Stock Price Manipulation: The Role of Intermediaries

Siddiqi, Hammad

Lahore University of Management Sciences

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Hammad Siddiqi
Department of Economics
Lahore University of Management Sciences
hammad@lums.edu.pk

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ABSTRACT

We model stock price manipulation when the manipulator is in the role of an intermediary (broker). We find that in the absence of superior information, the broker can manipulate equilibrium outcomes without losing credibility with respect to accurate forecasting. This result extends to the case when the broker prefers more investment to come into the market. However, when competition among brokers is introduced then the investors get their favorite outcome in the absence of superior information.
This result has important implications for encouraging broker competitions in developing markets. Many developing markets are still not demutualized; hence broker level competition is limited in such markets.

JEL Classification Codes: C72, D80, G10, G20

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Stock Price Manipulation: The Role of Intermediaries

In emerging stock markets, the issue of stock price manipulation by intermediaries often arises. Numerous accounts of emerging stock markets today share this concern. Khwaja and Mian (2005) use a unique trade level dataset to show that when market intermediaries (brokers) in a Pakistani stock exchange trade on their own behalf, they earn at least 50 to 90 percentage points higher annual returns and these abnormal returns are earned at the expense of outside investors. Zhou and Mei (2003) note that the China's worst stock market crime was the result of a scheme implemented in collusion with brokers. They argue that manipulation by brokers is common in many emerging stock markets. Khanna and Sunder (1999), in a case study of the Indian stock market, states that "brokers were often accused of collaborating with the company owners to rig share prices in pump and dump schemes". Furthermore, according to a survey conducted by the Times of India in October 2005, a majority of market participants in India believe that brokers manipulate prices. In fact, in 2005, the Securities and Exchange Board of India barred 11 brokers for engaging in price manipulation.

A number of studies have examined the issue of stock price manipulation by speculators who are not in the role of intermediaries. Allen and Gale (1992) show that it is possible for an uninformed trader to manipulate prices if the investors attach a positive probability to the manipulator being an informed player. Jarrow (1992) and Hart (1977) have analyzed manipulation in a dynamic asset pricing context and show that under certain conditions speculators can make profits. However, a theoretical framework for understanding manipulation when the manipulator is in the role of an intermediary is lacking, even though anecdotes abound. Consequently, a number of key questions remain unanswered. Firstly, anecdotal manipulation schemes involving brokers such as the pump and dump[2] schemes require a continuous supply of irrational investors who, like sheep, follow each other only to be slaughtered. Assuming a relentless supply of irrational investors who keep on placing themselves at the mercy of manipulating brokers specially when the stakes are very high seems unreasonable. Secondly, reputation is a key asset in

[2] See Khwaja and Mian (2005)

a market where brokers compete for business. How can manipulating brokers, if they indeed manipulate, maintain their credibility (reputation) and clientele in the face of competition from other brokers? Thirdly, mature markets do not seem to suffer from the manipulation schemes typically associated with emerging markets.[3] What allows mature markets to function seemingly free of this type of manipulation?

In this paper, we present a market microstructure model, which uses a 3-player coordination game framework developed in Jung (2007). Jung (2007) models an arms race scenario in which media has power to influence outcomes. However, the idea underlying Jung's model is general; if there is a coordination game between two parties with asymmetric information then a third part with powers to reduce asymmetry can manipulate equilibrium outcomes. Here, we apply this idea to financial markets and study a coordination game between institutional and individual investors with broker as an intermediary with powers to reduce asymmetry through its signaling. The key is to realize that if brokers care about their credibility and investors know that, then in an apparent defiance of intuition, brokers get to manipulate without losing credibility.

This paper should be thought of as an initial attempt at understanding the systematic price manipulation by brokers through microstructure approach. Specifically, it provides several simple models in which an intermediary can successfully manipulate demand in equilibrium without losing credibility. The models presented here are general and are not limited to emerging markets; hence they provide conditions under which manipulation is checked. Those conditions are more likely to be met in developed markets.

In the basic model, there are three players, an individual investor, an institutional investor, and a stock broker. There is a positive probability that the institutional investor has superior information. If it does, then it trades accordingly. However, if it does not, then it prefers to coordinate its demand level choices with the individual investor. The individual investor never has superior information so he always prefers to coordinate his demand level choices with the institutional investor. That is, in the absence of superior information, each investor prefers to do as the other investor does. This notion of feeling

[3] Aggarwal and Wu (2006) present evidence of stock market manipulations in the United States. Their data suggests that manipulators are plausibly brokers.

safe while doing as other do when information is insufficient is commonly known as the 'herd instinct' among traders. Such a tendency is known in microeconomic literature as the bandwagon effect. The bandwagon effect arises when people's preference for a commodity increases as the demand by others for the commodity increases. Leibenstein(1950) is one of the earlier studies of the bandwagon effect and the main impetus for the induction of this effect in microeconomics. The bandwagon effect is not only just intuitively and theoretically appealing, but there also exists significant empirical evidence for it. As on example, Biddle (1991) empirically estimates this effect in the demand and distinguishes it from other effects. Arguably, the bandwagon effect in the stock market is stronger when there is insufficient information.

In our model, the individual investor does not observe the type of the institutional investor, however, the broker does. The broker, whose primary preference is to preserve his credibility (which will be lost if either investor determines that the broker has lied), sends a signal in the form of a publicly available research report. The research report forecasts a bullish, bearish, or a neutral market. The report is read by each investor as providing a signal about the other investor. A bullish signal is read by the individual investor as implying that the institutional investor will invest with optimism, a bearish signal as implying no investment by the institutional investor, and a neutral signal indicating that the institutional investor will invest with caution. The institutional investor also reads the report in the same fashion as providing a signal about the individual investor.

The conditional preference of the broker is to manipulate demand. After the signal has been received and has become public knowledge, both types of investors choose their demand levels simultaneously. The main result is that if the institutional investor does not have superior information, then the broker can manipulate demand in equilibrium while maintaining credibility.

The model is then enriched to allow for competition between brokers and to allow for a specific broker bias. Conditions are specified under which manipulation is mitigated. Compared to mature markets, those conditions are much less likely to hold in emerging markets. Hence, as predicted by the model, broker manipulation anecdotes abound in emerging markets and not much so in mature markets.

The Basic Model

The basic model uses a 3-player coordination framework developed in Jung (2007). Jung(2007) models an arms race scenario in which media has power to influence outcomes. However, the idea underlying Jung's model is general; if there is a coordination game between two parties with asymmetric information then a third part with powers to reduce asymmetry can manipulate equilibrium outcomes. Here, we apply this idea to financial markets and study a coordination game between institutional and individual investors with broker as an intermediary with powers to reduce asymmetry through its signaling.

There are three players; the individual investor (S), the institutional investor (L), and the stock broker (B). Each investor can choose from any of the following demand levels: investing with optimism (I), investing with caution (C), and not investing (N). I>C>N=0.[4] S and L have their own types. L can be optimistic, neutral, or pessimistic. S is always neutral. The optimistic type has superior information that the market will go up so it prefers to choose I. The pessimistic type has superior information that the market will go down so it prefers to choose N, and the neutral type does not have superior information either way and is prone to the bandwagon effect. Specifically, his primary preference is to match his demand level choice with the other player and the conditional preference is to invest cautiously or choose C.

The following inequalities describe the preference of optimistic and pessimistic types of L:

$$u_{L(optimist)I}(.) > \max\{u_{L(optimist)C}(.), u_{L(optimist)N}(.)\} \quad (1)$$

$$u_{L(pessimist)N}(.) > \max\{u_{L(pessimist)I}(.), u_{L(pessimist)C}(.)\} \quad (2)$$

These inequalities show that the optimistic type of L prefers to choose the demand level I irrespective of what S does and the pessimistic type of L prefers to choose the demand level N irrespective of what S does. The fact the L is optimistic or pessimistic implies

[4] As all three demand level choices are non-negative, short selling is not allowed.

possession of superior information. Consequently, L acts in accordance with superior information and is not prone to the 'herd instinct'. That is, L does not care what S does as long as it has superior information to rely on.

The following inequality describes the primary preference of neutral type of L:

$$\min\{u_{L(neutral)CC}, u_{L(neutral)NN}, u_{L(neutral)II}\} > \max\{u_{L(neutral)CN}, u_{L(neutral)CI}, u_{L(neutral)NI}, u_{L(neutral)NC}, u_{L(neutral)IN}, u_{L(neutral)IC}\} \tag{3}$$

This inequality captures the 'herd instinct' or the bandwagon effect and shows that a neutral type of L prefers outcomes in which it successfully matches the demand level choices of S over outcomes in which the choices are not matched. A neutral type of L does not have superior information about the market going either way. Such an investor feels safe when he does the same as others are doing, a phenomenon known as the 'herd instinct' among market participants.

The conditional preference of neutral type of L:

$$u_{L(neutral)CC} > \max\{u_{L(neutral)II}, u_{L(neutral)NN}\} \tag{4}$$

This inequality shows that conditional on successfully coordinating its demand level choices with S, the neutral type of L prefers to invest cautiously. That is, when one does not have superior information, one prefers to do as others are doing and conditional on that, one prefers to invest cautiously.

The following inequalities describe the primary and conditional preference of S respectively (S is always of type neutral):

$$\min\{u_{sCC}, u_{sII}, u_{sNN}\} > \max\{u_{sCN}, u_{sCI}, u_{sNI}, u_{sNC}, u_{sIN}, u_{sIC}\} \tag{5}$$

$$u_{sCC} > \max\{u_{sII}, u_{sNN}\} \tag{6}$$

S never has superior information telling him what to do. So, he prefers to do as L is doing since L may have superior information. Furthermore, conditional on successfully mimicking L's choice, he prefers to invest cautiously.

The probability of L being optimistic is $o \in (0,1)$, of being pessimistic is $p \in (0,1)$, and the probability of being neutral is $1 - o - p$. In this model, uncertainty is only about the type of institutional investor.

This game proceeds as follows. At stage zero, Nature chooses L's type. Only L and B detect L's type. At stage one, B publishes a research report, which forecasts the direction of the market; bullish, bearish, or neutral. Each investor takes this report as a signal about the other investor's intention. Bullish means that the other investor will be choosing the demand level I, bearish means that the other investor will be choosing the demand level N, and neutral implies the demand level choice of C by the other investor. At stage 2, both S and L simultaneously choose I, C, or N. After all the actions are taken, payoffs are realized.

Regarding broker preferences, the broker has a primary preference for maintaining his credibility in the eyes of investors and a conditional preference for manipulating demand. The broker will lose credibility if he fails to correctly forecast the actions of investors.

The following inequality describes the broker's primary preference of credibility:

$$\begin{aligned}\min\{u_{III}, u_{CCC}, u_{NNN}\} > \max\{&u_{IIN}, u_{ICN}, u_{ICI}, u_{INI}.u_{CIC}, u_{CNC}, u_{NIN}, u_{NCN} \\ &u_{INN}, u_{IIC}, u_{ICC}, u_{INC}, u_{CII}, u_{CNI}, u_{CCI}, u_{CNN}, u_{CCN}, u_{CIN}, u_{NNI}, u_{NCI}, u_{NII}, u_{NIC}, u_{NCC}, u_{NNC}\}\end{aligned} \tag{7}$$

Here, u_{ICI} is the payoff to B if B signals I, S plays C, and L plays I. Other entries in the above inequality are similarly read. So, if the broker forecasts a bullish market, it would not lose credibility if both investors choose I (that would push prices up resulting in a bullish market). Similarly, if a bearish outlook is forecasted, then the credibility is preserved if both investors choose N (that would push prices down resulting in a bearish market). And if the prediction is neutral, then credibility is maintained if both investors choose C.

It is important to note that instead of expressing results in terms of demand level choices, we could as easily work with prices. All one has to do is note that since number of shares outstanding is exogenously fixed therefore fluctuations in prices are only caused by fluctuations in aggregate demand. We refrain from doing that since it would only add a layer of complexity without changing the results.

Figure 1 shows the game in extensive form.

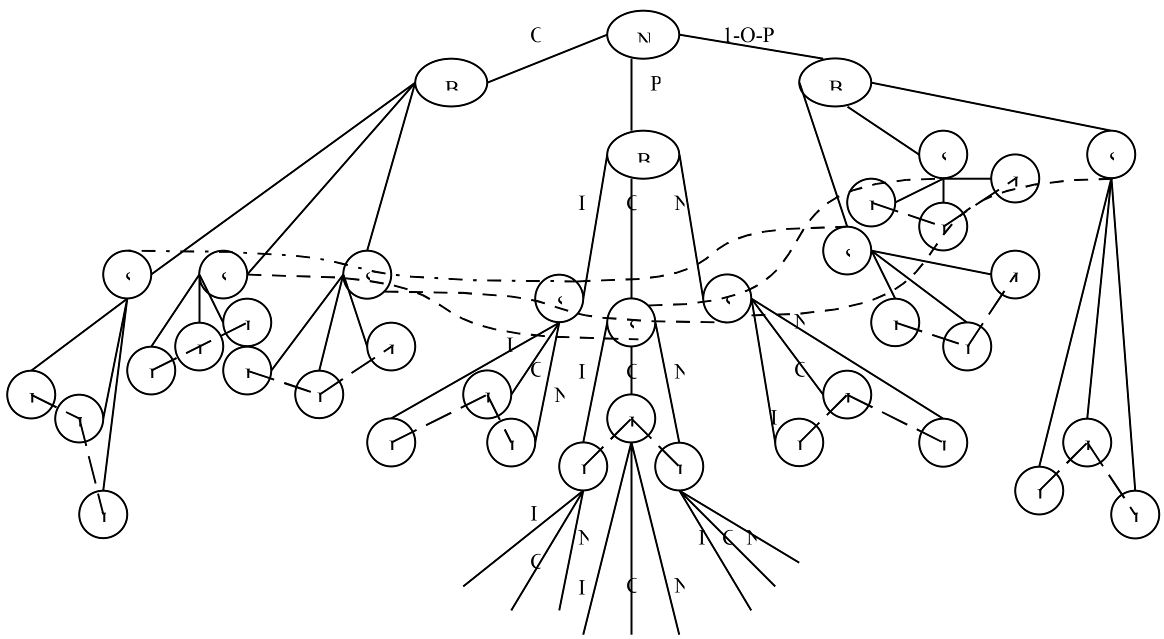

Figure 1: The coordination game in extensive form. Only the middle branch is labeled.

In the absence of B, it is easy to see that there is one pure-strategy Perfect Bayesian equilibrium if L's type is optimistic in which both S and L play I. Similarly, if L's type is pessimistic; both S and L play N in equilibrium. If L is neutral then the game in the absence of B has three pure-strategy Perfect Bayesian equilibria. They are both play I, both play C, and both play N. CC (both play C) outcome is preferred by both players. How does introducing B in this game change the outcomes? Theorem 1 provides an answer.

Theorem 1 *Pure-strategy Perfect Bayesian equilibria exist and, in the absence of superior information, the broker can manipulate equilibrium outcomes without losing credibility with respect to accurate forecasting.*

Proof. Here every pure strategy of each player is examined. L observes both the nature's move (its own type) as well as B's signal. Each type of L has 27 strategies; however, for the optimistic type 26 strategies are dominated by the strategy I since an optimistic type always prefers to play I (inequality 1). Similarly, for the pessimistic type 26 strategies are dominated by the strategy N since a pessimistic type always prefers to play N (inequality2). That leaves us with 27 undominated strategies for the neutral type of L and 1 undominated strategy each for other types of L.

B observes nature's move. B has 27 pure strategies. 24 of them are eliminated by iterated dominance since B cares about correctly forecasting the actions of L (inequality 7) and optimistic type of L always plays I and the pessimistic type of L always plays N. We are left with 3 pure strategies for B.

Next, if B signals C, and both S and L play either I or N then B would have an incentive to deviate (inequality 7) implying that a strategy combination in which B signals C, and both S and L play either I or N in response cannot be an equilibrium. By inspection, we arrive at the following pure-strategy Perfect Bayesian equilibria:

$$\begin{aligned}&[B:\{I \mid optimist, C \mid neutral, N \mid pessimist\}; S:\{I \mid I, C \mid C, N \mid N\};\\ &L(neutral):\{I \mid I, C \mid C, N \mid N\}; L(optimist):I; L(pessimist):N]\end{aligned} \qquad \text{(I)}$$

$$\begin{aligned}&[B:\{I \mid optimist, I \mid neutral, N \mid pessimist\}; S:\{I \mid I, C \mid C, N \mid N\};\\ &L(neutral):\{I \mid I, C \mid C, N \mid N\}; L(optimist):I; L(pessimist):N]\end{aligned} \qquad \text{(II)}$$

$$\begin{aligned}&[B:\{I \mid optimist, N \mid neutral, N \mid pessimist\}; S:\{I \mid I, C \mid C, N \mid N\};\\ &L(neutral):\{I \mid I, C \mid C, N \mid N\}; L(optimist):I; L(pessimist):N]\end{aligned} \qquad \text{(III)}$$

$$\begin{aligned}&[B:\{I \mid optimist, I \mid neutral, N \mid pessimist\}; S:\{I \mid I, I \mid C, N \mid N\};\\ &L(neutral):\{I \mid I, I \mid C, N \mid N\}; L(optimist):I; L(pessimist):N]\end{aligned} \qquad \text{(IV)}$$

$$\begin{aligned}&[B:\{I \mid optimist, I \mid neutral, N \mid pessimist\}; S:\{I \mid I, N \mid C, N \mid N\};\\ &L(neutral):\{I \mid I, N \mid C, N \mid N\}; L(optimist):I; L(pessimist):N]\end{aligned} \qquad \text{(V)}$$

$$[B:\{I \mid optimist, N \mid neutral, N \mid pessimist\}; S:\{I \mid I, I \mid C, N \mid N\};$$
$$L(neutral):\{I \mid I, I \mid C, N \mid N\}; L(optimist):I; L(pessimist):N] \quad \text{(VI)}$$

$$[B:\{I \mid optimist, N \mid neutral, N \mid pessimist\}; S:\{I \mid I, N \mid C, N \mid N\};$$
$$L(neutral):\{I \mid I, N \mid C, N \mid N\}; L(optimist):I; L(pessimist):N] \quad \text{(VII)}$$

Note that in all equilibria, when B signals I, both S and L play I and when B signals N, both S and L play N. In equilibrium (I), B correctly signals the type of L, and S acts in accordance with the signal. That is, if B signals I, S plays I, if B signals N, S plays N and if B signals C, S plays C. In the remaining equilibria, B incorrectly signals the type only when L is neutral. In that case, if B signals I then in the outcome both S and L play I. However, if B signals N then in the outcome both S and L play N. Hence, in the absence of superior information (when L is of neutral type) B can manipulate the equilibrium outcomes without losing credibility with respect to accurate forecasting.

■

It is easy to see how a manipulation scheme can work. Suppose L's type is neutral, that is, the institutional investor does not have superior information. Suppose that B wants the stock price to rise (B may have taken a long position on its own account), it will signal I (bullish report) and in the outcome both S and L will play I. In contrast, if B wants the stock price to fall (due to a short position), it will signal N (bearish report) and in the outcome both S and L will play N. This is consistent with Khwaja and Mian (2005), a study that uses a unique trade level dataset to show that when market intermediaries (brokers) in a Pakistani stock exchange trade on their own behalf, they earn at least 50 to 90 percentage points higher annual returns and these abnormal returns are earned at the expense of outside investors.

Brokers make money when people invest in the market. Arguably, brokers have a bias. They want more investment to come into the market. Next, we introduce this bias in the model. Specifically, conditional on successfully meeting its preference, the broker prefers an outcome in which more investment comes into the market. Consequently, another restriction is added to B's preference in addition to inequality 7:

$$u_{III} > u_{CCC} > u_{NNN} \tag{8}$$

How does this bias change equilibrium? Corollary 1 to theorem 1 provides an answer.

Corollary 1 *Pure-Strategy Perfect Bayesian equilibria exist in which, in the absence of superior information, the broker can manipulate demand to get its favorite outcome without losing credibility with respect to accurate forecasting.*

Proof. By a similar argument as given in the proof of theorem 1, we arrive at the following pure-strategy Perfect Bayesian equilibria:

$$\begin{array}{l} [B:\{I \mid optimist, I \mid neutral, N \mid pessimist\}; S:\{I \mid I, C \mid C, N \mid N\}; \\ L(neutral):\{I \mid I, C \mid C, N \mid N\}; L(optimist): I; L(pessimist): N] \end{array} \quad \text{(I)}$$

$$\begin{array}{l} [B:\{I \mid optimist, I \mid neutral, N \mid pessimist\}; S:\{I \mid I, I \mid C, N \mid N\}; \\ L(neutral):\{I \mid I, I \mid C, N \mid N\}; L(optimist): I; L(pessimist): N] \end{array} \quad \text{(II)}$$

$$\begin{array}{l} [B:\{I \mid optimist, I \mid neutral, N \mid pessimist\}; S:\{I \mid I, N \mid C, N \mid N\}; \\ L(neutral):\{I \mid I, I \mid C, N \mid N\}; L(optimist): I; L(pessimist): N] \end{array} \quad \text{(III)}$$

In these equilibria, if L's type is neutral, B always signals I and both S and L always play I in response. Hence, the broker gets its favorite outcome in the absence of superior information. The conditional preference of investors is not met.

■

Broker Competition

The basic model shows that the broker can manipulate equilibrium outcomes. What will happen if competition among brokers is introduced into the model? Will competition mitigate broker manipulation? In this section, we show that it does. Mature and emerging stock markets differ significantly along the dimension of brokerage competition. Hence, one reason for smaller anecdotal evidence of broker manipulation in mature markets may be the higher level of competition among brokers. As one example, in the Karachi Stock

Exchange (KSE), the premier exchange in Pakistan, two largest brokers practically dominate the market and have been the largest suppliers of a special mode of financing called *badla* financing. Anecdotes of manipulation in KSE have these two brokers acting in unison, practically nullifying any competition. See Khwaja and Mian (2005).

We allow broker competition in the model in the form of a second broker. In the modified model, there are 4 players; two brokers, an individual investor (S), and an institutional investor (L). At stage zero, nature chooses L's type. Only L and the two brokers, B_1 and B_2, detect L's type. At stage one, B_1 publishes a research reports which forecasts the direction of the market and is either bullish (I), bearish (N), or neutral (C). As before, this report is read by each investor as the signal about the intended demand level choice of the other investor. At stage two, B_2 also publishes a report which is similarly read by each investor. At stage 3, both S and L simultaneously choose I, C, or N. After all the actions are taken, payoffs are realized.

Regarding brokers' preferences, just like in the basic model and the broker bias model, the primary preference of the brokers is to preserve their credibility. The conditional preference of the brokers depends both on broker bias as well as broker competition. The individual investor, if it pays attention to brokers' signals, is additionally assumed to be conservative meaning that if the signals conflict than the lesser signal will be followed by the individual investor. As an example, if B_1 signals I and B_2 signals C then the individual investor, if it decides to pay attention to the signals, will act on C. The following inequalities describe relevant cases of broker competition:

<u>Severe Competition</u>

In this type of competition, each broker prefers an outcome in which its prediction holds true whereas the prediction of the other broker is wrong; even if it means that, as a result of conflicting signals from the brokers, the investors will not invest. Conditional on maintaining credibility, the following inequality describes the relevant cases for B_2:

$$\min\{u_{2ICC}, u_{2INN}, u_{2CNN}, u_{2CII}, u_{2NII}, u_{2NCC}\} > \max\{u_{2III}, u_{2CCC}, u_{2NNN}\} \qquad (10)$$

Here, u_{2ICC} is the payoff to B_2 if B_1 signals I, B_2 signals C, and the investors play C. That is, the prediction of B_2 holds true whereas the prediction of B_1 turns out to be false. Other payoffs of B_2 are read similarly. This inequality shows that if the broker moving second can choose between two types of outcomes, type 1 being outcomes in which B_2 is correct and B_1 is incorrect, and type 2 being outcomes in which both are correct, then it will choose type 1 even if it means that the investors will not invest in the market. This shows that competition is so severe that the broker is willing to sacrifice all of the potential investment by investors to prove that the other broker is wrong.

The following inequality describes the relevant cases for B_1:

$$\min\{u_{1CIC}, u_{1NIN}, u_{1NCN}, u_{1ICI}, u_{1INI}, u_{1CNC}\} > \max\{u_{1III}, u_{1CCC}, u_{1NNN}\} \tag{11}$$

Here, u_{1CIC} is the payoff to B_1 if B_1 signals C, B_2 signals I and the investors play C. That is, the prediction of B_1 holds true whereas the prediction of B_2 turns out to be false. Other payoffs are read in the same fashion.

<u>Moderate Competition</u>

In this type of competition, each broker prefers an outcome in which its own prediction turns out to be correct whereas the prediction of the other broker turns out to be incorrect provided that the investors do not entirely abstain from the market as a result of signals from the brokers. That is, each broker wants at least some investment (at least C) from the investors to remain in the market. This is in contrast with severe competition in which each broker is willing to tolerate complete abstention of the investors for the sake of being right when the other broker is wrong.
The following inequalities describe the relevant cases:

$$\min\{u_{2ICC}, u_{2CII}, u_{2NCC}, u_{2NII}\} > \max\{u_{2III}, u_{2CCC}\} \tag{12}$$

$$\min\{u_{2III}, u_{2CCC}\} > \max\{u_{2INN}, u_{2CNN}, u_{2NNN}\} \tag{13}$$

$$\min\{u_{1CIC}, u_{1ICI}, u_{1CNC}, u_{1INI}\} > \max\{u_{1III}, u_{1CCC}\} \tag{14}$$

$$\min\{u_{1III}, u_{1CCC}\} > \max\{u_{1NIN}, u_{1NCN}, u_{1NNN}\} \tag{15}$$

<u>Broker Bias</u>

The following inequalities describe the possible cases of broker bias conditional on maintaining credibility:

$$\min\{u_{1III}, u_{1ICI}, u_{1INI}\} > \max\{u_{1CIC}, u_{1CCC}, u_{1CNC}\} \tag{16}$$

$$\min\{u_{1CIC}, u_{1CCC}, u_{1CNC}\} > \max\{u_{1NIN}, u_{1NCN}, u_{1NNN}\} \tag{17}$$

$$\min\{u_{2III}, u_{2CII}, u_{2NII}\} > \max\{u_{2ICC}, u_{2CCC}, u_{2NCC}\} \tag{18}$$

$$\min\{u_{2ICC}, u_{2CCC}, u_{2NCC}\} > \max\{u_{2INN}, u_{2CNN}, u_{2NNN}\} \tag{19}$$

Here, u_{1ICI} is the payoff to B_1 if B_1 signals I, B_2 signals C, and investors plays I. Similarly, u_{2CII} is the payoff to B_2 if B_1 signals C, B_1 signals I and investors play I. These inequalities show that conditional on maintaining its credibility, each broker prefers an outcome in which more investment comes into the market.

The broker bias inequalities $u_{2III} > \max\{u_{2ICC}, u_{2NCC}\}$, $u_{2CCC} > \max\{u_{2INN}, u_{2CNN}\}$, $u_{1III} > \max\{u_{1CIC}, u_{1CNC}\}$, and $u_{1CCC} > \max\{u_{1NIN}, u_{1NCN}\}$ directly contradict the severe competition inequalities $\min\{u_{2ICC}, u_{2NCC}\} > u_{2III}$, $\min\{u_{2INN}, u_{2CNN}\} > u_{2CCC}$, $\min\{u_{1CIC}, u_{1CNC}\} > u_{1III}$, and $\min\{u_{1NIN}, u_{1NCN}\} > u_{1CCC}$. Also, the broker bias inequalities $u_{2III} > \max\{u_{2ICC}, u_{2NCC}\}$ and $u_{1III} > \max\{u_{1CIC}, u_{1CNC}\}$ directly contradict the moderate competition inequalities $\min\{u_{2ICC}, u_{2NCC}\} > u_{2III}$ and $\min\{u_{1CIC}, u_{1CNC}\} > u_{1III}$. So, there are four possible cases; competition is severe and it dominates bias, competition is moderate and it dominates bias, bias dominates severe competition, and bias dominates moderate competition. The following theorem describes the main result of this section:

Theorem 2 *If the investors are conservative, competition is moderate, and it dominates broker bias then there is a unique Pure-Strategy Perfect Bayesian* *equilibrium, in which, in the absence of superior information, investors' favorite outcome is realized.*

Proof Start by proposing the following strategy for S:

$\{I \mid II, N \mid NN, C \mid IC, C \mid CI, N \mid NI, N \mid IN, N \mid NC, N \mid CN, C \mid CC\}$

In this strategy, if both B_1 and B_2 send the same signal, I, N, or C, S plays I, N, or C respectively. However, if the signals are in conflict, lesser investment signal is followed (S is conservative). That is, if B_1 signals I but B_2 signals C then S plays C (third entry in the above set).

If L is optimistic then it always play I, if pessimistic then it always plays N. However, if L is neutral than it prefers to mimic S. Propose the following strategy for neutral L:

$\{I \mid II, N \mid NN, C \mid IC, C \mid CI, N \mid NI, N \mid IN, N \mid NC, N \mid CN, C \mid CC\}$.

In order to figure out the best response of B_1, consider the following:

B_1 has 27 possible strategies. Its primary preference of credibility eliminates 24 of them leaving only 3 strategies that are not dominated. These three strategies are:

$\{I \mid optimistic, I \mid neutral, N \mid pessimistic\}$

$\{I \mid optimistic, C \mid neutral, N \mid pessimistic\}$

$\{I \mid optimistic, N \mid neutral, N \mid pessimistic\}$

If nature picks L's type to be neutral, B_1 cannot report I since B_2 will then report C since in moderate competition $u_{2ICC} > u_{2III}$. Consequently, S and L will play C and B_1 will lose its credibility. Similarly, if L's type is neutral, B_1 cannot report N since B_2 will then report N also, resulting in both investors abstaining from the market. In moderate competition, B_1 and B_2 prefer that at least some investment (at least C) from L remains in the market. That guarantees that if B_1 signals C then B_2 will also signal C. That leaves only one possible strategy for B_1 that can be played in pure strategy equilibrium:

$\{I \mid optimistic, C \mid neutral, N \mid pessimistic\}$

Given the strategies of the other three players, the best response of B_2 is to signal C if L's type is neutral and B_1 has signaled C or I since in moderate competition $u_{2CCC} > u_{2CNN}$ and $u_{2ICC} > u_{2III}$. The best response strategy of B_2 is:

$\{I \mid optimistic\, I; N \mid pessimistic\, N, C \mid neutral\, C, C \mid neutral\, I, N \mid neutral\, N\}$

It is straightforward to see that the proposed strategies for S and L are the best responses of S and L to each other as well as to B_1 and B_2. Hence, the strategy profile considered constitutes a Nash equilibrium.

To see that this equilibrium is unique: Since brokers' primary preference is credibility, they will always report truthfully if nature chooses L's type to be either optimistic or pessimistic. That means, any strategy in which S ignores broker signals cannot be played in pure-strategy equilibrium simply because it cannot be the best response when nature picks L's type to be either optimistic or pessimistic. This observation combined with the conservative nature of investors' limits their strategy space to a singleton.

■

In this equilibrium, in the absence of superior information (when L is neutral), both the brokers signal C and the favorite outcome of the investors is realized (S and L both play C).

Corollary 1 *If bias dominates competition then, in the absence of superior information, the brokers get their favorite outcome.*

Proof If L's type is neutral, B_1 will signal I and B_2 will follow suit since when bias dominates, $u_{2III} > u_{2ICC} > u_{2INN}$ and $u_{1III} > u_{1CCC} > u_{1NNN}$. ■

Corollary 2 *If competition is severe and it dominates bias then, in the absence of superior information, both investors will abstain from investing in the market.*

Proof If L's type is neutral, it follows directly from severe competition inequalities that B_1 will signal N and B_2 will also signal N since if either broker signals anything else, it will lose its credibility. Both the investors will play N. ■

The results indicate that competition has a mitigating effect on intermediary manipulation. If competition is moderate then the most favored outcome of investors in the absence of superior information, which is to invest with caution, is realized. That is, the brokers cannot manipulate the outcome to their advantage in that case. If the competition is severe, then the investors abstain from the market in the absence of superior information. If bias dominates competition then the brokers get their favorite outcome in the absence of superior information. It is easy to extend theorems 1 and 2 to the case when broker(s) imperfectly observe L's type. Similarly, instead of brokers moving in a sequence, brokers may be allowed to move simultaneously without changing the results.

Do emerging markets differ significantly from mature markets along the dimension of competition? Indeed, they do. Many emerging markets are still not demutualized. As one example, the Karachi Stock Exchange, the premier stock exchange in Pakistan is still a mutually owned company. This mutual ownership by brokers severely limits competition apart from raising governance concerns. No wonder, broker manipulation stories abound in emerging markets and not much so in developed markets.

The above are simple microstructure models of stock price manipulation in which manipulators are in the role of intermediaries. Main findings are that an intermediary can manipulate outcomes in equilibrium without losing credibility. However, enough competition has a mitigating effect on manipulation and the investors' favorite outcome is realized. Nevertheless, if broker competition exceeds a certain threshold then, in the absence of superior information, it results in investors abstaining from the market entirely. The results indicate that encouraging broker competition may be a solution to the intermediary manipulation problem in emerging markets since competition checks broker bias. In this respect, demutualization of stock exchanges is a step in the right direction.

The results are important for three reasons. Firstly, it is an initial attempt at making sense of broker manipulation through rational economic models. Manipulation anecdotes abound, however, a model that predicts manipulation by brokers where all players are rational is lacking. Secondly, the role of competition in mitigating this type of manipulation has been highlighted. Competition among brokers reduces manipulation in these models. Thirdly, brokers make money when people invest in the market. This built in bias neutralizes competition by providing a powerful incentive for collusion, a finding with important governance implications.

Conclusion

Stock price manipulation by brokers is an issue that frequently raises its head, specially in less developed or emerging markets. However, the lack of an appropriate theoretical framework had left a number of questions unanswered thus far. In particular, Can brokers manipulate if all market participants are rational? Or, how can brokers not lose credibility if they indeed are engaged in manipulation? Presumably, loss of reputation or credibility would hamper their ability to continue manipulating. Also, what are the reasons behind fewer manipulation anecdotes emerging from the developed markets?

In this paper, we presented a simple market microstructure framework that provides an answer to these questions. Interestingly, we find that it is the brokers' concern for credibility that allows them to manipulate while maintaining credibility. Indeed, brokers can manipulate even when the investors are rational. We also find that broker level competition reduces manipulation. This last finding has important implications for corporate governance. Many of the emerging world markets are still not demutualized, that is, the exchanges are mutually owned by brokers, something that hampers broker level competition by effectively banning entry of new-comers. Our results suggest that demutualization of stock exchanges is a step in the right direction.

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