information or rumors, the manipulator already owns shares and thus comprises part of the supply curve.

This implies that if someone wished to buy all of the shares from the uninformed, the price would be V_H. It is important to note that this is not because the uninformed update about the stock's value. Instead, it is simply governed by the uninformed's willingness to sell more if offered a higher price.

The timing of the model is as follows. At time 0, all shares are held by the uninformed. At time 1, either the manipulator or the informed party can enter the market. The manipulator enters with probability γ, and the informed party enters with probability δ.[3] Since the informed party will only enter if the future stock value will be high (V_H), this is equivalent to saying the probability the future stock value is high is δ. Here we assume that the manipulator knows he does not have good information and the future stock value is V_L.[4] With probability $1 - \gamma - \delta$ neither the manipulator nor the informed enter and the future stock value is V_L. As a result, we can think of a as being the time 0 price, i.e., the unconditional expected value of final cash flows,

$$a = \delta V_H + (1 - \delta) V_L. \tag{3}$$

The information seekers observe the stock price and the quantity demanded or any relevant rumors or false information at time 1. At time 2, information seekers can buy shares. They will condition the number of shares they purchase on what they observed at time 1.[5] Also at time 2, the manipulator or the informed party can buy or sell shares. At times 1 and 2, the uninformed stand ready to sell shares. At time 3, the fundamental stock price is revealed to be either V_H or V_L.

[3] This is the case if the manipulator engages in trade-based manipulation. If the manipulator already has a position in the stock, then γ is the probability that the manipulator releases false information or engages in a wash sale.

[4] It is worth noting that the manipulator will not always try to manipulate the stock when the informed party does not enter. Later on we solve for the optimal amount or probability of manipulation. We also show that if the probability of manipulation is too high, then the market will break down in the sense that information seekers will not be willing to purchase shares. This explains why a manipulator who already owns shares may nonetheless choose not to try to manipulate the stock.

[5] If there is no purchase of shares at time 1, it is natural to assume that the information seekers will short sell the stock at time 2 until its value is driven to V_L (subject to there being a large number of information seekers). Our focus here is on what happens when there is a purchase of shares at time 1.

One may also wonder why the manipulator and the informed party, knowing that the stock value is low, do not short sell to take advantage of this information. First, with regard to the manipulator, our results would go through if we assumed that the manipulator was uninformed about the true value of the stock. Second, if both the informed party and the manipulator are insiders (as is true in most cases of manipulation), then restrictions on insiders short-selling their own firm's stock will prevent them from taking advantage of their information.

We make an additional assumption about the informed party. We assume that the informed party dislikes holding shares until time 3. We can think of this in several ways. First, time 3 represents the long-run, when stock prices have adjusted to fundamental values. The long-run may be very long, and thus it may be costly to hold shares for the informed party. Second, if the informed party is an insider, holding a large, undiversified position in the own-firm stock is costly from a portfolio diversification perspective. Though there is no uncertainty in our model, by adding some uncertainty about the distribution of time 3 prices, we can easily motivate a cost to holding shares for the informed party. We model the cost of holding shares until time 3 as a scalar k. If the stock price at time 3 is V_H, the value to the informed party of a share is $V_H - k$. In order for our problem to be meaningful, it must be the case that $V_H - k - a > 0$, otherwise no informed party would ever buy shares at a price greater than or equal to the time 0 price and hold them until time 3. There is no cost for the informed party to holding a share until time 2. Note that there is no such cost to the manipulator to holding shares until time 3 because the manipulator will never hold shares until time 3 when the value of the share will be V_L, conditional on the manipulator entering.

We next consider two cases. First, we examine what happens when an informed party is present as well as information seekers, but no manipulators. Second, we examine what happens when all three are potentially present in the market: the informed party, the manipulator, and the information seekers.

3.1 Equilibrium with information seekers

First, we consider what happens when there are N symmetric information seekers present in the market, but no manipulator. The information seekers condition their demand at time 2 on what they observe at time 1. Here there are two potential equilibria. In the first equilibrium, the informed party purchases shares at time 1 and then sells these shares at time 2 to the information seekers, who purchase additional shares from the uninformed.[6] In the second equilibrium, the informed party purchases shares at time 1 and then both the informed party and the information seekers purchase additional shares from the uninformed at time 2. In general, we think that the

[6] This is the case we focus on when we add manipulators to the market. For this reason, it is also worth thinking about what happens when the informed party already has shares. In this case, the informed party will want to release credible information about the true value of the shares at time 1 and then sell shares at time 2. For now, because there are no manipulators present, any information released is credible.

first equilibrium represents the usual case, as we discuss below.

Equilibrium 1

The information seekers are in the market at time 2. Given that the information seekers observe the trading activity at time 1, they know that the informed party has good information about the firm's prospects (V_H). Each information seeker also knows that she is competing against the other $N-1$ information seekers for shares. Lastly, the informed party's strategy at time 2 must be optimal given the information seekers' demands for shares. In this equilibrium, the conjectured optimal strategy for the informed party is to sell shares at time 2, which we will then verify as optimal. We denote the aggregate demand of the N information seekers at time 2 as:

$$q_2^A = \sum_{i \in N} q_2^{A_i}, \tag{4}$$

where $q_2^{A_i}$ is each information seeker i's demand at time 2. At time 2, all shares outstanding are available for purchase as the informed party sells her q_1^I shares.[7] Each information seeker i solves the following problem at time 2:

$$\max_{q_2^{A_i}} \quad V_H q_2^{A_i} - (a + b(\sum_{i \in N} q_2^{A_i}))q_2^{A_i}. \tag{5}$$

Taking the N first order conditions, imposing symmetry, and solving yields:

$$q_2^{A_i *} = \frac{V_H - a}{(N+1)b}. \tag{6}$$

The aggregate demand from the N information seekers is:

$$q_2^{A*} = \frac{N}{N+1} \frac{V_H - a}{b}. \tag{7}$$

The price at time 2 is:

$$p_2^* = a + b(\sum_{i \in N} q_2^{A_i}) = \frac{NV_H + a}{N+1}. \tag{8}$$

As the number of information seekers becomes large, the aggregate demand converges to all of the shares outstanding and the time 2 price converges to the fundamental value of the stock:

$$\lim_{N \to \infty} q_2^{A*} = \frac{V_H - a}{b} \tag{9}$$

$$\lim_{N \to \infty} p_2^* = V_H. \tag{10}$$

[7] We show below that as long as there is at least one information seeker ($N \geq 1$), the aggregate number of shares demanded by the information seekers at time 2 will exceed the number of shares sold by the informed party, $q_2^A > q_1^I$.

In this sense, *the information seekers push the market to efficiency.* This is true, of course, only if the number of information seekers is large. If the number is small, then the information seekers do not push the market all the way towards efficiency as each tries to extract rents. Only when the number is large is the ability to extract rents circumscribed by the competition from the other information seekers.

Under the conjectured equilibrium, the informed party purchases shares at time 1 and sells at time 2. The informed party chooses the number of shares to purchase at time 1 by solving the following problem:

$$\max_{q_1} \quad p_2^* q_1 - (a + bq_1)q_1. \tag{11}$$

The time 1 quantity demanded by the informed party is:

$$q_1^{I*} = \frac{N}{N+1}\frac{V_H - a}{2b}, \tag{12}$$

and the price is:

$$p_1^* = a + \frac{N}{N+1}\frac{V_H - a}{2}. \tag{13}$$

The informed party's profits are:

$$\pi^{I*} = \frac{N^2}{(N+1)^2}\frac{(V_H - a)^2}{4b}. \tag{14}$$

In this conjectured equilibrium, the equilibrium strategies are for the informed party to buy q_1^{I*} shares at time 1, for the informed party to sell q_1^{I*} shares at time 2, and for the N information seekers to each buy $q_2^{A_i*}$ shares at time 2. We now examine under what conditions this conjectured equilibrium will, in fact, be an equilibrium. In order for this conjectured equilibrium to be an equilibrium, it must be the case that no party benefits by deviating from the strategies conjectured. Suppose first that the informed deviates by trying to buy additional shares at time 2 rather than sell. Aggregate demand for shares at time 2 is then:

$$\begin{aligned} q_2^{A*} + q_1^{I*} + q_2^I &= \frac{N}{N+1}\frac{V_H - a}{b} + \frac{N}{N+1}\frac{V_H - a}{2b} + q_2^I \\ &= \frac{3N}{N+1}\frac{V_H - a}{2b} + q_2^I. \end{aligned} \tag{15}$$

Note that for $N \geq 2$, the total quantity demanded (assuming $q_2^I \geq 0$) exceeds the number of shares outstanding, $\frac{V_H - a}{b}$. In this case $p_2^* = V_H$ and the time 2 demand of the informed party is $q_2^I = 0$.

The value to the informed party for holding shares until time 3 is $V_H - k$. The informed party's profits from this deviation are:

$$\frac{N^2}{(N+1)^2}\frac{(V_H - a)^2}{4b} + \frac{1}{2}\frac{N\,(V_H - a)}{(N+1)\,b}\left[\frac{(V_H - a)}{(N+1)} - k\right]. \tag{16}$$

The first term is just the profits earned by not deviating from the equilibrium. The second term is the incremental profit from deviating. For N or k large enough, the second term is negative, establishing that the deviation is not profitable and the conjectured equilibrium is, in fact, an equilibrium. Further, each of the information seekers' strategies that we solved for was optimal given all of the other information seekers' strategies and the informed party's strategy, so no information seeker will deviate.

Equilibrium 2

The second equilibrium has the feature that the informed party buys in both periods. Paralleling the development above for the first equilibrium, for this equilibrium to be sustainable, it must be the case that the number of information seekers N or the cost of waiting to time 3 for the informed party k is small enough. For completeness, in the Appendix, we derive the equilibrium. The relevant condition for this equilibrium is that the informed party must prefer to hold shares until time 3 rather than sell them at time 2. From the Appendix, this condition is:

$$V_H - k - p_2^* = \frac{(N+2)\,(V_H - k - a) - 2kN^2 - 4kN}{2\,(3 + N^2 + 4N)}. \tag{17}$$

The key point that emerges from this condition is that as long as k is small or N is small, the expression will be positive and the informed party will prefer to purchase shares in both periods. Note that as N increases, eventually the expression switches sign and becomes negative. The informed party will cease buying shares at time 2.

The results here show that information seekers have two opposing effects on the profits of the informed party relative to the benchmark case. First, the information seekers compete with the informed party for shares at time 2. This reduces the informed party's information rents. Second, if the competition is sufficiently intense in the sense that there are a large number of information seekers, then the informed party's strategy will switch and the informed party will sell shares to the information seekers at time 2. This was the first equilibrium derived above. This makes the informed party better off as the informed party no longer incurs the cost of holding shares until time 3. In general, we think of N as being sufficiently large that the first equilibrium represents the usual case.

3.2 Equilibrium with a manipulator

Next we consider what happens when there is also potentially a manipulator present, in addition to the information seekers. For simplicity, we assume that the manipulator only enters if the informed does not enter, conditional on manipulation being profitable. In this case, the manipulator is present with probability γ. The information seekers continue to condition their demand at time 2 on what they observe at time 1. We discuss two possible equilibria: pooling and separating.

Pooling Equilibrium

We begin by conjecturing that the manipulator and the informed party pool in their strategies. That is, we conjecture that they buy the same quantity of shares at time 1 and sell these shares at time 2. This conjectured equilibrium is similar to equilibrium 1 from the previous subsection.[8] If the manipulator and the informed party choose to purchase the same number of shares at time 1, then the information seekers' posterior beliefs that the purchaser of the shares is the manipulator are:

$$\beta = \frac{\gamma}{\gamma + \delta}. \tag{18}$$

Each information seeker i solves the following problem at time 2, conditional on observing a purchase at time 1:

$$\max_{q_2^{A_i}} \begin{array}{l} (1-\beta)\left[V_H q_2^{A_i} - (a + b(\sum_{i\in N} q_2^{A_i}))q_2^{A_i}\right] + \\ \beta\left[V_L q_2^{A_i} - (a + b(\sum_{i\in N} q_2^{A_i}))q_2^{A_i}\right]. \end{array} \tag{19}$$

Taking the N first order conditions, imposing symmetry, and solving yields:

$$q_2^{A_i *} = \frac{(1-\beta)\,V_H + \beta V_L - a}{(N+1)b}. \tag{20}$$

The aggregate demand is:

$$q_2^{A*} = \frac{N}{N+1}\frac{(1-\beta)\,V_H + \beta V_L - a}{b}. \tag{21}$$

The time 2 price is:

$$p_2^* = a + \frac{N}{N+1}\left((1-\beta)\,V_H + \beta V_L - a\right). \tag{22}$$

Each information seeker makes expected profits of:

$$\pi^{A_i *} = \frac{\left((1-\beta)\,V_H + \beta V_L - a\right)^2}{(N+1)^2\,b}. \tag{23}$$

[8] The alternative interpretation of these results is that both the manipulator and the informed party hold shares at time 0, release information at time 1 with probabilities γ and δ respectively, and then sell at time 2. The manipulator's information release is false and the informed party's information release is true.

Under the conjectured pooling equilibrium, if either enters, the informed party and the manipulator both purchase shares at time 1 and sell shares at time 2. Both the informed party and the manipulator choose the number of shares to purchase at time 1 by solving the following problem:

$$\max_{q_1} \quad p_2^* q_1 - (a + bq_1)q_1. \tag{24}$$

The time 1 quantity demanded by the informed party and the manipulator is:

$$q_1^{M*} = q_1^{I*} = \frac{N}{N+1} \frac{(1-\beta) V_H + \beta V_L - a}{2b}, \tag{25}$$

and the price is:

$$p_1^* = a + \frac{N}{N+1} \frac{(1-\beta) V_H + \beta V_L - a}{2}. \tag{26}$$

Both the informed party's and the manipulator's expected profits are:

$$\begin{aligned} \pi^{M*} &= \pi^{I*} = \frac{N^2}{(N+1)^2} \frac{((1-\beta) V_H + \beta V_L - a)^2}{4b} \\ &= \frac{N^2}{(N+1)^2} \frac{((V_H - a) - \beta(V_H - V_L))^2}{4b}. \end{aligned} \tag{27}$$

In order for this pooling equilibrium to be sustainable, it must be incentive compatible for the informed party not to deviate and thus separate from the manipulator. Purchasing a different quantity of shares at time 1 but still selling them at time 2 will not be sufficient to break the pooling equilibrium because it is costless for the manipulator to mimic this strategy. Moreover, as the information seekers only observe the quantity and price from time 1, there is no credible way for the informed to commit to holding shares until time 3.[9] Thus, in order for the pooling equilibrium to be sustainable, the incentive compatibility condition reduces to checking that the informed party will want to sell shares at time 2 rather than hold them until time 3. The value to holding shares until time 3 for the informed party is $V_H - k$, so the incentive compatibility condition is:

$$p_2^* = a + \frac{N}{N+1} \left((1-\beta) V_H + \beta V_L - a\right) \geq V_H - k. \tag{28}$$

Rearranging this condition yields the following:

$$N(k - \beta (V_H - V_L)) \geq V_H - a - k. \tag{29}$$

[9]In the case of the release of information, the ability of the manipulator to appear as credible as the informed party is crucial, otherwise the pooling equilibrium cannot be sustained. This also suggests that in many cases, the manipulator cannot credibly release false information and rumor-based manipulation will fail.

Substituting for a and β from equations (3) and (18), we get the following:

$$k \geq \frac{1}{N+1}\left((1-\delta)+N\frac{\gamma}{\gamma+\delta}\right)(V_H - V_L)\,. \tag{30}$$

In order to sustain a pooling equilibrium in which both the manipulator and the informed party buy $q_1^{M*} = q_1^{I*}$ shares at time 1 and sell them at time 2, this incentive compatibility condition must be met.

Examining the incentive compatibility condition yields the following comparative statics. First, the greater the cost k of holding shares until time 3, the easier it is to sustain the pooling equilibrium and the more likely it is the informed party will pool with the manipulator. Second, it is straightforward to see that the right hand side of the condition is increasing in γ, implying that the greater the probability that the purchaser of shares at time 1 is a manipulator, the less likely it is the informed party will pool with the manipulator. The intuition here is that the greater the probability that the purchaser is a manipulator, the more severe the adverse selection problem for the information seekers, causing them to reduce the number of shares they purchase at time 2. As a result, the price the seller receives at time 2 is lower, making it less likely that the informed will pool with the manipulator. Similarly, the right hand side of the condition is decreasing in δ, the probability that the purchaser of shares is the informed party. The more likely that the purchaser is informed, the easier it is to sustain pooling.

Third, note that the right hand side of the condition is increasing in $V_H - V_L$. The greater the dispersion between the high value and the low value of the firm, the less likely it is that the informed party will pool with the manipulator. The greater the dispersion, the more valuable it is for the informed party to wait until time 3 and get the high value for the firm.

Fourth, an increase in the number of information seekers N increases the likelihood of pooling. To see this, note that the right hand side is decreasing in the number of information seekers. More information seekers improves the price that the purchaser of shares gets at time 2. Thus, increasing the number of information seekers makes it more likely that the incentive compatibility condition is met and the equilibrium is the pooling equilibrium. Yet the effect of this is that increasing the number of information seekers reduces market efficiency by reducing the revelation of information.

Because of this effect, there is a substantial and important role for government regulation. In the absence of a manipulator, the usual effect of increasing the number of information seekers is to enhance market efficiency by pushing the time 2 price towards its true value. In the presence of a manipulator, this is no longer necessarily true. Our second comparative static result above shows that decreasing the probability γ of a manipulator being present (or, more precisely, decreasing the conditional probability β of a manipulator being present) increases the likelihood of successful manipulation. However, our expression for the time 2 price,

$$p_2^* = a + \frac{N}{N+1}\left(\left(1-\beta\right)V_H + \beta V_L - a\right), \tag{31}$$

shows that decreasing the conditional probability of a manipulator being present also increases the efficiency of the time 2 price. Thus, to the extent that government regulation and enforcement decreases the probability of a manipulator being in the market, this leads to greater market efficiency even though it makes manipulation more likely to be successful when manipulation occurs.

Separating equilibrium

We also note the possibility that a separating equilibrium may exist as well. In the separating equilibrium, the informed party purchases shares in both periods. The manipulator will choose not to enter the market. In order to see why and under what conditions such an equilibrium can exist, we use the analysis of Equilibrium 2 from the previous section and the Appendix. Recall that in that equilibrium, the informed party purchases shares at time 1 and then purchases additional shares at time 2. The information seekers, observing the prices and quantities purchased at time 1, infer that the informed party is buying shares and also purchase shares at time 2.

Now suppose that the manipulator may also purchase shares at time 1. Clearly, the manipulator will want to sell these shares at time 2, since the manipulator knows the value of the shares at time 3 is V_L. The manipulator must purchase the same quantity of shares at time 1 as the informed party, $q_1^M = q_1^I = q_1$, because otherwise the information seekers will infer that the purchaser is the manipulator and they will buy no shares at time 2. This quantity from the Appendix is:

$$q_1 = \frac{V_H - k - a}{2b} - \frac{V_H - k - a - 2kN}{2b\left(3 + N^2 + 4N\right)}. \tag{32}$$

The price at which these shares are bought is:

$$p_1^* = \frac{V_H - k + a}{2} - \frac{V_H - k - a - 2kN}{2\left(3 + N^2 + 4N\right)}. \tag{33}$$

What do the information seekers infer from observing a purchase of shares q_1 at time 1? We claim that the information seekers' beliefs are that the purchaser of the shares at time 1 is the informed party with probability 1. To see this, take the information seekers' beliefs as correct. In this case, from the Appendix, the N information seekers each demand

$$q_2^{A_i*} = \frac{\left(N+2\right)\left(V_H - a + k\right) + 2k\left(N+1\right)}{2b\left(3 + N^2 + 4N\right)} \tag{34}$$

shares at time 2. As the manipulator is not holding his shares or buying additional shares, but instead selling his q_1 shares, the price at time 2 is determined by the information seekers' demands:

$$\begin{aligned} p_2 &= a + b(\sum_{i \in N} q_2^{A_i *}) && (35) \\ &= \frac{6a + aN^2 + 6aN + 2NV_H + 4kN + N^2 V_H + 3kN^2}{2\left(3 + N^2 + 4N\right)}. && (36) \end{aligned}$$

For k or N small enough, p_2 will be less than p_1, implying that the manipulator loses money on every share bought. To see this, note that:

$$p_1 - p_2 = \frac{V_H - k - a - 2kN}{N + 3}. \tag{37}$$

As a result, the manipulator will not enter the market for k or N small enough, and the beliefs we ascribed to the information seekers are, in fact, correct.

In this section, we have focused on two equilibria–a pooling equilibrium and a separating equilibrium. There are potentially many other equilibria as well that we have not studied. In particular, we have associated the separating equilibrium with low values of two parameters: the number of information seekers N and the cost of holding shares for the informed party k. We have associated the pooling equilibrium with high values of these two parameters. In between high and low values for these parameters exists a range of values for which other equilibria are possible.

We focus on the pooling and separating equilibria because they exhibit the basic forces we wish to study. In the separating equilibrium, manipulation is not possible. This is governed by two factors. First, in order for manipulation to be sustainable, it must be the case that the informed party wishes to sell her shares before the fundamental value is realized. If she is sufficiently patient, then a manipulator will not be able to mimic her strategy. Second, if there are a small number of information seekers, then the best the informed party can do is to hold shares until the fundamental value is realized. In this sense, the information seekers provide a benefit to the informed party. If there are enough information seekers, they will push the time 2 price up to a level at which the informed party is willing to sell rather than incur the cost of waiting until time 3. Up until this point, the information seekers provide the usual service of arbitrage–they incorporate information into the market price and improve the efficiency of market prices.

In the pooling equilibrium, manipulation occurs. The manipulator is able to mimic the strategy of the informed party. In such an equilibrium, the time 2 price cannot converge to the high fundamental value of the stock because the information seekers do not know if the purchaser of shares or releaser of information at time 1 is informed or a manipulator. As we expect, the possibility of manipulation worsens market efficiency. Interestingly, increasing the number of information seekers increases the likelihood that there is manipulation. The intuition for this result is that increasing the number of information seekers makes the informed party more willing to sell shares at time 2 rather than holding them until time 3. Having the informed party sell shares at time 2 is a key condition for allowing the manipulator to enter the market.

3.3 An example

Recall that the manipulator's profits conditional on entering in the pooling equilibrium are:

$$\begin{aligned}\pi^{M*} &= \frac{N^2}{(N+1)^2}\frac{((V_H-a)-\beta(V_H-V_L))^2}{4b} \\ &= \frac{N^2}{4b(N+1)^2}\left[\frac{\delta(1-\gamma-\delta)(V_H-V_L)}{(\gamma+\delta)}\right]^2. \end{aligned} \tag{38}$$

The manipulator's unconditional profits are therefore:

$$\gamma\pi^{M*} = \frac{\gamma N^2}{4b(N+1)^2}\left[\frac{\delta(1-\gamma-\delta)(V_H-V_L)}{(\gamma+\delta)}\right]^2. \tag{39}$$

The optimal level of manipulation is found by maximizing the unconditional profits with respect to the probability of manipulation γ.[10] This level of manipulation is:

$$\gamma^* = -\delta - \frac{1}{2} + \frac{1}{2}\sqrt{(8\delta+1)}. \tag{40}$$

In this case, the optimal level of manipulation depends only on the likelihood that the informed party enters.[11] Substituting this into the incentive compatibility condition yields:

$$k \geq \frac{1}{N+1}\left(1-\delta+\frac{3}{4}N-\frac{1}{4}N\sqrt{8\delta+1}\right)(V_H-V_L).$$

To get a sense of the magnitudes involved, we set the following parameter values:

$$V_L = 0, V_H = 100, \delta = 0.7, N = 100, b = 1.$$

Given these parameter values, the optimal probability of manipulation is $\gamma^* = 0.0845$ and the cost of waiting for the informed party is $k \geq 10.964$. Interpreting this as a percent of the dispersion in the true value of the stock, we get:

$$\frac{k}{V_H-V_L} \geq 10.964\%.$$

[10] The second order condition is also satisfied.

[11] Note that this analysis takes the existence of the pooling equilibrium as given.

In order for the informed party to be willing to pool with the manipulator, this suggests that the informed party must have a relatively high discount rate of waiting.

Using these values, we can trace out the evolution of manipulation for the pooling equilibrium. The time 0 price is $a = p_0 = 70$. The conditional probability of a manipulator being in the market is $\beta = 0.1077$. The time 1 price is $p_1^* = 79.520$ and the time 1 quantity purchased by the manipulator (and the informed) is $q_1^{I*} = q_1^{M*} = 9.5198$. The time 2 price is $p_2^* = 89.040$ and the time 2 quantity purchased in the aggregate by the information seekers is $q_2^{A*} = 19.040$. The profits for both the manipulator and the informed party are $\pi^{M*} = \pi^{I*} = 90.627$.

While we have not modeled the possibility of enforcement actions, their impact is straightforward. By reducing the manipulator's profits (but not the informed party's profits), enforcement reduces the likelihood of manipulation while at the same time increasing market efficiency. A lower probability of manipulation results in information seekers pushing prices towards their full information values. As a result, the higher the likelihood of manipulation, the greater the need for government regulation and enforcement.

3.4 Empirical Implications

We now consider some empirical implications of our model. While the model generates many testable implications, we focus here on those implications that we actually are able to test given our data. As a result, there are many implications left which represent potentially fruitful avenues for future research. First, we consider the time path of prices. In the pooling equilibrium:

$$
\begin{aligned}
p_0 &< p_1^* < p_2^* \text{ , and} \\
p_0 &> p_3.
\end{aligned}
$$

These predictions are intuitive. The manipulator's demand for shares at time 1 raises the price relative to time 0. At time 2, when the manipulator sells, the information seekers are in the market, and their demand exceeds the manipulator's supply, which is how the manipulator is able to profit. At time 3, the value of the shares is revealed and the price falls to its true value. We consider this last prediction to be a weak prediction and we discuss it further in the empirical tests below.

Next we consider the impact of the information seekers on volume. In the pooling equilibrium:

$$
q_1^* < q_2^{A*},\ \frac{\partial q_1^*}{\partial N} > 0,\ \frac{\partial q_2^{A*}}{\partial N} > 0,\ \text{and}\ \frac{\partial \left(q_2^{A*} - q_1^*\right)}{\partial N} > 0.
$$

These predictions are also intuitive. Volume is greater when the manipulator sells (in the second period) than when the manipulator buys (in the first period). Volume in both periods is increasing in the number of information seekers. Obviously, the more information seekers there are in the second period, the more they will buy. If the manipulator knows that he can sell more shares in the second period because there are more information seekers, then he will buy more shares in the first period. However, the manipulator does not buy one-for-one. Trying to sell too many shares in the second period will drive the information seekers from the market. As a result, the volume differential between the second period and the first period will be increasing in the number of information seekers.

Last, we consider the impact of information seekers and value dispersion on prices. In the pooling equilibrium:

$$
\begin{aligned}
\frac{\partial\left(p_2^* - p_1^*\right)}{\partial N} &> 0, \frac{\partial\left(p_2^* - p_0\right)}{\partial N} > 0, \\
\frac{\partial\left(p_2^* - p_1^*\right)}{\partial (V_H - V_L)} &> 0, \frac{\partial\left(p_2^* - p_0\right)}{\partial (V_H - V_L)} > 0.
\end{aligned}
$$

The first set of predictions is that price differentials (or returns) are increasing in the number of information seekers. These predictions are central to our story – more information seekers increase the manipulator's return. The second set of predictions has to do with the impact of dispersion in the true value of the stock on returns. The greater is this dispersion, the greater the returns to the manipulator. Intuitively, if there is little disagreement or uncertainty about the true value of the stock, then there is little room in which the manipulator can operate by posing as an informed party.

These are the empirical implications that we test after we describe the data we use. There are a number of other implications that are potentially testable that we do not test due to data limitations. For example, there are a number of implications for returns and volume associated with the unconditional probability of manipulation γ or the conditional probability of manipulation β. Our data are for actual manipulations so we do not test these. We also have implications for the profitability of manipulation. Data on profitability are less systematically available, so we do not test these. There are also implications for the viability of pooling versus separating that we mentioned in the context of the incentive compatibility constraint. Because we do not observe instances in which manipulation did not occur, we cannot test these implications cross-sectionally.

4 Empirical Evidence from Manipulation Cases

4.1 Anatomy of Stock Manipulation Cases

Before our empirical analysis we provide summaries of two manipulation cases according to Securities and Exchange Commission complaints filed with U.S. district courts. It is important to note that these cases are not purely trade-based manipulation cases, but also involve the use of rumors, wash sales, and attempts to corner the market. Even though actual cases of stock manipulation involve multiple ways to manipulate stock, it is worth noting that our model will still apply in that the welfare, regulatory, and policy implications of these alternative forms of manipulation will be the same as those studied in our manipulation model.

4.1.1 WAMEX Holding Inc.

WAMEX Holdings, Inc. (WAMX) is a New York-based company with its common stock traded on the OTC Bulletin Board.[12] The company apparently had plans to operate an electronic trading system for stocks. From December 1999 through June 2000, Mitchell H. Cushing (WAMX's CEO), Russell A. Chimenti, Jr. (Chief Administrative Officer), Edward A. Durante (a stock promoter), and several others engaged in a market-manipulation scheme which drove WAMX's stock price from \$1.375 per share to a high of \$22.00 per share.

As part of the scheme, millions of WAMEX shares were transferred to Durante-controlled nominee accounts at Union Securities, Ltd., a Canadian brokerage firm. Durante then instructed his broker for these accounts to execute a series of public trades to create artificial price increases in WAMEX stock.

In addition, the manipulators made false public statements through press releases, SEC filings, and Internet publications concerning, among other things: approximately \$6.9 million in funding that WAMEX had supposedly raised from a private investment group; WAMEX's ability to legally operate an electronic stock trading system; and the purportedly extensive experience of Cushing and Chimenti in the investment banking industry. The SEC reports that WAMEX had only received a fraction of the financing it had reported, all of which came from fraudulent stock sales. WAMEX had never obtained regulatory approval to operate its electronic stock trading system. Cushing's and Chimenti's investment banking experience consisted of their employment at several

[12] The information for this case comes from Securities and Exchange Commission (2001b, 2002).

boiler rooms in the United States and Austria. Cushing neglected to disclose that he faced arrest in Austria as a result of his fraudulent securities activities there.

Durante also entered into a series of block deals. The block deals involved pre-arranged public market purchases of large blocks of WAMEX stock which were sold at a discount. The block deals apparently misled investors into believing that there was a highly liquid market for WAMEX shares and led to artificially inflated prices. The SEC alleges that as a result of this scheme, Durante and the others were able to sell 6.9 million WAMEX shares into the market for profits of over $24 million.

This particular example illustrates several features common to many cases of stock price manipulation: first, the use of nominee accounts to create artificial volume in a stock; second, the release of false information and rumors; third, the purchase of large blocks of stock to create the impression of information-based trade.

4.1.2 Paravant Computer Systems, Inc.

In June 1996, Duke & Company, a broker-dealer, served as the underwriter for the initial public offering of common stock of Paravant Computer Systems, Inc. in the Nasdaq market.[13] In the IPO, Paravant's common stock was offered to the public at $5.00 per share. On June 3, 1996, the IPO was declared effective and trading commenced in Paravant securities. During the first day of trading, the price of Paravant's common stock increased to $9.875 per share.

This increase occurred because Duke, which served as a market maker for Paravant securities, and Victor M. Wang (CEO of Duke) and his associates (Gregg A. Thaler, Charles T. Bennett, and Jeffrey S. Honigman), artificially restricted the supply of Paravant common stock and created significant demand for the common stock. Wang and Thaler allocated a large percentage of the common stock issued in the Paravant IPO to affiliated customer accounts on the condition that these customers immediately flip this common stock back to Duke after the commencement of trading following the IPO. This arrangement ensured that Duke had a large supply of Paravant common stock in its inventory. Prior to the IPO, Bennett and Honigman, as well as other Duke representatives, pre-solicited customers to purchase Paravant common stock once aftermarket trading in Paravant securities commenced to ensure demand for the common stock. Thus, as a result of the artificially small supply of common stock and the artificially created demand, once aftermarket

[13] The information for this case comes from Securities and Exchange Commission (1999) and Morgenson (1999).

trading commenced, the price of Paravant common stock increased.

On June 4, 1996, after the price of Paravant common stock had increased to prices ranging from \$10.75 to \$13.375 per share, Duke resold the common stock that it had purchased from the affiliated customer accounts, as well as stock Duke did not own (thus taking a large short position in the stock), to the retail customers Duke had pre-solicited to purchase common stock. As a result of its manipulative activities in connection with Paravant common stock, Duke generated over \$10,000,000 in illegal profits. The manipulation ceased on June 21, 1996.

In this example, the manipulation is quite straightforward. A market maker and underwriter simply uses its privileged position to restrict supply while using its brokerage to generate demand from retail investors. The market maker is able to sell shares from inventory, thereby profiting at the expense of both the issuer and the retail investors.

4.2 Data Description

To provide more systematic evidence on stock market manipulation, we collect data on stock market manipulation cases pursued by the U.S. Securities and Exchange Commission from January 1990 to October 2001. Specifically, we collect all SEC litigation releases that contain the key word "manipulation" and "9(a)" or "10(b)" which refer to the two articles of the Securities and Exchange Act of 1934. We then manually construct a database of all these manipulation cases. Additional information about the cases are collected from other legal databases such as Lexis-Nexis and the Securities and Exchange Commission Annual Reports. There are 142 cases in total. Table 1 reports data on the distribution of cases by year and by the markets in which the manipulated stocks were traded. There was an increase in manipulation cases in 2000 and 2001, either due to an increase in manipulation activities or intensified enforcement action by the SEC.

For manipulated stocks, we collect daily stock prices, trading volume, and capitalization from January 1989 to December 2001 from the online service Factset. Since about half of the manipulated stocks were traded in over-the-counter markets such as NASD's OTC Bulletin Board and the Pink Sheets, we collect daily price, volume, and capitalization data for all stocks traded on the OTC Bulletin Board from January 1989 to December 2001. We are able to collect some data for 78 stocks, and our empirical tests are designed to use as much of the data as possible. Of the 78 stocks, we have complete data for 51 stocks to conduct our empirical analysis.

Table 2 reports summary statistics for the manipulated stocks. Sample mean, standard deviation, skewness and kurtosis coefficients for daily returns and turnover are computed. The results for the manipulation period, the 1-year pre- and post- manipulation periods are reported in Panels A to C, respectively. Our estimate of volatility is the standard deviation of daily stock returns for the three periods, and the statistics reported are cross-sectional. The mean return during the manipulation period is higher than the mean returns during the pre- and post- manipulation periods. Similarly, the manipulation period returns display the highest standard deviation, positive skewness and kurtosis. Turnover during the manipulation period is on average higher than that in the pre-manipulation period. During the post-manipulation period, average turnover is still very high. Average volatility during the manipulation period is higher than that during the pre-manipulation period which in turn is higher than that during the post-manipulation period. Finally, we report in Panel D statistics on the length of the manipulation period. The median length of manipulation is 202 days. The maximum is 1373 days and the minimum is 2 days.

4.2.1 Implications for Manipulators

Our theoretical analysis above shows that a key to successful manipulation is the pooling of the manipulator with the informed party. Hence, the manipulator needs to be able to credibly pose as a potentially informed party. There are many ways to do this. For example, one way to credibly pose as an informed party is to be an insider. Others such as brokers, underwriters, market makers, or large shareholders can also credibly pose as potentially informed investors. Table 3 shows results on the distribution of several types of "potentially informed" parties who were involved in manipulation cases. Corporate insiders such as executives and directors are involved in 47.89% of the manipulation cases. Brokers are involved in 64.08% of the cases. Large shareholders with at least 5% equity ownership are involved in 31.69% of the cases. Market makers and stock underwriters are involved in more than 20% of the manipulation cases. The sum of the percentages across types exceeds 100% because more than one "potentially informed" type can be involved in any given case. Indeed, most manipulation schemes are undertaken jointly by several parties. This evidence suggests that manipulators are close to the information loop and can thus credibly pose as being informed about the future value of stocks.

Furthermore, it is likely that information seekers actively look for information during important corporate events such as the issuance of stocks or bonds. Thus, the number of information seekers may be higher around these events. Hence we expect that manipulations are more likely during these events. We find that about 15% of the manipulation cases are related to initial public offerings or secondary offerings.

4.2.2 Implications for Manipulation Schemes

Our model of manipulation occurs in a setting where the manipulator inflates the stock price in the absence of good news. Our analysis of manipulation cases shows that inflating the stock price is indeed the most common type of manipulation. Figure 1 displays the breakdown of manipulation types. 84.51% of manipulation cases involve the inflation of stock prices while less than 1% of cases involve the deflation of stock prices. Stabilization accounts for 2%. For about 13% of cases we do not have enough information to classify the type of manipulation.

Figure 2 shows the distribution of ways to profit in manipulation cases. Since not all activities of the manipulators are reported and identified in the cases, the reported percentages are a lower bound for the true percentages. Manipulators often try to create an artificially high price through wash trades and the use of nominee accounts (40.14% of our cases involve such trades). They trade among accounts owned by essentially the same individual or group. We argue that the increased trading volume and price often attract the attention of investors or information seekers. Indeed, for our entire sample of manipulated stocks, the mean daily average turnover during manipulation periods is about 20% higher than that for non-manipulation periods. In these cases, it is plausible that investors believe there is good news about the stock, without realizing that much of the trading activity does not involve any real change in ownership.

Since information seekers constantly search for investment opportunities, manipulators often resort to propagating false information to encourage information seekers to purchase shares. For our entire sample, 55.63% of all cases involve the spread of rumors. Historically, manipulators have colluded with newspaper columnists and stock promoters to spread false information. With the advent of the Internet, chat rooms and message bulletin boards have become popular means to distribute false information. From January 2000 to October 2001, about 39% of all manipulation cases involved the use of the Internet to spread rumors. Figure 2 also shows that in 54.93% of the cases, manipulators buy and then sell stock in the market to realize a profit (as opposed to situations in which they already own the stock). Finally, about 13% of the manipulators tried to corner the supply of stock in order to inflate prices.

4.2.3 Implications for Market Efficiency

As shown above in the model, when there are more information seekers in the market and in the absence of manipulators, information is quickly reflected in the stock price and the market is more efficient. Yet the presence of more information seekers also makes it possible for manipulators to pool with the informed party and profit from trading with the information seekers. Certainly, the more information seekers trade with manipulators, the more they lose. Hence in a market with many manipulators, information seekers cannot survive if they trade frequently. Therefore market manipulation can drive away information seekers and make the market inefficient. In the extreme, there will be no information seekers and the market is informationally inefficient. With manipulators present in the market, our model predicts that the price at time 2 does not converge to the true value of the stock to be revealed at time 3. Therefore a higher probability of manipulation decreases market efficiency.

Our results in Table 1 show that most manipulation cases occur in markets we think of as being relatively inefficient. For example, 47.89% of all manipulation cases happen in the over-the-counter markets such as the OTC Bulletin Board and the Pink Sheets. Whereas 33.81% of the cases happen in either regional exchanges or unidentified markets, about 17% of the cases occur on the NYSE, AMEX, or Nasdaq National Market combined. Overall, the OTC Bulletin Board, the Pink Sheets, and the regional exchanges are relatively inefficient in the sense that they are small and illiquid. For example, currently the OTC Bulletin Board provides access to more than 3,800 securities and includes more than 330 participating market makers. Yet the daily average volume is still \$100 million to \$200 million.[14] Our results show that about over 50% of the stocks manipulated are "penny stocks" with very low average trading volume and market capitalization.

The markets in which manipulation is more likely to occur also have the feature that there are much lower disclosure requirements for their listed firms, and the firms are subject to much less stringent securities regulations and rules. For example, OTC Bulletin Board stocks were not required to file annual reports with regulators before June 2000. The new disclosure requirements

[14] As of November, 2001, the largest company on the OTCBB was Publix Super Markets with a \$9 billion market capitalization and \$15 billion in revenues. Heroes, Inc., was the smallest, with a \$302,000 market capitalization and revenues of \$6.5 million. Some 2,000 OTCBB companies have an average market cap of \$1 million or less. Some 42% of all trades are made in the top 100 OTCBB securities. The top 500 stocks account for 74% of the total trading volume, and the top 1,000 stocks account for 88% of the total.

seem to have driven many OTC Bulletin Board stocks to the Pink Sheets, which require virtually no disclosure at all.[15] These are precisely the markets where asymmetric information problems are likely to be the most severe. Thus we argue that the lack of disclosure requirements and regulatory oversight allow manipulators to operate with ease. In particular, it will be easier for manipulators to pool with informed parties. Hence, these markets are likely to be informationally inefficient.

In contrast to the more inefficient markets, the New York Stock Exchange is relatively free from manipulation. Only 2.11% of manipulation cases occur on the NYSE, yet its total market capitalization is much larger than the sum of the market capitalizations of the OTC Bulletin Board, the Pink Sheets, the regional exchanges, and the Nasdaq small cap market.

It is interesting to note that not all small and relatively illiquid markets are rife with manipulation. From Table 1 we see that the Nasdaq SmallCap Market had only two manipulation cases during our sample. This market has to follow similar disclosure and trading rules as those followed by the Nasdaq National Market. This highlights the importance of regulations and oversight for stock markets, even for small and relatively illiquid ones.

4.3 The Liquidity, Return and Volatility of Manipulated Stocks

We observed above that many manipulated stocks trade in relatively illiquid over-the-counter market. Does illiquidity in a stock imply a higher likelihood of it being manipulated? This is plausible since one key element to a successful manipulation is to move the price effectively. It is hard to imagine that any manipulator would be able to move a large capitalization and highly liquid stock such as GE by any significant amount without incurring huge cost and taking on enormous risk. To study this issue, we compute the average daily turnover over the manipulation, pre- and post-

[15] The SEC and the NASD are in the process of turning the OTC Bulletin Board into a more regulated market place. As part of the transformation, qualifying small issuers will need to meet defined listing standards and pay listing fees. Minimal governance standards will require that companies must have at least 100 shareholders who own at least 100 shares each, and that there be 200,000 shares in the public float. Also, the auditor must be subject to peer review, the company will need to issue an annual report, there will have to be an annual shareholder meeting with proxies and a quorum of at least 1/3rd of the shareholders present in person or by proxy. Listed companies will need at least one independent director and there must be an independent audit committee with a majority of independent directors. Certain transactions will require shareholder approval, and rules will be in effect to prohibit voting restrictions. Our model predicts that with regulators playing an active role in this market, the OTC Bulletin Board will be subject to the action of fewer manipulators; trading volume will increase, and the market will become more efficient.

manipulation periods. The pre- and post- manipulation periods are the 1-year periods before and after the manipulation period.

For each manipulated stock we also compute the average daily turnover for a benchmark. We then cross-sectionally regress the average daily turnover on a constant and a dummy for manipulation. The dummy variable equals 1 for the manipulated stock and equals 0 for the benchmark. The sample period is from January 1990 to December 2001:

$$turnover = \alpha_0 + \alpha_1 * I\{manipulated\} + e. \tag{41}$$

There are a total 51 manipulated stocks for which we can find trading data. With the matched sample from the benchmark, we have a total of 102 observations in the regressions.

For the benchmark, we match the manipulated stock to an equally weighted portfolio of 10 randomly selected stocks. These stocks must have market capitalizations within 10% of that of the manipulated stock, and they are chosen from all stocks available in the specific market on which the manipulated stock trades. For example, for a manipulated OTC Bulletin Board stock, we would randomly choose 10 stocks with similar capitalizations from all available OTC Bulletin Board stocks. We then compute the average daily turnover for the portfolio as the benchmark to be used in the regression. Panel A of Table 4 reports the regression results. For the pre-manipulation period, manipulation period and the post-manipulation period, average daily turnover is between 3-4% for the benchmark. For the pre-manipulation period, the coefficient on the dummy variable is negative and significant, implying that manipulated stocks are less liquid prior to the manipulation than their benchmarks. In the manipulation period and the post-manipulation period, liquidity is higher for the manipulated stocks than the benchmarks.

How did the manipulated stocks perform relative to other stocks during manipulation periods? Since most manipulations involve inflating stock prices as shown in Figure 1, we expect prices to go up on average in a manipulation. However, for some cases manipulators drove up the price which subsequently dropped below the pre-manipulation level before the end of manipulative activities. We show below that the overall effect is still positive during manipulation periods. We also examine if manipulators prefer stocks that have underperformed or outperformed market benchmarks. Finally we study the return performance of manipulated stocks after manipulative activities have stopped to see if they systematically underperform.

To study these issues, we compute the average daily returns over the manipulation periods as well as over the pre- and post- manipulation periods. As before, we compute the average daily returns for the corresponding period for a benchmark. We construct the benchmark as we did in the previous subsection, except now we compute average daily returns instead of average daily turnovers. We then cross-sectionally regress the average daily return on a constant and a dummy for manipulation. The dummy variable equals 1 for the manipulated stock and equals 0 for the benchmark. The sample period is from January 1990 to December 2001:

$$return = \alpha_0 + \alpha_1 * I\{manipulated\} + e. \tag{42}$$

Panel B of Table 4 reports the regression results. For the benchmark, average daily returns are not significantly different from zero for the pre-manipulation period, the manipulation period and the post-manipulation period. For the manipulated stocks, average daily returns are not different from the benchmarks during the pre-manipulation period. During the manipulation period, however, average daily returns are 2.56% higher than for the benchmark and this difference is statistically significant. During the post-manipulation period, average daily returns are lower for manipulated stock than the benchmarks at 0.13% and statistically significant. We therefore conclude that manipulated stocks on average experience an increase in the stock price during the manipulation period, and the price subsequently drops down during the post-manipulation period. There is no evidence that manipulators prefer either underperforming or outperforming stocks.

We next examine the volatility of manipulated stocks and the results are reported in Panel C of Table 4. The analysis is similar to that on returns above, except now we use standard deviation as the dependent variable in the regression:

$$volatility = \alpha_0 + \alpha_1 * I\{manipulated\} + e. \tag{43}$$

In computing the benchmark volatility, we average the standard deviation for the 10 stocks in the portfolio. For the pre- and post- manipulation periods, volatility is higher for manipulated stocks, but the coefficients are not statistically significant. The volatility for manipulated stocks is much higher than that for the benchmark during the manipulation period. This reflects the fact that manipulated stocks often experience dramatic price movements during the manipulation period.

5 Empirical Tests of the Model

In this section we test the empirical implications of our model. There are four periods including time zero in the theoretical model. From our case information we know the beginning and end dates of manipulations. Note that this reported manipulation period corresponds to the sum of time 1, when the manipulator buys, and time 2, when the manipulator sells. Since we do not know exactly when time 1 ends and time 2 begins, we simply break the reported manipulation period into two equal sub-periods, with the first half representing time 1 and the second half representing time 2. We use the one-year period before manipulation as time 0 and the one-year period after manipulation as time 3.

We first test that the price in time 1 is higher than time 0 ($p_0 < p_1^*$) and the price in time 2 is higher than the price at time 1 ($p_1^* < p_2^*$). We estimate the average cumulative return between time 0 and and time 1 (221%), and between time 1 and time 2 (174%), respectively. The test statistics are reported in Table 5. The manipulator's demand for shares at time 1 raises the price relative to time 0. At time 2, when the manipulator sells, the information seekers are in the market, and their demand exceeds the manipulator's supply, which is how the manipulator is able to profit. We also test that price declines after the manipulation. Contrary to our model, the price p_3 is greater than p_0. However, we consider this to be a weak test of the model for two reasons. First, the manipulation period differs quite dramatically across our manipulation cases. Second, p_3 is meant to capture the long run in our model, and the one-year post-manipulation period may not be sufficient. Further, our test shows that p_2^* is greater than p_3 (-27%). This is consistent with our model. The price of the shares falls after the manipulation ends.

The above result is shown graphically by plotting the path of manipulated stock prices. Since for different manipulated stocks the lengths of the periods can be very different, we need to standardize the manipulation periods. We scale the lengths of the manipulation periods such that they are presented over a grid showing different stages of the manipulation. For example, 0 represents the beginning of the manipulation period, 0.5 represents the middle and 1 represents the end of the manipulation. Cumulative returns are computed for each manipulated stock from the beginning to the end of the manipulation. Figure 3 shows the average cumulative returns and average turnover for the 51 manipulated stocks for which data are available. The top panel shows the average cumulative return and the bottom panel the average daily turnover over the manipulation period. The cumulative return increases dramatically during the manipulation period with relatively high volatility. At the end of the manipulation period, it declines as discussed above. In the bottom panel of Figure 3, average daily turnover increases throughout the manipulation period, but is quite noisy. While average turnover is higher in the second half (0.1288) than in the first half (0.0667), the difference is not statistically significant.

We next test the hypothesis that price changes in both the first and the second period are higher when there are more information seekers:

$$\frac{\partial\left(p_2^* - p_1^*\right)}{\partial N} > 0, \frac{\partial\left(p_2^* - p_0\right)}{\partial N} > 0.$$

Our model predicts that the amount of trading is increasing in the number of information seekers. We use the overall level of trading activities for a manipulated stock as a measure of the level of presence of information seekers. We classify manipulated stocks into two groups, one with high average turnover in the second period and one with low average turnover during that period. The two groups of stocks are formed based on whether the average turnover for the stock is higher or lower than the median average turnover. We then test if the cumulative return between time 2 and time 1 is significantly higher for the higher turnover group than for the low turnover group. Similarly we also test if the cumulative return between time 2 and time 0 is significantly higher for the higher turnover group than for the low turnover group. From Table 6, the t-statistic for the first test equals 1.2545, which is not statistically significant. The second test statistic equals 2.7544, which is statistically significant at the 1% level. Hence there is some evidence supporting these predictions.

The above tests can be shown graphically. Figure 4 shows the average cumulative returns for low and high turnover manipulated stocks. Cumulative returns are computed for each manipulated stock from the beginning to the end of the manipulation, and then averaged across stocks. They are presented over a grid showing different stages of the manipulation. The difference between the initial price and the peak price during manipulation reflects the profitability of the manipulator. The figure shows that high turnover stocks on average reach a higher peak price, consistent with the theoretical prediction that returns are increasing in the number of information seekers.

Finally, we test the impact of dispersion in the value of the stock on stock returns:

$$\frac{\partial\left(p_2^* - p_1^*\right)}{\partial(V_H - V_L)} > 0, \frac{\partial\left(p_2^* - p_0\right)}{\partial(V_H - V_L)} > 0.$$

We sort manipulated stocks by their average daily volatility over the manipulation period, and form two groups of stocks based on whether the average volatility for the stock is higher or lower than the median average volatility. We then estimate the difference in average cumulative returns between these groups, and test for its statistical significance. The last two rows of Table 6 show that both t-statistics are positive, and the test for $(p_2^* - p_0)$ is significant. The greater is the dispersion in the stock value, the greater the returns to the manipulator.

6 Conclusion

In this paper we study what happens when a manipulator can trade in the presence of other traders who seek out information about the stock's true value. These information seekers or arbitrageurs play a vital role in sustaining manipulation. Because information seekers buy on information, they are the ones who are manipulated. In a market without manipulators, these information seekers unambiguously improve market efficiency by pushing prices up to the level indicated by the informed party's information. In a market with manipulators, the information seekers play a more ambiguous role. More information seekers imply greater competition for shares, improving market efficiency, but also increasing the possibility for the manipulator to enter the market. This worsens market efficiency from the perspective of price transparency. This suggests a strong role for government regulation to discourage manipulation while encouraging greater competition for information.

We then provide evidence from SEC actions in cases of stock manipulation. We find that potentially informed parties such as corporate insiders, brokers, underwriters, large shareholders and market makers are likely to be manipulators. More illiquid stocks are more likely to be manipulated and manipulation increases stock volatility. We show that stock prices rise throughout the manipulation period and then fall in the post-manipulation period. Prices and liquidity are higher when the manipulator sells than when the manipulator buys. In addition, at the time the manipulator sells, prices are higher when liquidity is greater, consistent with returns to manipulation being higher when there are more information seekers in the market. Also, at the time the manipulator sells, prices are higher when volatility is greater, consistent with returns to manipulation being higher when there is greater dispersion in the market's estimate of the value of the stock. These results are consistent with the model and suggest that stock market manipulation may have important impacts on market efficiency.

Appendix

Here we consider the case in which there is an informed party and information seekers but no manipulator present. We present, for completeness, an alternative equilibrium to the one in the text. In this equilibrium, the informed party buys at both time 1 and time 2 and the information seekers buy at time 2. At time 2, the price of shares as a function of the demand for shares by both the informed and the information seekers is represented by:

$$p_2 = a + b(q_1^I + q_2^I + \sum_{i \in N} q_2^{A_i}). \tag{44}$$

The information seekers choose their demand according to:

$$\max_{q_2^{A_i}} \quad V_H q_2^{A_i} - (a + b(q_1^I + q_2^I + \sum_{i \in N} q_2^{A_i}))q_2^{A_i}. \tag{45}$$

The informed chooses her demand according to:

$$\max_{q_2^I} \quad V_H q_2^I - (a + b(q_1^I + q_2^I + \sum_{i \in N} q_2^{A_i}))q_2^I. \tag{46}$$

Taking the first order conditions of the information seekers and the informed party, imposing symmetry on the information seekers, and solving yields:

$$q_2^{A_i} = \frac{V_H - a + k - bq_1^I}{(N+2)b}. \tag{47}$$

$$q_2^I = \frac{V_H - k - a - kN - bq_1^I}{(N+2)b}. \tag{48}$$

At time 1, the informed party solves:

$$\max_{q_1^I} \quad \begin{array}{l} (V_H - k)\left(q_1^I + q_2^I\right) - (a + bq_1^I)q_1^I \\ -(a + b(q_1^I + q_2^I + \sum_{i \in N} q_2^{A_i}))q_2^I. \end{array} \tag{49}$$

Taking the first order condition and solving yields the following choices of quantities for both the informed party and the information seekers:

$$q_1^{I*} = \frac{V_H - k - a}{2b} - \frac{V_H - k - a - 2kN}{2b\,(3 + N^2 + 4N)} \tag{50}$$

$$q_2^{I*} = \frac{(N+2)\,(V_H - k - a - 2kN)}{2b\,(3 + N^2 + 4N)} \tag{51}$$

$$q_2^{A_i*} = \frac{(N+2)\,(V_H - a + k) + 2k\,(N+1)}{2b\,(3 + N^2 + 4N)}. \tag{52}$$

As a result of these quantity choices, we can derive equilibrium prices at time 1 and time 2 as well as profits for the information seekers:

$$p_1^* = \frac{V_H - k + a}{2} - \frac{V_H - k - a - 2kN}{2\left(3 + N^2 + 4N\right)} \tag{53}$$

$$p_2^* = \frac{2a + aN + 7V_H N + 4V_H - 3kN - 4k + 2V_H N^2}{2\left(3 + N^2 + 4N\right)} \tag{54}$$

$$\pi^{A_i *} = \frac{1}{4}\frac{\left(aN - V_H N - 3kN + 2a - 2V_H - 4k\right)^2}{\left(3 + N^2 + 4N\right)^2 b}. \tag{55}$$

The equilibrium profits for the informed party is a long and complicated expression which we do not reproduce here. It is also not particularly revealing for our purposes. In order to see that the informed party will not deviate from the equilibrium of purchasing shares in both periods, we need only show that the time 2 price is less than the value the informed party gets from holding shares until time 3, $V_H - k$. In this case, the informed party cannot do better by selling shares at time 2. This condition is:

$$V_H - k - p_2^* = \frac{(N+2)\left(V_H - k - a\right) - 2kN^2 - 4kN}{2\left(3 + N^2 + 4N\right)}. \tag{56}$$

The key point that emerges from this condition is that as long as k is small or N is small, the expression will be positive and the informed party will prefer to purchase shares in both periods.

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Table 1 : Distribution of Manipulation Cases

This table reports the distribution of manipulation cases in various markets from 1990 to 2001. 'Nasdaq' denotes NASDAQ National Market System. 'SmallCap' denotes NASDAQ Small Capitalization Market. 'OTC' includes both the OTC Bulletin Board and the Pink Sheets. 'Other' denotes cases that occur on other regional markets and those that cannot be classified to a particular market.

Year	NYSE	AMEX	Nasdaq	SmallCap	Other*	OTC	Unknown	Total
1990	3	0	2	0	4	11	5	25
1991	0	1	0	0	1	0	2	4
1992	0	0	2	0	0	3	7	12
1993	0	0	0	0	0	2	0	2
1994	0	0	0	0	0	1	0	1
1995	0	0	8	0	0	0	1	9
1996	0	0	0	0	1	0	1	2
1997	0	0	0	0	0	5	6	11
1998	0	0	1	0	0	4	2	7
1999	0	0	1	0	0	5	5	11
2000	0	2	0	1	0	19	6	28
2001	0	1	3	1	0	18	7	30
Total	3	4	17	2	6	68	42	142
Total %	2.11	2.82	11.97	1.41	4.23	47.89	29.58	100.00

* Cases in 'Other' are for stocks traded in the following exchanges:

In 1990 - 3 on Pacific Stock Exchange and 1 on Vancouver Stock Exchange;

In 1991 - Boston Stock Exchange;

In 1996 - Alberta Stock Exchange.

Table 2 : Summary Statistics of Manipulated Stocks

This table reports summary statistics for the manipulated stocks. Panels A to C report the sample mean, standard deviation, skewness and kurtosis coefficients for daily returns and turnover, for the manipulation period, the 1-year pre- and post- manipulation periods, respectively. The data for return and turnover is panel and volatility is cross-sectional. In Panel D: we report statistics on the length of the manipulation period. The overall sample period is from January 1990 to December 2001.

	Mean	Std. dev	Skewness	Kurtosis	
A: Manipulation period					
return	0.0274	0.8933	60.66	3939	
turnover	0.0385	0.2227	11.88	422.0	
volatility	0.5730	1.6091	3.117	19.23	
B: Pre-manipulation period					
return	0.0169	0.4880	52.93	3433	
turnover	0.0079	0.0421	37.91	1576	
volatility	0.2431	0.4564	3.787	18.22	
C: Post-manipulation period					
return	-0.0031	0.1417	8.640	189.1	
turnover	0.0368	0.2018	25.07	178.3	
volatility	0.1189	0.1322	2.779	12.71	
D: The length of the manipulation period (in days)					
	Mean	Median	Std. dev.	Max	Min
	308.33	202	332.07.	1373	2

Table 3 : Types of People Involved in Manipulation Cases

This table reports the occurance of 'potentially informed' people who are involved in manipulation cases from 1990 to 2001. 'Insider' denotes corporate executives and directors. 'Shareholder' denotes large shareholder with 5% or more ownership in the manipulated stock. Note that more than one type of people may be involved in any case.

Year	Broker	Insider	MarketMaker	Underwriter	Shareholder	Total Case
1990	17	9	0	6	3	25
1991	3	3	0	1	1	4
1992	11	2	2	2	0	12
1993	2	0	0	0	0	2
1994	1	1	0	0	1	1
1995	8	8	7	0	7	9
1996	1	2	0	0	2	2
1997	10	10	1	0	8	11
1998	5	3	0	0	3	7
1999	7	5	1	1	7	11
2000	12	8	2	5	6	28
2001	14	17	1	0	7	30
Total	91	68	14	15	45	142
Total %	64.08	47.89	9.86	10.56	31.69	-

Table 4: Liquidity, Return and Volatility of Manipulated Stocks

This table reports the results for regressing the average daily turnover, return, and volatility over the manipulation, pre- and post- manipulation periods on a constant and a dummy for the stock that's manipulated. For non-manipulated stocks, we use the average turnover, return, and volatility for the same period as the manipulated stock. The results are based on matching the manipulated stock with a portfolios of 10 stocks traded on the same market and with similar sizes. The sample has 51 stocks and the sample period is from January 1990 to December 2001.

	Manipulation Period	Pre-Manipulation Period	Post-Manipulation Period
A: Liquidity			
α_0	0.03601**	0.03369**	0.03946**
	(0.01164)	(0.01197)	(0.01517)
α_1	0.01097**	-0.02895*	0.01255*
	(0.00409)	(0.01587)	(0.00670)
R^2	6.44%	5.56%	6.31%
B: Return			
α_0	0.00293	0.00394	0.00020
	(0.02021)	(0.02114)	(0.03390)
α_1	0.02559*	0.00581	-0.00130*
	(0.01377)	(0.01829)	(0.00079)
R^2	5.06%	3.60%	2.28%
C: Volatility			
α_0	0.03325	0.04637	0.04601
	(0.09851)	(0.12477)	(0.15640)
α_1	0.40112**	0.18016	0.06718
	(0.08996)	(0.13039)	(0.09268)
R^2	8.91%	5.80%	4.07%

**: 1% significance level; *: 5% significance level. All are one-tailed tests.

Table 5: Empirical Tests of Price Levels

This table reports empirical tests of the price levels using price and turnover data of manipulated stocks. The p-value is based on a one-tail test. The sample period is from January 1990 to December 2001. "Cumulative return" is the average cumulative return over the testing period.

Null hypothesis	Alternative hypothesis	t-statistic	p-value	# of stocks	Cumul. return
Price at time 1 is higher than that before manipulation:					
$p_0 = p_1^*$	$p_0 < p_1^*$	3.7900	0.0001	51	221%
Price at time 2 is higher than that at time 1:					
$p_1^* = p_2^*$	$p_1^* < p_2^*$	2.3000	0.0107	60	174%
Price at time 2 is higher than that after manipulation:					
$p_2^* = p_3$	$p_2^* > p_3$	3.8036	0.0001	51	-27%

Table 6: Empirical Tests of the Model

This table reports empirical tests of the model using price and turnover data of manipulated stocks. The p-value is based on a one-tail test. The sample period is from January 1990 to December 2001.

Null hypothesis	Alternative hypothesis	t-statistic	p-value	Number of stocks
Price change between time 2 and time 1 is increasing in the number of information seekers:				
$\frac{\partial\left(p_2^*-p_1^*\right)}{\partial N}=0$	$\frac{\partial\left(p_2^*-p_1^*\right)}{\partial N}>0$	1.2545	0.1048	60
Price change between time 2 and time 0 is increasing in the number of information seekers:				
$\frac{\partial\left(p_2^*-p_0\right)}{\partial N}=0$	$\frac{\partial\left(p_2^*-p_0\right)}{\partial N}>0$	2.7544	0.0029	51
Price change between time 2 and time 1 is increasing in volatility:				
$\frac{\partial\left(p_2^*-p_1^*\right)}{\partial(V_H-V_L)}=0$	$\frac{\partial\left(p_2^*-p_1^*\right)}{\partial(V_H-V_L)}>0$	1.0374	0.1498	61
Price change between time 2 and time 0 is increasing in volatility:				
$\frac{\partial\left(p_2^*-p_0\right)}{\partial(V_H-V_L)}=0$	$\frac{\partial\left(p_2^*-p_0\right)}{\partial(V_H-V_L)}>0$	2.3789	0.0026	51

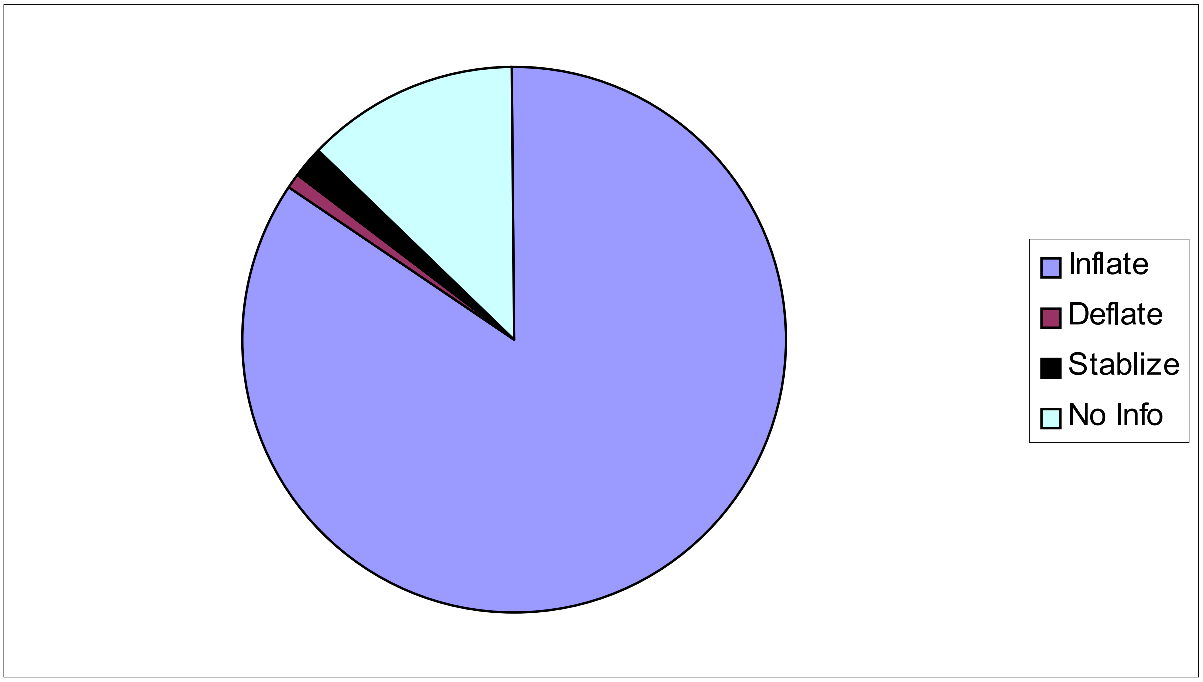

Figure 1: Distribution of Types of Manipulation

This figure shows the distribution of the types of manipulation. ‘No Info’ means we cannot determine from case information whether the manipulator intends to inflate or deflate the stock price. The sample is from January 1990 to October 2001.

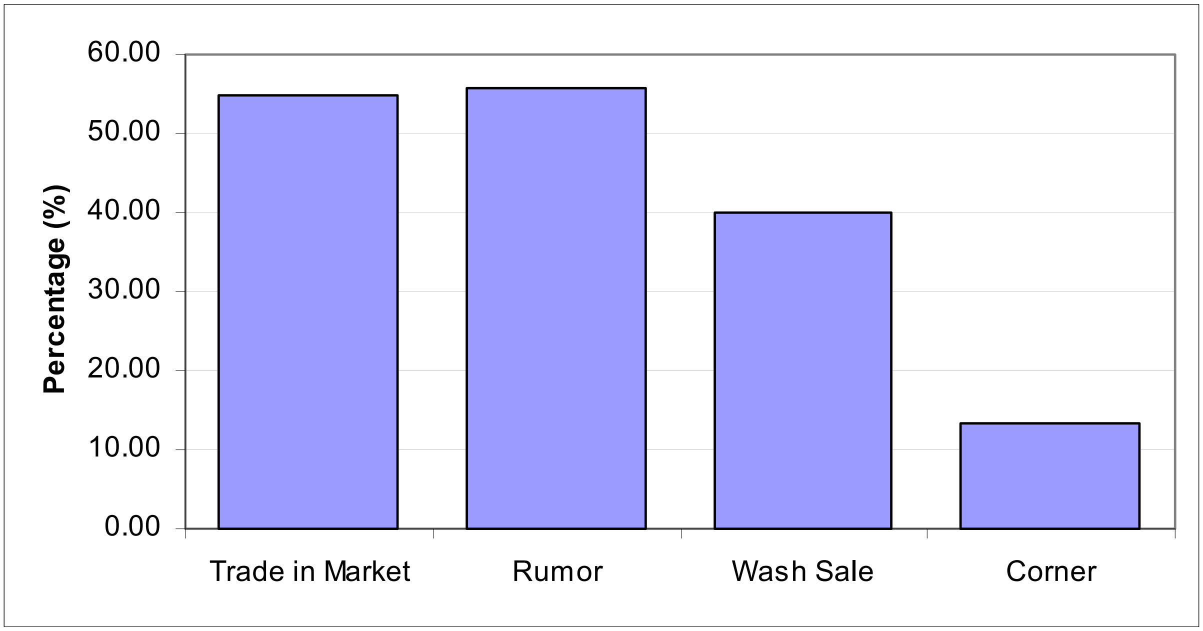

Figure 2: Ways to Profit in Manipulation Case

This figure shows the percentage of the ways market manipulators use to profit from their actions in all cases. There may be more than one way in each particular case. The sample is from January 1990 to October 2001.

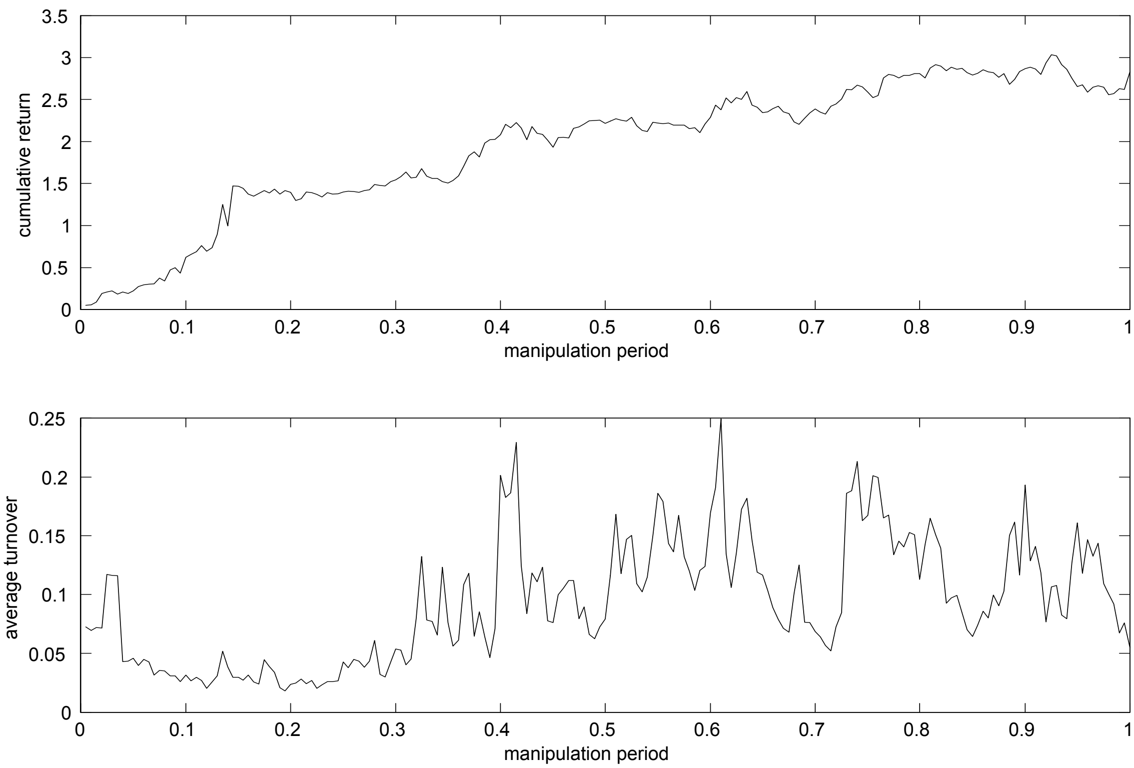

Figure 3: Cumulative Returns and Average Turnover During Manipulation

This figure shows the average cumulative returns and average turnover for 51 manipulated stocks for which return and turnover data are available. Cumulative returns are computed for each manipulated stock from the beginning to the end of the manipulation. They are presented over a grid showing different stages of the manipulation. For example, 0 represents the beginning of the manipulation period, 0.5 represents the middle and 1 represents the end of the manipulation. The top panel shows the average cumulative return and the bottom panel the average daily turnover over the manipulation period.

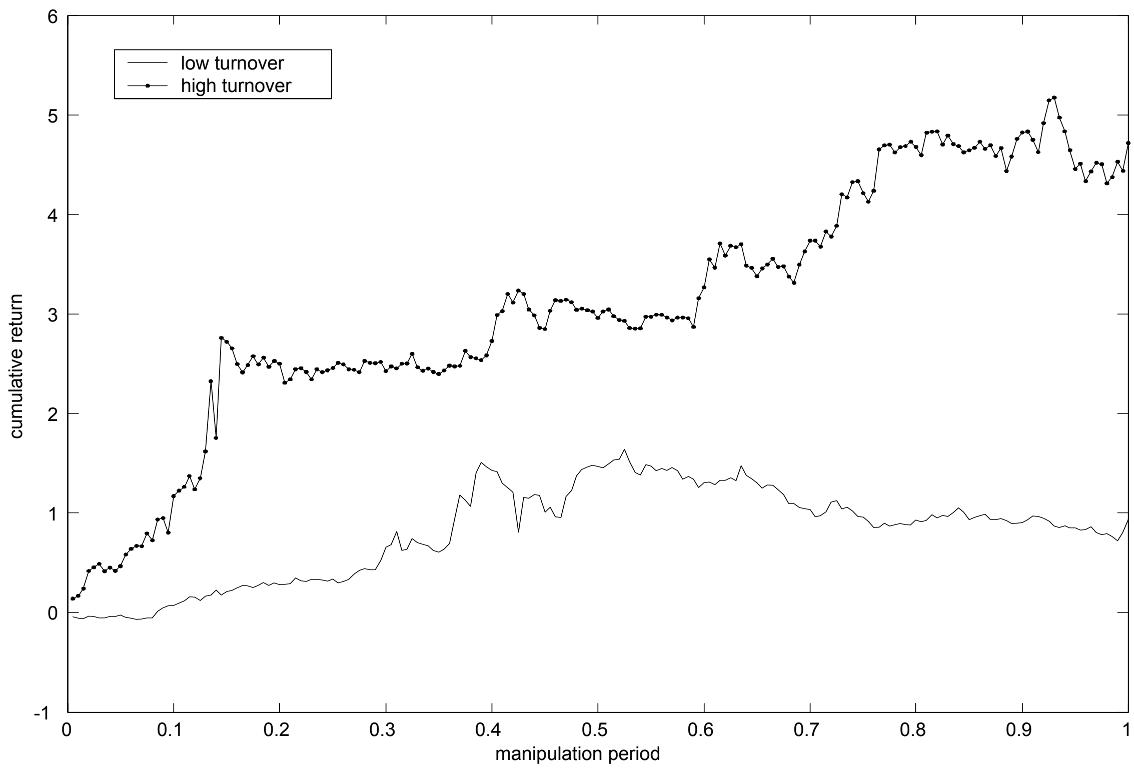

Figure 4: Cumulative Returns for Low and High Turnover Manipulated Stocks

This figure shows the average cumulative returns for 51 manipulated stocks for which data are available. Specifically it shows the average cumulative returns for low and high turnover manipulated stocks. The stocks are classified by whether their average turnover during the manipulation period is higher or lower than the median of all 51 manipulated stocks for which data are available. Cumulative returns are computed for each manipulated stock from the beginning to the end of the manipulation, and then averaged across stocks. They are presented over a grid showing different stages of the manipulation. For example, 0 represents the beginning of the manipulation period, 0.5 represents the middle and 1 represents the end of the manipulation.