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## Stock Market Manipulations\*

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. (*SEC v. Robert C. Ingardia*, U.S. District Court for the Southern District of New York)

### I. Introduction

The possibility that stock markets (both developed and emerging) can be manipulated is an important issue

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We present theory and evidence of stock price manipulation. Manipulators trade in the presence of other traders seeking information about the stock's true value. More information seekers imply greater competition for shares, making it easier for manipulators to trade and potentially worsening market efficiency. Data from SEC enforcement actions show that manipulators typically are plausibly informed parties (insiders, brokers, etc.). Manipulation increases volatility, liquidity, and returns. Prices rise throughout the manipulation period and fall post-manipulation. Prices and liquidity are higher when manipulators sell than when they buy. When manipulators sell, prices are higher when liquidity and volatility are greater.

for the regulation of trade and the efficiency of the market. One of the reasons the Securities and Exchange Commission (SEC) was established by Congress in 1934 was to eliminate stock market manipulation. While manipulative activities seem to have declined on the main exchanges, it is still a serious issue in the over-the-counter (OTC) market in the United States and in emerging financial markets.

Manipulation can occur in a variety of ways, from actions taken by insiders 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, it is well known that large block trades can influence prices. For example, 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 would 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 trade-based manipulation.<sup>1</sup>

In this paper, we examine stock market manipulation and its 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. In general, information seekers improve market efficiency and manipulators reduce market efficiency. Surprisingly, we find that increasing the number of information seekers may worsen market efficiency when there are manipulators present. Because the information seekers compete for shares, increasing the number of information seekers will increase the manipulators' profit, thereby making manipulation more likely. 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 antimanipulation rules can improve market efficiency by restoring the effectiveness of arbitrage activities.

We then establish some basic facts about stock market manipulation in the United States. We construct a unique data set of stock market manipulation

1. An interesting recent counterexample to the unraveling problem is provided by Citigroup's trading in Eurozone bonds on August 2, 2004, on the MTS system. Citigroup was able to profit from MTS rules requiring market makers to provide liquidity at restricted bid-ask spreads for European government bonds. Citigroup placed orders to sell 11 billion euros worth of 200 different bonds within two minutes, taking advantage of the forced slow adjustment of prices. Citigroup later repurchased 4 billion euros worth of bonds before many dealers stopped trading. Citigroup netted a profit of 15 million euros (see Munter and Van Duyn 2004). While the mechanism through which this trade-based manipulation scheme worked is somewhat different from what we study here, it does show the limits of unraveling in preventing manipulation.

cases by analyzing SEC litigation releases from 1990 to 2001. 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 on these markets, and they are subject to much less stringent securities regulations and rules. We find that, 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 downward. We also find that “potentially informed parties” such as corporate insiders, brokers, underwriters, large shareholders, and market makers are likely to be manipulators.

Using these data, we then examine the empirical implications of the model. As far as we know, our study is the first to test models of stock market manipulation using a comprehensive sample of cases. 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 postmanipulation period. In particular, prices are higher when the manipulator sells than when the manipulator buys, suggesting that the unraveling problem does not apply in practice. After the manipulation ends, prices fall. We find 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 these results are consistent with the model.

There are several caveats to note about these results. We have data only 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 apply only to poor manipulators in the sense that they were caught. While this selection problem is true for our descriptive results, it does not affect the empirical tests of the model because we examine only 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.

In addition, we have a relatively small number of cases of manipulation.

However, as far as we know, ours is the first study to systematically examine instances of stock market manipulation in the United States using a comprehensive sample of actual manipulation cases. 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 focus only 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 was limited over our sample period, the small number of cases may only be a reflection of budget constraints.<sup>2</sup>

Second, even if manipulation is a small issue in U.S. markets in that most of the manipulation cases analyzed in this paper occurred on the OTC or regional markets, manipulation may be a much larger issue for emerging stock markets, such as those in Pakistan (Khwaja and Mian 2003) and China (Walter and Howie 2003). For example, anecdotal evidence from conversations with Chinese securities regulators suggests that price manipulation is a significant impediment to the development of the Chinese securities markets.<sup>3</sup>

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. The case of Jonathan Lebed, a teenager in New Jersey who successfully manipulated stocks 11 times by posting messages on Yahoo Finance message boards and made profits of \$800,000, is instructive.<sup>4</sup>

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. Specifically, our model is relevant for and can be applied to cases of financial fraud given that we can think of financial

2. Specifically, in response to corporate governance concerns and financial fraud at companies such as Enron and Worldcom, the SEC's budget was increased to \$745 million in fiscal year 2003 from \$437.9 million in fiscal year 2002, a 70% increase. Of this increase, \$258 million was for enforcement activities. This increase occurred after our sample period, which ends in 2001. Over our sample period, the SEC's budget increased about 7% per year (in nominal terms). Interestingly, in fiscal year 2003, the number of all administrative proceedings (not just those for stock price manipulation) brought by the SEC increased by 30%, although the number of civil injunctive actions did not change. This suggests that prior to 2003, the resource constraint on SEC enforcement may have been binding. For further details, see <http://www.sec.gov>.

3. To take one example, the manipulation of the stock of China Venture Capital was one of the largest such cases in history. About 5.4 billion *renminbi* (RMB) (US\$1=RMB8.28) were used to manipulate the stock of China Venture Capital Group in 1999 and 2000. At one time, the manipulators controlled over 50% of the company's stock, enough to control its board of directors. At that point, they began to issue false statements to the media in order to boost the stock price. They were also coordinating the buying and selling of the stock among their accounts in order to further drive up the price. Shares in China Venture Capital rose from about RMB10 in December 1998 to a peak of RMB84 in February 2000. They dropped back to RMB15 in January 2001, when the scheme collapsed. The principal manipulator made a profit of RMB110–169 million. For more information about the scheme, see *Caijing Magazine* in 2001 (in Chinese).

4. For a description of this case, see Lewis (2001).

fraud as an attempt to manipulate market prices. To the extent that our empirical results are consistent with our model, they may also shed light on situations of financial fraud.

There is a large literature on market microstructure that examines whether informed traders such as insiders can trade profitably.<sup>5</sup> Our paper examines whether a manipulator can distort the stock price away from its true value and profitably trade on this distortion. Van Bommel (2003) looks at situations in which traders can spread rumors in the market about their trades. He shows in a Kyle (1985) setting that a potentially informed trader with limited wealth can raise her trading profits by pretending to be informed even when she is not. He also shows that a potentially informed trader would prefer to commit to not trading against her own information (i.e., buying when the true value is low), in contrast to our finding that a manipulator distorts prices against his information. Van Bommel focuses on the dissemination of information by gurus, analysts, investment newsletters, and other potentially informed parties. Our paper focuses on manipulation with a specific emphasis on cases of an informed party illegally manipulating stock prices. In cases of rumor-based manipulation, our empirical results are also consistent with Van Bommel's model.

Allen and Gorton (1992) argue that 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 that the trader is informed. The bid price then moves less in response to a sale than the ask price does in response to a purchase. Allen and Gorton argue that it is much more difficult to justify forced purchasing by liquidity traders who have a pressing need to buy securities. This asymmetry of price elasticities can create an opportunity for profitable price manipulation. As a result, 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 acting rationally, 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

5. See Glosten and Milgrom (1985), Kyle (1985, 1989), and Easley and O'Hara (1987). For a comprehensive review of these models, see O'Hara (1995).

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 stock 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 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 rationally on the basis of what they observe about the potentially informed ("large") trader's buying activity.

There also exist a large number of papers that theoretically and empirically examine price manipulation in 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. Merrick, Naik, and Yadav (2005) examine a case of manipulation involving a delivery squeeze on a bond futures contract traded in London. Khwaja and Mian (2003) analyze a unique data set containing daily firm-level trades of every broker trading on the stock exchange in Pakistan over a 32-month period. They find evidence that brokers manipulate price to profit from positive feedback traders. Finally, a recent paper by Mei, Wu, and Zhou (2004) shows that smart money can strategically take advantage of investors' behavioral biases and manipulate the price process to make profits (see also related papers by Chakraborty and Yilmaz [2000], Drudi and Massa [2002], and Goldstein and Guembel [2003]).

Relative to the existing literature, our paper makes three contributions. First, we generate testable implications about the evolution of prices, volume, and volatility in cases of stock market manipulation. Second, we construct a unique data set of cases of manipulation in the U.S. equity market. Third, we provide some of the first sample-based tests of models of stock market manipulation.

This paper proceeds as follows. In Section II, we present a model of stock

price manipulation. In Section III, we describe our data and present some basic empirical results. Section IV presents the empirical tests of the model. Section V presents conclusions. Some technical details are provided in Appendices A and B.

## II. Model

We consider a simple model of stock price manipulation. There are three 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 information about the firm's prospects. If the informed party has information that the stock value in the future will be high, then the informed party can choose to trade on this information by buying shares. In this case, we call the informed party truthful (superscripted  $T$ ). Alternatively, the informed party may have information that the future stock value will be low. In this case, the informed party may choose to manipulate the stock price. If the informed party chooses to do so, we call the informed party a manipulator (superscripted  $M$ ).<sup>6</sup>

The manipulator tries to drive the price of the stock up and then profit by selling at the higher price. In our model, we jointly 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 by law, 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: when the manipulator's demand is met, the price is driven up so that the manipulator buys at a higher price. When the manipulator's supply is cleared, the price is driven down so that 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: In addition, we show the impact of manipulation on market efficiency.

The second group of investors is  $N$  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

6. One may wonder why the informed party, knowing that the stock value will be low in the future, does not short sell to take advantage of this information. If the informed party is an insider (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. Clearly, insiders with information that the stock value will decrease in the future can also take other actions, such as selling shares from their personal holdings, having the firm issue additional shares, or engaging in mergers using stock as consideration. Our point here is to examine what other mechanisms (specifically, manipulation) exist for insiders to profit from their information.

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 and whether they should be buying the stock as well.

The third group of investors is 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:

$$P(Q) = a + bQ, \quad (1)$$

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.<sup>7</sup> 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

$$\frac{V_H - a}{b}. \quad (2)$$

This implies that if someone wished to buy all the shares from the uninformed, the price would be  $V_H$ . It is important to note that the reason for this is not that the uninformed investors Bayesian update their assessments of the stock's value. Instead, the price rising to  $V_H$  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, the informed party (either a truthful party or a manipulator) can enter the market. The informed party is the manipulator with probability  $\gamma$ , and the informed party is truthful with probability  $\delta$ .<sup>8</sup> Since, by definition, the informed party will be truthful only if the future stock value is high ( $V_H$ ), and since being truthful is clearly a profitable strategy for the informed party when the future stock value is high, this is equivalent to saying that the probability that the future stock value is high is  $\delta$ . With probability  $1 - \gamma - \delta$ , the informed party does not enter the market and the future stock

7. 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 constitutes part of the supply curve.

8. This is the case if the manipulator engages in trade-based manipulation. If the manipulator already has a position in the stock, then  $\gamma$  is the probability that the manipulator releases false information or engages in a wash sale.

value is  $V_L$ .<sup>9</sup> As a result, we can think of  $a$  as being the time 0 price, that is, the unconditional expected value of final cash flows,

$$a = \delta V_H + (1 - \delta)V_L. \quad (3)$$

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.<sup>10</sup> 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  $V_L$ .

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. Although all parties are risk neutral in our model, by adding some risk aversion, 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 hold a share until time 2. Note that if the informed party is a manipulator, the manipulator will never hold shares until time 3 because the value of the share will be  $V_L$ .

We next consider two cases. First, we examine what happens when an informed party is truthful only and does not manipulate the stock price. Second, we examine what happens when the informed party can either be truthful or be a manipulator (or choose not to participate in the market).

#### A. An Economy with a Truthful Informed Party

First, we consider what happens when there are  $N$  symmetric information seekers and a truthful informed party present in the market. The information seekers condition their demand at time 2 on what they observe at time 1.

9. It is worth noting that the informed party will not always try to manipulate the stock when the future stock value is low. 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 also explains why an informed party who already owns shares and who also knows that the future stock value will be low may nonetheless choose not to try to manipulate the stock.

10. 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). We focus here on what happens when there is a purchase of shares at time 1.

Here there are two potential equilibria. In the first equilibrium, the truthful 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.<sup>11</sup> In the second equilibrium, the truthful informed party purchases shares at time 1, and then both the truthful informed party and the information seekers purchase additional shares from the uninformed at time 2. In general, we think that the first equilibrium represents the usual case, as we discuss below.

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 ( $V_H$ ) if they observe shares being purchased. Each information seeker also knows that she is competing against the other  $N - 1$  information seekers for shares. Finally, 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.

In order to see this, we denote the aggregate demand of the  $N$  information seekers at time 2 as

$$q_2^A = \sum_{i \in N} q_2^{A_i}, \quad (4)$$

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 truthful informed party sells her  $q_1^T$  shares.<sup>12</sup> Each information seeker  $i$  solves the following problem at time 2:

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

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

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

The aggregate demand from the  $N$  information seekers is

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

11. This is the case we focus on when we allow the informed party to be a manipulator in the next section. 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 the informed party cannot be a manipulator, any information released is credible.

12. 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,  $q_2^A > q_1^T$ .

The price at time 2 is

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

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

$$\lim_{N \rightarrow \infty} q_2^{A^*} = \frac{V_H - a}{b} \quad (9)$$

and

$$\lim_{N \rightarrow \infty} p_2^* = V_H. \quad (10)$$

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 toward 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 truthful 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:

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

The time 1 quantity demanded by the truthful informed party is

$$q_1^{T^*} = \frac{N}{N + 1} \frac{V_H - a}{2b}, \quad (12)$$

and the price is

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

The truthful informed party's profits are

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

In Appendix A, we show that for  $N$  or  $k$  large enough, the equilibrium strategies are for the informed party to buy  $q_1^{T^*}$  shares at time 1, for the informed party to sell  $q_1^{T^*}$  shares at time 2, and for the  $N$  information seekers to each buy  $q_2^{A_i^*}$  shares at time 2. Thus the conjectured strategy for the truthful informed party of selling shares at time 2 will in fact be an equilibrium.

There is also a second equilibrium that has the feature that the informed

party buys in both periods. For this second 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 Appendix A, we derive that equilibrium. The intuition for these results is that if the cost of waiting is small enough for the informed party, then there will be additional profit to be made by buying shares in the second period since the information seekers will not have fully exhausted the informed party's informational rents relative to the cost of waiting. Anticipating this, the information seekers accommodate the informed party's demand in the second period. Similarly, more information seekers push the price toward its true (high) value in the second period. But if the number of information seekers is small, then the informed party can profit by continuing to purchase shares in the second period because again the informed party's informational rent will not have been exhausted. In general, we think of  $N$  as being sufficiently large in competitive capital markets that the first equilibrium represents the usual case, as opposed to the second equilibrium just discussed.

### *B. An Economy with Manipulators*

Next we consider what happens when the informed party is also potentially a manipulator. The informed party is a manipulator with probability  $\gamma$ .<sup>13</sup> The information seekers continue to condition their demand at time 2 on what they observe at time 1. In this case there is a multiplicity of equilibria. We discuss the pooling equilibrium here and a separating equilibrium in Appendix B.

It is convenient to talk about the truthful informed party and the manipulator as separate entities, rather than just as the informed party with different information (high or low future stock value). We begin by conjecturing that the manipulator and the truthful 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 the first equilibrium from subsection A.<sup>14</sup> If the manipulator and the truthful 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

$$\beta = \frac{\gamma}{\gamma + \delta}. \quad (15)$$

13. We demonstrate later that, in equilibrium,  $\gamma < 1 - \delta$ .

14. If the manipulator and the truthful informed party already own shares at time 0, then the alternative interpretation of these results is that the manipulator and the truthful informed party release information at time 1 with probabilities  $\gamma$  and  $\delta$ , respectively, and then sell at time 2. The manipulator's information release is false and the truthful informed party's information release is true.

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

$$\begin{aligned} \max_{q_2^{A_i}} (1 - \beta) & \left\{ V_H q_2^{A_i} - \left[ a + b \left( \sum_{i \in N} q_2^{A_i} \right) \right] q_2^{A_i} \right\} \\ & + \beta \left\{ V_L q_2^{A_i} - \left[ a + b \left( \sum_{i \in N} q_2^{A_i} \right) \right] q_2^{A_i} \right\}. \end{aligned} \quad (16)$$

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

$$q_2^{A_i*} = \frac{(1 - \beta)V_H + \beta V_L - a}{(N + 1)b}. \quad (17)$$

The aggregate demand is

$$q_2^{A*} = \frac{N}{N + 1} \frac{(1 - \beta)V_H + \beta V_L - a}{b}. \quad (18)$$

The time 2 price is

$$p_2^* = a + \frac{N}{N + 1} [(1 - \beta)V_H + \beta V_L - a]. \quad (19)$$

Each information seeker makes expected profits of

$$\pi^{A_i*} = \frac{[(1 - \beta)V_H + \beta V_L - a]^2}{(N + 1)^2 b}. \quad (20)$$

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

$$\max_{q_1} p_2^* q_1 - (a + b q_1) q_1. \quad (21)$$

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

$$q_1^{M*} = q_1^{T*} = \frac{N}{N + 1} \frac{(1 - \beta)V_H + \beta V_L - a}{2b}, \quad (22)$$

and the price is

$$p_1^* = a + \frac{N}{N + 1} \frac{(1 - \beta)V_H + \beta V_L - a}{2}. \quad (23)$$

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

$$\begin{aligned}\pi^{M*} = \pi^{T*} &= \frac{N^2}{(N+1)^2} \frac{[(1-\beta)V_H + \beta V_L - a]^2}{4b} \\ &= \frac{N^2}{(N+1)^2} \frac{[(V_H - a) - \beta(V_H - V_L)]^2}{4b}.\end{aligned}\quad (24)$$

In order for this pooling equilibrium to be sustainable, it must be incentive compatible for the truthful 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 observe only the quantity and price from time 1, there is no credible way for the truthful informed party to commit to holding shares until time 3.<sup>15</sup> Thus, in order for the pooling equilibrium to be sustainable, the incentive compatibility condition reduces to checking that the truthful 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 truthful informed party is  $V_H - k$ , so the incentive compatibility condition is

$$p_2^* = a + \frac{N}{N+1} [(1-\beta)V_H + \beta V_L - a] \geq V_H - k. \quad (25)$$

Rearranging this condition and substituting for  $a$  and  $\beta$  from equations (3) and (15), we get

$$\frac{k(N+1) - (1-\delta)(V_H - V_L)}{-k(N+1) + (1-\delta)(V_H - V_L) + N(V_H - V_L)} \delta \geq \gamma. \quad (26)$$

In order to sustain a pooling equilibrium in which both the manipulator and the truthful informed party buy  $q_1^{M*} = q_1^{T*}$  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 for the possibility of pooling.

**PROPOSITION.** The possibility of pooling is (a) decreasing in  $\gamma$ , (b) increasing in  $\delta$ , (c) increasing in  $k$ , (d) decreasing in  $V_H - V_L$ , and (e) increasing in  $N$ .

First, obviously, the right-hand side of the incentive compatibility condition is increasing in  $\gamma$ , implying that the greater the probability that the purchaser of shares at time 1 is a manipulator, the less likely it is that the truthful informed party will pool with the manipulator. The intuition here is that the

15. In the case of the release of information, the ability of the manipulator to appear as credible as the truthful 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.

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 truthful informed party will pool with the manipulator. Therefore, the probability that the informed party will manipulate is bounded above. In particular, if the informed party always manipulates when he has information that the value of the firm will be low, that is,  $\gamma = 1 - \delta$ , then the price at time 2 will equal the price at time 1, which will equal the price at time 0. This is not surprising, given that the information seekers will not update their beliefs when they see a purchase of shares. As a result, manipulation will not be profitable, so we know that  $\gamma < 1 - \delta$ . In addition, the left-hand side of condition (26) is increasing in  $\delta$ , the probability that the purchaser of shares is the truthful informed party. The more likely that the purchaser is the truthful informed party, the easier it is to sustain pooling.

Third, 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 that the truthful informed party will pool with the manipulator. The left-hand side of the incentive compatibility constraint is increasing in  $k$ , and so the constraint is loosened as  $k$  increases. This allows the manipulator to increase the probability of manipulation.

Fourth, the left-hand side of the condition is decreasing 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 truthful informed party will pool with the manipulator. The greater the dispersion, the more valuable it is for the truthful informed party to wait until time 3 and get the high value for the firm, and this tightens the incentive compatibility constraint.

Fifth, an increase in the number of information seekers  $N$  increases the likelihood of pooling. To see this, note that the left-hand side is increasing 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. Interestingly, 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 toward its true value. In the presence of a manipulator, this is no longer necessarily true. Our first comparative static result above shows that decreasing the probability  $\gamma$  of a manipulator being present (or, more precisely, decreasing the conditional probability  $\beta$  of a manipulator

being present) increases the likelihood of successful manipulation. However, our expression for the time 2 price,

$$p_2^* = a + \frac{N}{N+1} [(1-\beta)V_H + \beta V_L - a], \quad (27)$$

shows that decreasing the conditional probability  $\beta$  of a manipulator being present also increases the efficiency of the time 2 price. Thus, to the extent that government regulation and enforcement decrease 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.

It is also possible that the incentive compatibility condition cannot be met. If  $k$ ,  $N$ , or  $\delta$  is small enough or  $V_H - V_L$  is large enough, then the numerator of the incentive compatibility condition (26) will be negative and pooling will not be possible. In this case, other equilibria may exist. We discuss one of these, a separating equilibrium, in Appendix B. We focus on the pooling equilibrium here in the text because it has the key feature we are interested in: manipulation successfully occurs in equilibrium. In the pooling equilibrium, 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 is 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 hold 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.

### C. 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 that represent potentially fruitful avenues for future research. All the implications we test pertain to the pooling equilibrium assuming the manipulator has entered the market.

First, we consider the time path of prices.

**PREDICTION 1.** Prices increase throughout the manipulation period and then fall when the true value is revealed.

Mathematically,  $p_3 < p_0 < p_1^* < p_2^*$ . This prediction is 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 ma-

nipulator is able to profit. At time 3, the value of the shares is revealed and the price falls to its true value. This prediction will also be true of many models of successful manipulation such as Allen and Gale (1992), Jarrow (1992), and Van Bommel (2003). However, this prediction stands in contrast to the unraveling problem, which predicts that the price at time 2 is lower than the price at time 1, as well as the model of Allen and Gorton (1992).

We now consider the impact of the information seekers on volume. Our model predicts that volume is greater when the manipulator sells (in the second period) than when the manipulator buys (in the first period),  $q_1^{M*} < q_2^{A*}$ . It also predicts that volume in both periods is increasing in the number of information seekers,  $\partial q_1^{M*}/\partial N > 0$  and  $\partial q_2^{A*}/\partial N > 0$ . The more information seekers there are in the second period, the more they will buy in the aggregate because they compete with each other for shares. 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 model predicts that the volume differential between the second period and the first period will be increasing in the number of information seekers,  $\partial(q_2^{A*} - q_1^{M*})/\partial N > 0$ . We do not directly test these predictions. Instead, these predictions suggest that we can use volume as a proxy for the number of information seekers in the market. As a result, our test using volume will be a joint test of these predictions as well.

Next, we consider the impact of information seekers and value dispersion on returns.<sup>16</sup>

**PREDICTION 2.** Returns are increasing in the number of information seekers,  $\partial(p_2^* - p_1^*)/\partial N > 0$  and  $\partial(p_2^* - p_0)/\partial N > 0$ .

This prediction is central to our story: more information seekers increases the manipulator's return, where we proxy for information seekers by the level of volume.

**PREDICTION 3.** Returns to the manipulator are increasing in the dispersion of the true value of the stock,  $\partial(p_2^* - p_1^*)/\partial(V_H - V_L) > 0$  and  $\partial(p_2^* - p_0)/\partial(V_H - V_L) > 0$ .

Intuitively, if there is little disagreement or uncertainty about the true value of the stock, then there is little room for returns to manipulation. Note that while greater dispersion increases the returns to manipulation conditional on manipulation occurring, it also decreases the likelihood of manipulation oc-

16. Note that

$$p_2^* - p_1^* = \frac{N}{N+1} \frac{(1-\beta)V_H + \beta V_L - a}{2} = \frac{N}{N+1} \frac{\delta(1-\gamma-\delta)(V_H - V_L)}{2(\gamma + \delta)}$$

and

$$p_2^* - p_0 = \frac{N}{N+1} \frac{\delta(1-\gamma-\delta)(V_H - V_L)}{\gamma + \delta}.$$

curing because it makes it less likely that a truthful informed party would be willing to pool with the manipulator.

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 because of data limitations. For example, there are a number of implications for returns and volume associated with the unconditional probability of manipulation  $\gamma$  or the conditional probability of manipulation  $\beta$ . Our data pertain to actual manipulations, so we cannot test these. We also have implications for the profitability of manipulation. Data on profitability are less systematically available (at least for our data), so we cannot 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. These implications potentially represent avenues for additional research if the data become available.

### III. Empirical Evidence from Manipulation Cases

#### A. Anatomy of Stock Manipulation Cases

To help fix ideas, we provide summaries of two manipulation cases according to SEC 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 involve multiple ways of manipulating 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.

Specifically, in the case of wash sales or corners, information seekers will, as in our model, observe (artificial) volume and price increases and incorrectly infer that there is news behind the volume. The only difference is that, in our model, the manipulator is actually buying shares as opposed to already having established a position and creating artificial volume in the case of wash sales or artificial price increases in the case of corners. As long as information seekers do not realize that the supply is not coming from uninformed traders and price increases are not due to news, then the mechanism of our model will apply: information seekers will buy shares from the manipulator.

In addition, if information seekers do not observe volume or price movements but do observe other manipulative activities (such as rumors), then the equilibrium will be the same as what we describe. Suppose, for example, that a manipulator can establish a position without being detected by information seekers (perhaps by purchasing shares over a long period of time or, as directly in our model, because the manipulator is an insider but with a preexisting position). After establishing the position, the manipulator releases a rumor. Upon hearing the rumor, the information seekers ascribe a probability  $\beta$  to

the rumor being from an informed manipulator and a probability  $1 - \beta$  to the rumor being from a truthful informed party. In this case, our equilibrium is unaffected.<sup>17</sup>

1. WAMEX Holdings, Inc.

WAMEX Holdings, Inc. is a New York-based company with its common stock traded on the OTC Bulletin Board.<sup>18</sup> The company claimed to have plans to operate an electronic trading system for stocks. From December 1999 through June 2000, Mitchell H. Cushing (WAMEX's chief executive officer), Russell A. Chimenti Jr. (chief administrative officer), Edward A. Durante (a stock promoter), and several others engaged in a market manipulation scheme that drove WAMEX's stock price from \$1.375 per share to a high of \$22.00 per share. As part of the scheme, several million 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 apparently create artificial price increases in WAMEX stock.

In addition, Cushing, Chimenti, and Durante 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 claimed that WAMEX had received only 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 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 prearranged public market purchases of large blocks of WAMEX stock that 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;

17. For a related model of rumors, see Van Bommel (2003).

18. The information for this case comes from Securities and Exchange Commission (2001, 2002).

and third, the purchase of large blocks of stock to create the impression of information-based trade.

## 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.<sup>19</sup> 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 trade, the price of Paravant's common stock increased to \$9.875 per share.

The SEC alleges that this increase occurred because Duke, which served as a market maker for Paravant securities, artificially restricted the supply of Paravant common stock and created significant demand for the common stock. Specifically, Victor M. Wang, the CEO of Duke, and his associates 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 trading commenced following the IPO. This arrangement ensured that Duke had a large supply of Paravant common stock in its inventory. Prior to the IPO, several Duke representatives presolicited customers to purchase Paravant common stock once aftermarket trading commenced to ensure demand for the stock. Thus, as a result of the artificially small supply of common stock and the artificially created demand, once aftermarket 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 presolicited to purchase common stock. As a result of its manipulative activities in connection with Paravant common stock, Duke generated over \$10 million 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.

### *B. Data Description*

To provide more systematic evidence on stock market manipulation, we collect data on stock market manipulation cases pursued by the SEC from January 1990 to October 2001. Specifically, we collect all SEC litigation releases that contain the key words "manipulation" and "9(a)" or "10(b)," which refer to

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

**TABLE 1** Distribution of Manipulation Cases

| Year    | NYSE | AMEX | NASDAQ | Small<br>Cap | 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 |

NOTE.—This table reports the distribution of manipulation cases in various markets from 1990 to 2001. NASDAQ refers to the denotes NASDAQ National Market System; Small Cap refers to the 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 Unknown denotes cases in which the market information is not available.

\* Cases in Other pertain to stocks traded in the following exchanges: in 1990, three on the Pacific Stock Exchange and one on the Vancouver Stock Exchange; in 1991, the Boston Stock Exchange; in 1996, the Alberta Stock Exchange.

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 is collected from other legal databases such as Lexis-Nexis and SEC annual reports. There are 142 cases in total.

### 1. Manipulated Markets

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, due to either an increase in manipulation activities or intensified enforcement action by the SEC.

As shown above in the model, when there are more information seekers in the market and there are no 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 a higher likelihood of manipulation, information seekers make fewer profits, so they enter the market less frequently. As a result, 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 OTC markets such as the OTC Bulletin Board and the Pink Sheets, and 33.81% of the cases happen in either regional exchanges or unidentified markets. About 17% of the cases occur on the New York Stock Exchange (NYSE), American Stock Exchange (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–\$200 million.<sup>20</sup> Our results show that 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 seem to have driven many OTC Bulletin Board stocks to the Pink Sheets, which require virtually no disclosure at all.<sup>21</sup> These are precisely the markets in which asymmetric information problems are likely to be the most severe. Thus we argue that the lack of disclosure requirements and regulatory oversight allows 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 NYSE 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 capi-

20. As of November, 2001, the largest company on the OTC Bulletin Board 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 OTC Bulletin Board companies have an average market cap of \$1 million or less. Some 42% of all trades are made in the top 100 OTC Bulletin Board 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.

21. The SEC and the National Association of Securities Dealers (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 one-third 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.

TABLE 2 Types of People Involved in Manipulation Cases

| Year    | Broker | Insider | Market<br>Maker | Underwriter | Shareholder | Total<br>Cases |
|---------|--------|---------|-----------------|-------------|-------------|----------------|
| 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       |                |

NOTE.—This table reports the occurrence of potentially informed people who are involved in manipulation cases from 1990 to 2001. Insider denotes corporate executives and directors, and Shareholder denotes large shareholders with 5% or more ownership in the manipulated stock. More than one type of person may be involved in any case.

talizations 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 Small Cap Market had only two manipulation cases during our sample period. This market has to follow disclosure and trading rules similar to 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.

## 2. Manipulators and Manipulation Schemes

Our theoretical analysis above shows that a key to successful manipulation is the pooling of the manipulator with the truthful informed party. Hence, the manipulator needs either to be informed or to be able to credibly pose as being informed. 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 informed investors. Table 2 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.

Our model of manipulation occurs in a setting in which the manipulator inflates the stock price when he knows that there is bad news about the true value of the stock. Our analysis of manipulation cases shows that inflating the stock price is indeed the most common type of manipulation. In our sample, 84.5% of manipulation cases involve the inflation of stock prices whereas 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.

It is also interesting to look at the different types of manipulation schemes that are employed. 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 much higher than that for the premanipulation periods (see below). In these cases, it is plausible that investors believe that 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.

In addition, in 54.93% of the cases, manipulators buy and then sell stock in the market to realize a profit (i.e., at least partially trade-based manipulation), as opposed to situations in which they already own the stock. Finally, in about 13% of the cases, manipulators tried to corner the supply of stock in order to inflate prices. Many of our cases involve multiple forms of manipulation, so that the percentages of different types of manipulation schemes sum to greater than 100%. Also, 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.

### 3. Characteristics of Manipulated Stocks

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 OTC markets such as NASD's OTC Bulletin Board and the Pink Sheets, we collect

TABLE 3 Summary Statistics of Manipulated Stocks

|                            | Mean   | Standard<br>Deviation | Skewness | Kurtosis |
|----------------------------|--------|-----------------------|----------|----------|
| A. Manipulation Period*    |        |                       |          |          |
| Return                     | .0274  | .8933                 | 60.66    | 3,939    |
| Turnover                   | .0385  | .2227                 | 11.88    | 422.0    |
| Volatility                 | .5730  | 1.6091                | 3.117    | 19.23    |
| B. Premanipulation Period  |        |                       |          |          |
| Return                     | .0169  | .4880                 | 52.93    | 3,433    |
| Turnover                   | .0079  | .0421                 | 37.91    | 1,576    |
| Volatility                 | .2431  | .4564                 | 3.787    | 18.22    |
| C. Postmanipulation Period |        |                       |          |          |
| Return                     | -.0031 | .1417                 | 8.640    | 189.1    |
| Turnover                   | .0368  | .2018                 | 25.07    | 178.3    |
| Volatility                 | .1189  | .1322                 | 2.779    | 12.71    |

NOTE.—This table reports summary statistics for the manipulated stocks. Panels A–C report the sample mean, standard deviation, skewness, and kurtosis coefficients for daily returns and turnover, for the manipulation period and the one-year pre- and post manipulation periods, respectively. The data for return and turnover are panel (daily series for each manipulated stock) and volatility is cross-sectional. The total sample has 78 stocks, of which the data are complete for 51 stocks, and the sample period is from January 1990 to December 2001.

\* The length of the manipulation period is defined as the number of days between the start and the end of the manipulation according to the SEC litigation releases. The mean is 303.33 days, the median 202 days, the standard deviation 332.07 days, the maximum 1,373 days, and the minimum two days.

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. Of the 78 stocks, we have complete data for 51 stocks to conduct our empirical analysis.

From our case information, we know the beginning and end dates of manipulations. While this information is likely to be reported with some noise from the case summaries,<sup>22</sup> we define the manipulation period as the number of days between the start and end of the manipulation.

Table 3 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, one year prior to the manipulation period (premanipulation period), and one year following the manipulation period (postmanipulation period) are reported in panels A–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 postmanipulation 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 premanipulation period. During the postmanipulation period, av-

22. See, e.g., the WAMEX case discussed above. In that case, information on the manipulation period is given since the manipulation happened between December 1999 and June 2000. In our data, we would say that the manipulation happened between December 1, 1999, and June 30, 2000, because we do not have more precise information.

verage turnover is still very high. Average volatility during the manipulation period is higher than that during the premanipulation period, which in turn is higher than that during the postmanipulation period. For the manipulation period, the mean length is 308.33 days, the median is 202 days, the standard deviation is 332.07 days, the maximum is 1,373 days, and the minimum is two days.

### C. *The Liquidity, Return, and Volatility of Manipulated Stocks*

We observed above that many manipulated stocks trade in the relatively illiquid OTC market. Does illiquidity in a stock imply a higher likelihood of its 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 General Electric through trade-based manipulation by any significant amount without incurring huge costs and taking on enormous risk. Conversely, information-based manipulation (e.g., spreading rumors) may be able to move even highly liquid stocks, although the persistence of the movement may be short-lived for more liquid stocks. To study this issue, we use as our measure of liquidity the average daily turnover over the manipulation, premanipulation, and postmanipulation periods.

For each manipulated stock, we also compute the average daily turnover for a benchmark. For the benchmark, we match the manipulated stock to an equally weighted portfolio of 10 stocks. These stocks must be in the same size decile of all Center for Research in Security Prices (CRSP) stocks as that of the manipulated stock, and they are the closest in estimated betas to that of the manipulated stock. We compute the average daily turnover for the portfolio as the benchmark and then cross-sectionally regress the average daily turnover on a constant and a dummy for manipulation. The dummy variable equals one for the manipulated stock and equals zero for the benchmark. The sample period is January 1990 to December 2001:

$$\text{turnover} = \alpha_0 + \alpha_1 \times I\{\text{manipulated}\} + e. \quad (28)$$

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.

Panel A of table 4 reports the regression results. For the premanipulation period, manipulation period, and the postmanipulation period, average daily turnover is between 0.5% and 0.9% for the benchmarks. For the premanipulation period, the coefficient on the dummy variable is negative but insignificant. In the manipulation period, liquidity is significantly higher for the manipulated stocks than for the benchmarks. In the postmanipulation period, the coefficient on the manipulation dummy is positive but insignificant.

How did the manipulated stocks perform relative to other stocks during the manipulation period? Since most manipulations involve inflating stock prices,

**TABLE 4** Liquidity, Return and Volatility of Manipulated Stocks

|               | Manipulation<br>Period | Premanipulation<br>Period | Postmanipulation<br>Period |
|---------------|------------------------|---------------------------|----------------------------|
| A. Liquidity  |                        |                           |                            |
| $\alpha_0$    | .00514<br>(.01075)     | .00900*<br>(.00339)       | .00539*<br>(.00125)        |
| $\alpha_1$    | .055166*<br>(.01586)   | -.00197<br>(.00538)       | .00342<br>(.00182)         |
| $R^2$         | 10.91%                 | .24%                      | 4.65%                      |
| B. Return     |                        |                           |                            |
| $\alpha_0$    | -.00080<br>(.01106)    | .00171<br>(.00327)        | .00087<br>(.00086)         |
| $\alpha_1$    | .06111*<br>(.01631)    | .00966<br>(.00506)        | -.00093<br>(.00122)        |
| $R^2$         | 16.32%                 | 5.91%                     | .77%                       |
| C. Volatility |                        |                           |                            |
| $\alpha_0$    | .00346<br>(.01207)     | .012376<br>(.03109)       | .01008<br>(.00982)         |
| $\alpha_1$    | .11972*<br>(.01795)    | .15638*<br>(.04817)       | .08792*<br>(.01398)        |
| $R^2$         | 38.51%                 | 15.37%                    | 34.50%                     |

NOTE.—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 variable equal to one for the stock that was manipulated. For nonmanipulated 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 portfolio of 10 stocks in CRSP within the same size decile of the manipulated stock and with betas that are the closest to that of the manipulated stock. The sample has 51 stocks, and the sample period is from January 1990 to December 2001.

\* Significant at the 1% level.

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 premanipulation level before the end of manipulative activities. We show below that the overall effect is still positive during the manipulation period. We also examine whether manipulators prefer stocks that have underperformed or outperformed their market benchmarks. Finally, we study the return performance of manipulated stocks after manipulative activities have stopped to see whether they systematically underperform.

We compute the average daily returns over the manipulation period, as well as over the pre- and postmanipulation periods. As we did for turnover, we compute the average daily returns for the corresponding period for a benchmark, an equally weighted portfolio of 10 stocks matched on size and beta. We then cross-sectionally regress the average daily return on a constant and a dummy for manipulation. The dummy variable equals one for the manipulated stocks and equals zero for the benchmarks:

$$\text{return} = \alpha_0 + \alpha_1 \times I\{\text{manipulated}\} + e. \tag{29}$$

Panel B of table 4 reports the regression results. For the manipulated stocks, average daily returns are not different from the benchmark during the pre-

manipulation period. During the manipulation period, however, average daily returns are 6.11% higher than for the benchmarks, and this difference is statistically significant. During the postmanipulation period, average daily returns are not statistically different from those of the benchmarks. There is no evidence that manipulators prefer either underperforming or outperforming stocks.

We next examine the volatility of manipulated stocks. 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:

$$\text{volatility} = \alpha_0 + \alpha_1 \times I\{\text{manipulated}\} + e. \quad (30)$$

In computing the benchmarks' volatilities, we average the standard deviation for the 10 benchmark stocks in the portfolio. For all three periods, volatility is higher for manipulated stocks, and the coefficients are statistically significant. This indicates that manipulation is more likely to happen in volatile stocks, and manipulated stocks often experience dramatic price movements during the manipulation period.

Overall, these results suggest that prior to the manipulation, manipulated stocks are unexceptional in terms of returns, but they tend to be more volatile. During the manipulation period, manipulated stocks exhibit higher returns, higher liquidity, and higher volatility. Volatility remains higher for manipulated stocks in the postmanipulation period. These results are interesting in their own right since they establish some basic facts about stock market manipulation in the United States. These results are consistent with most models of successful trade-based manipulation such as Allen and Gale (1992). As a result, they do not uniquely identify the forces we focus on in our model, namely, the interaction between manipulators and information seekers. In order to provide more direct tests of our model, in the next section we focus on specifications based on changes rather than on levels. In this section, we noted that during the manipulation period, volatility, liquidity, and returns are all high. In the next section, we ask whether returns are higher when liquidity is higher and when volatility is higher.

#### IV. Empirical Tests of the Model

In this section we test the empirical implications of our model. There are four periods including time 0 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 subperiods, 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.

**TABLE 5** Empirical Tests of Price Levels

| Null Hypothesis  | Alternative Hypothesis | <i>t</i> -Statistic | <i>p</i> -Value | Stocks | Cumulative Return |
|--|------------------------|---------------------|-----------------|--------|-------------------|
| A. Price at Time 1 Is Higher than That before Manipulation |                        |                     |                 |        |                   |
| $p_0 = p_1^*$  | $p_0 < p_1^*$          | 3.7900              | .0001           | 51     | 221%              |
| B. Price at Time 2 Is Higher than That at Time 1           |                        |                     |                 |        |                   |
| $p_1^* = p_2^*$  | $p_1^* < p_2^*$        | 2.3000              | .0107           | 60     | 174%              |
| C. Price at Time 2 Is Higher than That after Manipulation: |                        |                     |                 |        |                   |
| $p_2^* = p_3$  | $p_2^* > p_3$          | 3.8036              | .0001           | 51     | -27%              |

NOTE.—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.

We first test prediction 1, that the price at time 1 is higher than the price at time 0 ( $p_0 < p_1^*$ ) and the price at time 2 is higher than the price at time 1 ( $p_1^* < p_2^*$ ). We estimate the average cumulative return between time 0 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 the price declines after the manipulation period. Contrary to our model, the price  $p_3 > p_0$ . 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 postmanipulation period may not be sufficient. Further, our test shows that  $p_2^* > p_3$  (−27% return). This is consistent with our model. The price of the shares falls after the manipulation ends.

There are two things to note about this result. First, this result is consistent with many models of manipulation such as Allen and Gale (1992), not just ours. It is inconsistent, however, with the unraveling problem and with the model of Allen and Gorton (1992). Second, the magnitudes involved are quite large. As noted in table 3, the median (mean) manipulation period is 202 (308) days. Given that we break this period in half, we calculate that manipulators make returns of 174% in 101–154 days.

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.<sup>23</sup> Cumulative returns are computed

23. When we map this into our model, 0.0–0.5 corresponds to time 1 and 0.5–1.0 corresponds to time 2.

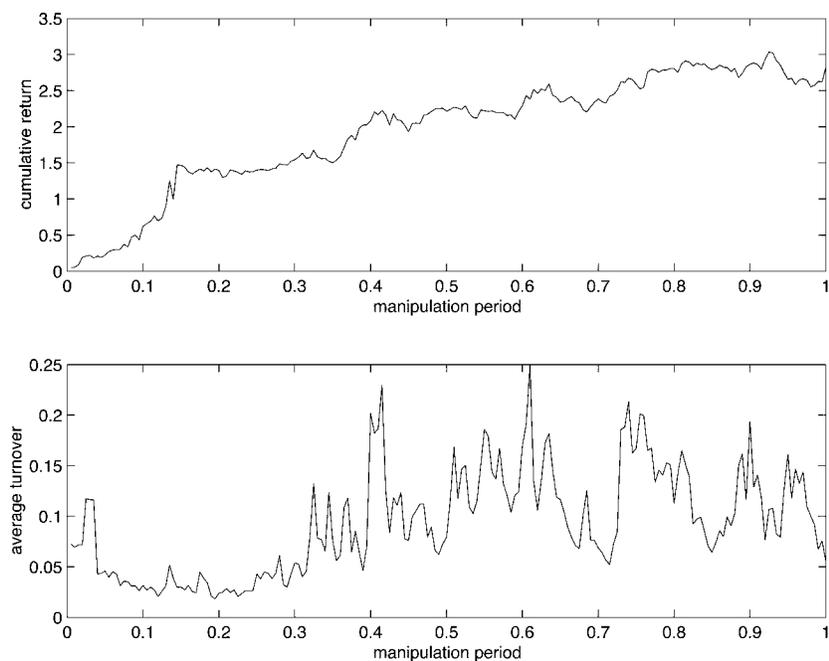


FIG. 1.—Cumulative returns and average turnover during manipulation. This figure shows the average cumulative returns and average turnover for 51 manipulated stocks for which return and turnover data are available. Cumulative returns are computed for each manipulated stock from the beginning to the end 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. The sample period is January 1990 to October 2001.

for each manipulated stock from the beginning to the end of the manipulation. Figure 1 shows the average cumulative returns and average turnover for the 51 manipulated stocks for which complete 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 1, 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 prediction 2, that returns are higher when there are more information seekers. Our model predicts that the amount of trading is in-

creasing in the number of information seekers. We use the overall level of trading 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 on the basis of whether the average turnover for the stock is higher or lower than the median average turnover. We then test whether the cumulative return between time 2 (end of the manipulation period) and time 1 (midpoint of the manipulation period) is significantly higher for the high-turnover group than for the low-turnover group. The return differential for the high-turnover group relative to the low-turnover group is 208%. Similarly, we also test whether the cumulative return between time 2 (end of the manipulation period) and time 0 (beginning of the manipulation period) is significantly higher for the high-turnover group than for the low-turnover group. The return differential for the high-turnover group relative to the low-turnover group is 388%. 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 prediction 2.

The above tests can be shown graphically. Figure 2 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.

What is interesting about this result is the extent to which volume matters for returns. Consistent with the model, a large number of active traders is necessary for high returns to the manipulator. Importantly, this result is not predicted by Allen and Gale (1992), who do not have cross-sectional predictions for volume. Furthermore, in the more general market microstructure literature, the evidence on the relation between volume and the direction of the returns is mixed (see Lee and Swaminathan 2000). Thus this finding is useful in understanding manipulation.

Finally, we test prediction 3, that returns are increasing in the dispersion in the value of the stock. 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 the dispersion in the stock value, the greater the returns to the manipulator.

**TABLE 6** Empirical Tests of the Model

| Null Hypothesis  | Alternative Hypothesis                            | <i>t</i> -Statistic | <i>p</i> -value | Average Cumulative Return Difference | Stocks in the Sample |
|--|---|---------------------|-----------------|--------------------------------------|----------------------|
| A. Price Change between Time 2 and Time 1 Is Increasing in the Number of Information Seekers |   |                     |                 |                                      |                      |
| $\partial(p_2^* - p_1^*)/\partial N = 0$   | $\partial(p_2^* - p_1^*)/\partial N > 0$          | 1.2545              | .1048           | 207.97%                              | 60                   |
| B. Price Change between Time 2 and Time 0 Is Increasing in the Number of Information Seekers |   |                     |                 |                                      |                      |
| $\partial(p_2^* - p_0)/\partial N = 0$   | $\partial(p_2^* - p_0)/\partial N > 0$            | 2.7544              | .0029           | 387.89%                              | 51                   |
| C. Price Change between Time 2 and Time 1 is Increasing in Volatility                        |   |                     |                 |                                      |                      |
| $\partial(p_2^* - p_1^*)/\partial(V_H - V_L) = 0$  | $\partial(p_2^* - p_1^*)/\partial(V_H - V_L) > 0$ | 1.0374              | .1498           | 172.79%                              | 61                   |
| D. Price Change between Time 2 and Time 0 Is Increasing in Volatility                        |   |                     |                 |                                      |                      |
| $\partial(p_2^* - p_0)/\partial(V_H - V_L) = 0$  | $\partial(p_2^* - p_0)/\partial(V_H - V_L) > 0$   | 2.3789              | .0026           | 213.35%                              | 51                   |

NOTE.—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. To compute “average cumulative return difference,” we classify firms into two groups according to their level of average turnover (for the first two tests) or their level of average volatility (for the last two tests). The return difference is the difference between the average cumulative return of the high group and the low group. The sample period is from January 1990 to December 2001.

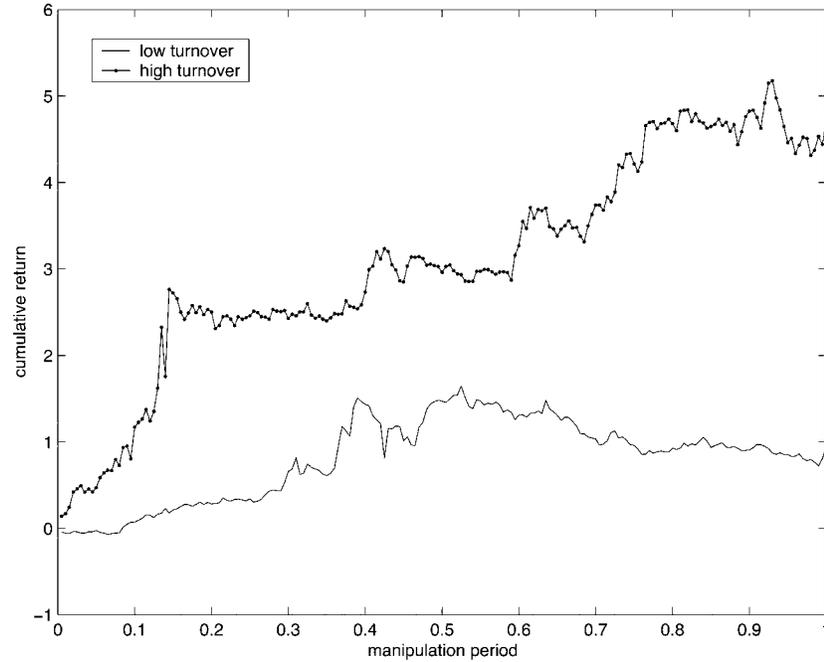


FIG. 2.—Cumulative returns for low- and high-turnover manipulated stocks. This figure shows the average cumulative returns for 51 manipulated stocks for which data are available. Specifically, it shows the average cumulative returns for low- and high-turnover manipulated stocks. The stocks are classified 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. See also the legend of fig. 1.

## V. 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 implies 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.

Using a unique data set, 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. Manipulation is associated with greater stock volatility, great liquidity, and high returns during the manipulation period. We show that stock prices rise throughout the manipulation period and then fall in the postmanipulation 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.

Our results are relevant not just for cases of stock market manipulation but also for cases of securities fraud generally. For example, cases of accounting and earnings manipulation such as Enron and Worldcom also fit within our model. To the extent that these were companies closely followed by information seekers, they were more susceptible to manipulation by insiders. On the empirical side, we have just scratched the surface of what is known about cases of stock market manipulation, and there are many empirical implications of our model left to be tested.

## Appendix A

### Derivation of the Equilibrium

#### Equilibrium in Which the Truthful Informed Party Buys at Time 1 and Sells at Time 2

In the text, for an economy with a truthful informed party, we asserted that for  $N$  or  $k$  large enough, the equilibrium strategies are for the informed party to buy  $q_1^{T*}$  shares at time 1, for the informed party to sell  $q_1^{T*}$  shares at time 2, and for the  $N$  information seekers to each buy  $q_2^{A*}$  shares at time 2.

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 truthful informed party deviates by trying to buy additional shares at time 2 rather than sell. Aggregate demand for shares at time 2 is then

$$\begin{aligned} q_2^{A*} + q_1^{T*} + q_2^T &= \frac{N}{N+1} \frac{V_H - a}{b} + \frac{N}{N+1} \frac{V_H - a}{2b} + q_2^T \\ &= \frac{3N}{N+1} \frac{V_H - a}{2b} + q_2^T. \end{aligned} \tag{A1}$$

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

informed party is  $q_2^T = 0$ . 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

$$\frac{N^2}{(N+1)^2} \frac{(V_H - a)^2}{4b} + \frac{1}{2} \frac{N(V_H - a)}{(N+1)b} \left[ \frac{(V_H - k - a) - kN}{N+1} \right]. \quad (A2)$$

The first term is just the profits earned by not deviating from the equilibrium. The second term is the incremental profit from deviating. Since by assumption  $V_H - k - a > 0$  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 the other information seekers' strategies and the informed party's strategy, so no information seeker will deviate.

**Equilibrium in Which the Truthful Informed Party Buys at Both Times 1 and 2**

Here we present, for completeness, an alternative equilibrium to the one in the text. In this equilibrium, the truthful 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

$$p_2 = a + b \left( q_1^T + q_2^T + \sum_{i \in N} q_2^{A_i} \right). \quad (A3)$$

The information seekers choose their demand according to

$$\max_{q_2^{A_i}} V_H q_2^{A_i} - \left[ a + b \left( q_1^T + q_2^T + \sum_{i \in N} q_2^{A_i} \right) \right] q_2^{A_i}. \quad (A4)$$

The informed party chooses her demand according to

$$\max_{q_2^T} V_H q_2^T - \left[ a + b \left( q_1^T + q_2^T + \sum_{i \in N} q_2^{A_i} \right) \right] q_2^T. \quad (A5)$$

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

$$q_2^{A_i} = \frac{V_H - a + k - b q_1^T}{(N+2)b} \quad (A6)$$

and

$$q_2^T = \frac{V_H - k - a - kN - b q_1^T}{(N+2)b}. \quad (A7)$$

At time 1, the informed party solves

$$\max_{q_1^T} (V_H - k)(q_1^T + q_2^T) - (a + b q_1^T) q_1^T - \left[ a + b \left( q_1^T + q_2^T + \sum_{i \in N} q_2^{A_i} \right) \right] q_2^T. \quad (A8)$$

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

$$q_1^{T*} = \frac{V_H - k - a}{2b} - \frac{V_H - k - a - 2kN}{2b(3 + N^2 + 4N)}, \quad (\text{A9})$$

$$q_2^{T*} = \frac{(N + 2)(V_H - k - a - 2kN)}{2b(3 + N^2 + 4N)}, \quad (\text{A10})$$

and

$$q_2^{A,*} = \frac{(N + 2)(V_H - a + k) + 2k(N + 1)}{2b(3 + N^2 + 4N)}. \quad (\text{A11})$$

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:

$$p_1^* = \frac{V_H - k + a}{2} - \frac{V_H - k - a - 2kN}{2(N^2 + 4N + 3)}, \quad (\text{A12})$$

$$p_2^* = \frac{2a + aN + 7V_H N + 4V_H - 3kN - 4k + 2V_H N^2}{2(N^2 + 4N + 3)}, \quad (\text{A13})$$

and

$$\pi^{A,*} = \frac{1}{4} \frac{(aN - V_H N - 3kN + 2a - 2V_H - 4k)^2}{(N^2 + 4N + 3)^2 b}. \quad (\text{A14})$$

The equilibrium profit 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

$$V_H - k - p_2^* = \frac{(N + 2)(V_H - k - a - 2kN)}{2(N^2 + 4N + 3)} > 0. \quad (\text{A15})$$

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 truthful informed party. 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 in the text. This makes the informed party better off since

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.

## Appendix B

### A Separating Equilibrium

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 the equilibrium from Appendix A. 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 that 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 Appendix A is

$$q_1 = \frac{V_H - k - a}{2b} - \frac{V_H - k - a - 2kN}{2b(N^2 + 4N + 3)}. \quad (B1)$$

The price at which these shares are bought is

$$p_1^* = \frac{V_H - k + a}{2} - \frac{V_H - k - a - 2kN}{2(N^2 + 4N + 3)}. \quad (B2)$$

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 Appendix A, the  $N$  information seekers each demand

$$q_2^{A_i*} = \frac{(N + 2)(V_H - a + k) + 2k(N + 1)}{2b(N^2 + 4N + 3)} \quad (B3)$$

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:

$$p_2 = a + b \left( \sum_{i \in N} q_2^{A_i*} \right) \quad (B4)$$

$$= \frac{6a + aN^2 + 6aN + 2NV_H + 4kN + N^2V_H + 3kN^2}{2(N^2 + 4N + 3)}. \quad (B5)$$

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 the incentive compatibility condition for separation is

$$p_1 - p_2 = \frac{V_H - k - a - 2kN}{N + 3} > 0. \quad (\text{B6})$$

Rewriting this condition, we have

$$\frac{(1 - \delta)(V_H - V_L) - k - 2kN}{N + 3} > 0$$

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

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. For example, for some parameter values, neither the condition for strict pooling nor that for strict separation will be satisfied.<sup>24</sup> In particular, we have associated the separating equilibrium with low values of three parameters—the number of information seekers  $N$ , the cost of holding shares for the informed party  $k$ , and the probability of being truthfully informed  $\delta$ —and high values of a fourth parameter, the dispersion in the true value of the firm  $V_H - V_L$ . We have associated the pooling equilibrium with high values of the first three parameters and low values for the fourth parameter. 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 several factors. 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. In addition, 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.

## References

- Allen, Franklin, and Douglas Gale. 1992. Stock price manipulation. *Review of Financial Studies* 5:503–29.
- Allen, Franklin, and Gary Gorton. 1992. Stock price manipulation, market microstructure and asymmetric information. *European Economic Review* 36:624–30.
- Chakraborty, Archishman, and Bilge Yilmaz. 2000. Informed manipulation. Unpublished manuscript, University of Pennsylvania, Wharton School.
- Drudi, Francesco, and Massimo Massa. 2002. Asymmetric information and trading strategies:

24. Obviously, the set of parameters for which both conditions are satisfied is empty.

- Testing behavior on the primary and secondary T-bond markets around auction days. Unpublished manuscript, INSEAD, Paris.
- Easley, David, and Maureen O'Hara. 1987. Price, trade, size, and information in securities markets. *Journal of Financial Economics* 19:69–90.
- Felixson, Karl, and Anders Pelli. 1999. Day end returns—stock price manipulation. *Journal of Multinational Financial Management* 9:95–127.
- Gerard, Bruno, and Vikram Nanda. 1993. Trading and manipulation around seasoned equity offerings. *Journal of Finance* 48:213–45.
- Glosten, Lawrence R., and Paul R. Milgrom. 1985. Bid, ask and transaction prices in a specialist market with heterogeneously informed traders. *Journal of Financial Economics* 14:71–100.
- Goldstein, Itay, and Alexander Guembel. 2003. Manipulation, the allocational role of prices and production externalities. Unpublished manuscript, Duke University.
- Jarrow, Robert A. 1992. Market manipulation, bubbles, corners, and short squeezes. *Journal of Financial and Quantitative Analysis* 27:311–36.
- . 1994. Derivative security markets, market manipulation, and option pricing theory. *Journal of Financial and Quantitative Analysis* 29:241–61.
- Jordan, Bradford D., and Susan D. Jordan. 1996. Salomon Brothers and the May 1991 Treasury auction: Analysis of a market corner. *Journal of Banking and Finance* 20:25–40.
- Khwaja, Asim Ijaz, and Atif Mian. 2003. Price manipulation and “phantom” markets—an in-depth exploration of a stock market. Unpublished manuscript, University of Chicago.
- Kumar, Praveen, and Duane J. Seppi. 1992. Futures manipulation with “cash settlement.” *Journal of Finance* 47:1485–1502.
- Kyle, Albert S. 1985. Continuous auctions and insider trading. *Econometrica* 53:1315–35.
- . 1989. Informed speculation with imperfect competition. *Review of Economic Studies* 56:317–56.
- Lee, Charles M. C., and Bhaskaran Swaminathan. 2000. Price momentum and trading volume. *Journal of Finance* 55:2017–69.
- Lewis, Michael. 2001. *Next: The future just happened*. New York: Norton.
- Mahoney, Paul G. 1999. The stock pools and the Securities Exchange Act. *Journal of Financial Economics* 51:343–69.
- Mei, Jianping, Guojun Wu, and Chunsheng Zhou. 2004. Behavior based manipulation—theory and prosecution evidence. Unpublished manuscript, New York University.
- Merrick, John J., Narayan Y. Naik, and Pradeep K. Yadav. 2005. Strategic trading behavior and price distortion in a manipulated market: Anatomy of a squeeze. *Journal of Financial Economics* 77:171–218.
- Morgenson, Gretchen. 1999. Ex-broker pleads guilty in state and federal courts. *New York Times* (August 20).
- Munter, Paivi, and Aline Van Duyn. 2004. The world's largest bank is thought to have netted around euros 15m through rapid-fire selling and buying last month. *Financial Times London* (September 10), p. 17.
- O'Hara, Maureen. 1995. *Market microstructure theory*. Cambridge: Blackwell.
- Securities and Exchange Commission. 1999. Litigation release no. 16256, August 19. <http://www.sec.gov/litigation/litreleases/lr16256.htm>.
- . 2001. Litigation release no. 17178, October 11. <http://www.sec.gov/litigation/litreleases/lr17178.htm>.
- . 2002. Litigation release no. 17602, July 9. <http://www.sec.gov/litigation/litreleases/lr17602.htm>.
- Van Bommel, Jos. 2003. Rumors. *Journal of Finance* 58:1499–1520.
- Vitale, Paolo. 2000. Speculative noise trading and manipulation in the foreign exchange market. *Journal of International Money and Finance* 19:689–712.
- Walter, Carl E., and Fraser J. T. Howie. 2003. *Privatizing China: The stock markets and their role in corporate reform*. New York: Wiley.