Rational Manipulation by Large Shareholders:  
The Hijacking of an Election

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Abstract

We develop a model where a manager bases value-affecting decisions on observed price patterns. This introduces the possibility of price manipulation by shareholders to induce a manager to take decisions he would not otherwise. We show that manipulation can be supported as a rational expectations equilibrium as long as there is some divergence in the objectives of the manager and shareholders, the decision is value enhancing for shareholders, and they retain an inventory in the firms stock. Providing evidence in support of manipulation is problematic because prices are forward looking making it difficult to distinguish whether prices are affecting real decisions or anticipating them. However, the Indian General Election of 2004 provides a rare opportunity. The election unexpectedly brought a new coalition into power. When the new coalition announced its leader to be the next prime minister, markets tumbled a record 11% in one day. The drop was confined only to the Indian markets and occurred in spite of abnormally low liquidity. By day-end the candidate withdrew. While supporters were dismayed, markets quickly recovered and climbed to record levels less than a year later. Apparently, through a drastic drop, markets were able to induce a change of decision that turned out to be quite favorable for business.

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Rational Manipulation by Large Stockholders: The Hijacking of an Election

The more established theory in finance is that prices reflect fundamental value of assets conditional on available information, making prices unbiased estimates of future cash flows. New information that increases expected cash flows leads to higher prices while information that decreases expected cash flows lowers prices. Thus, causation is strictly one way, from fundamentals to prices, making inference from price movements a discovery process about underlying fundamentals.

Some recent work suggests the possibility of reverse causality in that underlying fundamentals may themselves be affected by how prices move. For a financially constrained firm, higher prices (especially “bubbles”) relax its budget constraint and increase its opportunity set; while lower prices constrain its ability to make certain investments or retain critical stakeholders. Papers capturing this feedback effect include Subrahmanyam and Titman (2001), Guembel and Goldstein (2003), and Khanna and Sonti (2004). Other papers like Leland (1992) and Khanna, Slezak and Bradley (1994) focus on the signaling effect of prices. Managers are imperfectly informed and condition capacity choice on inference based on stock price levels. The higher the prices, the more likely they are to choose higher capacities.

1 The use of ‘stock currency’ was particularly noticeable during the dot.com boom. For instance, Amazon.com made over 30 acquisitions between 1998 and 2000 when its stock price was between $70 and $207, and none after its stock price tumbled. Similarly Nortel made about 20 acquisitions worth over $30 billion during a similar time period. Ninety-five percent of the acquisitions were made through stock swaps.

2 The reason for the price movement is not important for whether there is a feedback effect. Price movements for rational, irrational or behavioral reasons could all potentially impact real decisions and fundamental value.
Some recent papers empirically test for the impact of price changes on managerial decision-making. Luo (2005) finds that merging companies appear to learn from the market reaction to the merger announcement and use this information in deciding whether to close the deal. Baker, Stein, and Wurgler (2006) and Chen, Goldstein, and Jiang (2005), document that investments of companies more dependent on equity-financing are particularly sensitive to stock price fluctuations. We contribute to this literature in two significant ways. First, we argue that if prices affect investments there may be an incentive for investors to manipulate prices to induce reluctant managers to choose investments investors desire. Second, we provide an empirical example that neatly captures both the feedback effect from price movements to a real decision, and the possibility of price manipulation to ensure that decision.

In the model, manipulation occurs when an informed trader consciously trades in a manner that takes prices away from expected value given his private information. This is costly because a rational financially unconstrained market maker anticipates this behavior and sets prices at which the manipulating trader incurs a trading loss. Thus, for manipulation to occur, the trader needs to make profits elsewhere.

Advocates of investor sentiment [Neal and Wheatley (1998), Shiller (2000)] would expect the trader to make up trading losses by reversing his position during over/under reaction to his trades. However, since in our model the market maker is assumed to be financially unconstrained, prices are martingales (with respect to information inferred from trades) and the trader will be unable to recover his losses.

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[3] See also Kumar and Seppi (1992) and Allen and Gorton (1993) for additional arguments in support of price manipulation/bubbles. Khanna and Sonti models the possibility of manipulation in the presence of the feedback effect, but does not do so as a rational expectations equilibrium.
through future trades. He could, however, recover them through a value increase in his remaining inventory of the firm’s stock if the price manipulation results in the manager taking value-enhancing decisions.\(^5\) In such a framework, only value-increasing manipulation occurs.

This suggests that in the presence of the feedback effect, there are four necessary conditions for manipulation to occur: there be some divergence in the objectives of the decision maker and shareholders, the decision is value enhancing for shareholders, they retain an inventory in the firm’s stock, and the manager cares about price levels. For this paper, we assume a risk averse manager and risk neutral shareholders, and establish that manipulation occurs in equilibrium.\(^6\) If a value enhancing decision has both higher conditional mean and higher conditional variance, and if the manager’s utility is dependent on realized firm value, then he may reject some projects that risk neutral shareholder’s desire. However, if the manager is inferring information from shareholders’ trades, shareholders can influence the manager to take the value enhancing decision by optimally hiding some information through price manipulation.

Unlike most papers on market micro-structure, the role of large traders in this paper is similar to that of large stockholders as they continue to hold inventories of the firm’s stock. As such, some of the basic tradeoffs that drive our results are similar to those in large stockholder papers like Shleifer and Vishny (1986) and Hirshleifer and

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\(^5\) This too is consistent with behavioral explanation of ‘bubbles’. In fact, allowing for momentum trading would make the manipulation modeled here more frequent, since informed traders would be able to influence decisions by manipulating through smaller trades expecting momentum traders to do the rest.

\(^6\) Giving decision makers an affinity for control or personal utility from specific projects should also work. By manipulating prices, shareholders implicitly increase the cost to decision makers if they do not act as shareholders desire.
Titman (1988). In these papers, a large stockholder incurs most of the fixed cost of acquiring another firm expecting to make it up from an increase in the value of his holding either through synergy gains and/or target performance improvement. Papers like Kahn and Winton (1998) and Maug (1998) study large stockholders’ choice between liquidating their shareholding (trading strategies) and intervening to improve firm performance. Intervention can occur through boards, proxy fights, LBOs, and other mechanisms. Our paper also models large shareholder intervention except it is achieved through trading strategies and price movements. This kind of intervention is more probable when other measures are unlikely to be successful or time is of the essence.

A number of results and empirical implications emerge from our model. For instance, manipulation is more likely to be observed when:

1. The increase can be achieved without replacing existing managers, i.e., there are no meaningful agency or incompetence problems;
2. Traders hold large inventories of stock, i.e., stockholding is concentrated;
3. The quality of private information of large stockholders is high, reducing the probability of bad decisions and making expected gains from inventory larger;
4. Markets are less liquid as that allows informed traders to reveal their information to the manager more easily. This also makes exit more difficult and intervention more likely.
5. Other measures like acquisitions or proxy fights are either unlikely to succeed or unsuitable for these circumstances due to the amount of time they require for success.
We believe the Indian General Election of 2004 is a promising setting to test for the existence of such manipulation. The election was a very significant event for Indian stockholders since which party/coalition came to power could seriously impact the political and economic environment of the country and the wealth of its businesses. Party platforms were reasonably well advertised, so quality of information was probably good. India, like other third-world countries, was more likely to have concentrated stockholding. Finally, other measures like acquisitions and proxy fights were unsuitable both because of the shortness of time and because the manipulation was directed towards changing a Government’s decision, not a firm’s decision. All these factors together should make the kind of manipulation we are focusing on possible.

We document the following results. When the ruling party unexpectedly lost the election, the market reacted negatively as as the incoming government was considered much less business-friendly. However, the biggest drop in stock markets occurred over a weekend, when the identity of the new prime minister was revealed. The suggested prime minister was the most influential person in the incoming government and was widely expected to be the driving force behind the policies of the new government whether as prime minister or behind the scenes. The markets either personally disliked having this candidate as prime minister or, more likely, felt that as prime minister the candidate would be politically divisive, hurting business further. The price drop over the weekend was one of the largest in the history of Indian stock markets. It was also spread across a whole spectrum of traded firms. There was no other significant release of news that could explain this sharp market drop. Given the market already reflected the agenda of the new government, this large a drop across all markets appears to be an over-reaction
to the incremental economic damage any candidate for prime minister could do. It is consistent though, with a last ditch effort by market participants to compel the incoming government into selecting a more business-friendly candidate as prime minister. While it was too late for the business community to influence the election outcome, it was perhaps not too late to get a friendlier leader to minimize (perhaps even reduce) the potential damage.\footnote{A large price drop of this magnitude would probably have increased the incoming government’s concern that it may not be able to survive for long if it were viewed as so business-unfriendly. Even if the}

The large price decline apparently achieved the desired result. After an emergency session, the incoming government chose a different, well-known, and business friendly individual as their leader. After this announcement the markets quickly recovered the losses of the weekend. Interestingly, the Indian stock market outperformed most international indices by a substantial margin over the following year.

It is remarkable that a complex market was able to achieve this kind of coordination in such a short period of time. What is even more remarkable is that trading volume was lower than normal on the day of the largest drop. It appears the desired outcome was sufficiently critical for at least the larger traders that they, on average, did not attempt to make a quick profit by taking the other side of the trades. Also, they preferred to incur substantial short-term losses in an attempt to prevent an outcome they disliked, or more likely viewed as potentially damaging for the future of their businesses.

The remainder of the paper is organized as follows. Section I consists of a theoretical model of manipulation. Section II describes details of the Indian election process and our empirical results from examining the Indian stock market. In the paper’s last section, we offer conclusions and implications of our findings.
I. The Model

A. Information structure

The model builds on Khanna and Sonti (2004). Assume a firm owns an asset whose value, \( v \) per share, depends on both the future terminal state and the manager’s investment decision. The manager’s investment decision is influenced by the trading patterns he observes in his firm’s shares. A strong buying sequence induces the manager to expand capacity while a weak buying sequence does not. There are \textit{a priori} two equally likely states, high (\( \theta = H \)) and low (\( \theta = L \)). There are three informed traders/shareholders, \( i = 1, 2, 3 \), who trade sequentially and can either publicly buy one or sell one share. Unlike most market micro-structure papers, here informed traders are large stockholders who trade only a portion of their holding and are left with inventory, \( I \), of the stock after their buy/sell of one share. As such, they care about both their trading profits/losses and the impact of the trade on the value of their remaining inventory. Before trading, each is endowed with an independent but imperfect signal, \( s_i \), about the future state. As in Bikhchandani, et al. (1992) it has the following structure:

\[
\begin{align*}
\Pr (s_i = H | \theta) & \quad \Pr (s_i = L | \theta) \\
\theta = H & \quad q \quad 1 - q \\
\theta = L & \quad 1 - q \quad q
\end{align*}
\]

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\(^8\) Without loss of generality we could also introduce a 3rd option of no trade.
We assume \( q > 1/2 \), so that the signal is informative of the future terminal state in the sense the probability of getting an \( H \) signal when the state \( \theta = H \) is higher than getting an \( L \) signal.

Markets open for trading three times and one share is traded by a different informed trader every round. There is an unconstrained risk-neutral market maker who sets share price in each round conditional on the expected terminal value of a share, given the direction of the trade and the history of earlier trades. After trading, each trader is left holding an inventory, \( I > 0 \), of the firm’s shares. For simplicity we assume this is public information.

We initially assume the terminal firm value \( v \) is both state and trading-pattern dependent as follows. Later we show this can be fully supported in a rational expectations framework. If the sequence of trades is not all buys, the firm stays with existing capacity with \( v = 1 \) if \( \theta \) turns out to be \( H \) and \( v = 0 \) if \( \theta \) turns out to be \( L \). However, if the trading pattern is buy, buy, buy, the firm/manager responds by increasing capacity and \( v = 1 + d \) (where \( d > 0 \)) if \( \theta \) turns out to be \( H \) and \( v = -d \) if \( \theta \) turns out to be \( L \). This captures the feedback effect of prices on the firm’s investment decisions. A strong buy pattern gives a signal to the firm the market believes the probability of the \( H \) state is higher. The firm can optimally respond by increasing its capacity as in Leland (1992) and Khanna et al. (1994), or retain its network externality as in Subrahmanyam

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9 The one share trade is without loss of generality. We could also model the amount traded as a proportion of the holding. The order in which a trader trades is randomly selected. As will become obvious later, there is a disadvantage to going third. This is the opposite of most models of free riding/herding where it is beneficial to go later as you can condition on your own as well as signals of earlier traders. Here it occurs because of the trading loss the third trader may incur.

10 This is standard assumption in market making models like Kyle (1985) and Glosten and Milgrom (1985), and is equivalent to a no-arbitrage condition.

11 Doing it in this manner makes it much easier to focus on the main tradeoffs driving our results.
and Titman (2001). Given a larger capacity, shareholders do better than at the original capacity if the state turns out to be $H$, otherwise they do worse.\textsuperscript{13}

\textit{B. Equilibrium}

We restrict our attention to Bayesian Nash equilibria. A sequence of trading strategies and a belief system constitute an equilibrium if, given the belief system, no player has an incentive to deviate from the prescribed strategies. We investigate two equilibria, non-manipulating and manipulating. In a non-manipulating equilibrium, each trader trades according to his signal, buying one share if his signal is $H$ and selling one if his signal is $L$. Thus, the trading price set by the market maker is equal to the expected terminal value of the share to the trader given his private signal. In a manipulating equilibrium, a trader may choose not to trade as per his signal. He does so to get the strong buying pattern of buy, buy, buy even if his signal is $L$, and thus induce the firm to increase its capacity. Since the market maker sees only the trade and not the signal, the trading price he sets after conditioning on the possibility of manipulation and its impact on firm’s capacity, is different from the expected terminal value of the share to the manipulating trader (who knows his signal). Thus, the trader buys at a price different from the expected value of the share implied by his private signal and incurs an expected trading loss.\textsuperscript{14}

\textsuperscript{12} We could similarly write the model in terms of the pivotal trading sequence being a succession of sell, sell, sell and manager reducing capacity in a fully rational expectations model.

\textsuperscript{14} Since the prices established by the market maker are martingales, free riding on the possibility of manipulation will not be profitable for uninformed investors as this possibility is already correctly priced. Informed traders, too, would not benefit from selling if they have a low signal as the market maker would
C. Non-manipulation Equilibrium

In this equilibrium each informed trader trades according to his signal. Thus the sequence of trades fully reveals the private information of traders and the price set by the market maker each period, conditional on the trade in that period, is equal to the expected terminal value for the trader given his signal and the inference of earlier trader’s signals from their trades. For instance, $P_{-1,+1,+1}$, the price offered in the third period for a buy order, given that period one was a sell while period two was a buy is just the expected terminal value given two $H$ signals and one $L$ signal. Not surprisingly, $P_{-1,+1,+1}$ is equal to the price that would result from a single $H$ signal since the information in the earlier buy and sell trades cancels out. Thus, $P_{-1,+1,+1} = \mathbb{E}(v|s_1 = L, s_2 = H, s_3 = H) = \mathbb{E}(v|s = H)$. Since with this trading sequence there is no increase in firm capacity, $v = 1$ if $\theta$ turns out to be $H$ and $v = 0$ if $\theta$ turns out to be $L$. Using the probability structure between states and signals given earlier, $\mathbb{E}(v \mid s = H) = 1^*q + 0^*(1-q) = q$.

Other third session trading prices are similarly determined and are summarized in Table 1. Prices for the second and first sessions are derived through backward induction from third session prices. The more involved prices $P_{+1,+1,+1}$ and $P_{+1,+1}$ have been derived in the appendix.

D. Manipulation Equilibrium

As a first step we identify a potential candidate for this equilibrium and then check whether deviating from this equilibrium is a profitable strategy. We assume that traders one and two trade according to their signals, while trader three may choose to establish market clearing prices taking the same information into account. Again, there would be no trading profits. See Avery and Zemsky (1998).
manipulate prices by trading against his signal in the event the first two trades are buy, buy and his own signal is $L$.\textsuperscript{15} Again, we assume an unconstrained rational market maker who is aware of trader three’s incentive to manipulate and establishes third session prices after taking that into account. Since, in equilibrium, trader three buys with either an $L$ or $H$ signal, his trade is uninformative about his signal. Thus, the market maker establishes the third session price when the first two traders buy, buy (revealing $H$ signals) equal to the second period price after two buys. That is, $P_{+1,+1,+1} = P_{+1,+1}$. At this price, however, trader three makes expected trading losses by buying when his signal is $L$.\textsuperscript{16} For him to manipulate, he needs to make profits elsewhere. In our model he gets the profits from his inventory in the event the manipulation results in the firm taking a value increasing decision. The minimum amount of inventory that supports manipulation is where expected trading loss from trading against the signal is less than the gain on the value of inventory from inducing the firm to profitably increase capacity when it is worthwhile to do so. Table 2 gives the prices for the manipulation equilibrium and the appendix derives the expressions for $P_{+1,+1,+1}$.\textsuperscript{17} As expected, all prices except $P_{+1}$, $P_{+1,+1}$, and $P_{+1,+1,+1}$ are the same across Tables 1 and 2. These three prices differ under each scenario because of the profitability from an increase in firm capacity.

\textsuperscript{15} Assuming traders 1 and 2 do not manipulate is innocuous. The reason lies in traders being endowed with equal quality signals. Obviously, trader 1 has no history so he is better off trading according to his signal. Since trader 2 has a similar quality signal he too goes with his signal whether it is same or different from trader 1’s signal. Manipulation is profitable only if it increases the expected value of the firm. That occurs if the probability of the $H$ state occurring is strictly higher even after the trader conditions on his signal. By this reasoning only trader 3 can increase his probability of forecasting the $H$ state correctly by trading against his $L$ signal when traders 1 and 2 have revealed their $H$ signals through their buy, buy trades. Proofs can be had from the authors on request.

\textsuperscript{16} This result is similar to one derived in Avery and Zemsky. In the presence of a rational market maker, uncertainty about the state along with asymmetric information between the trader and market maker is not enough to achieve manipulation. Avery and Zemsky introduce multi-dimensional uncertainty to get manipulation. We achieve that through the feedback effect along with inventories. Introducing the feedback effect (without inventories) also does not support manipulation.
**Proposition 1:** Trader three will trade against his signal only if his trading losses are less than the expected gains on his inventory from affecting firm decisions through price manipulation. This happens only if his inventory exceeds:

\[
I^* > \frac{q^2 + 1}{d(2q-1)} - \frac{q}{q + (1-q)^2} - 1 \tag{1}
\]

Proof: In the Manipulation equilibrium, trader three is willing to buy even if \( s_3 = L \) as long as the first two traders bought implying signals of \( s_1 = H \) and \( s_2 = H \). The market maker anticipates trader three’s action and knows his buy-trade is not revealing of his signal. The market maker pools over the possibility of either \( H \) or \( L \) signal and the session three price at which trader three can buy is the same as session two’s:

\[
P_{+1,+1,+1} = P_{+1,+1} = \frac{q^2 + d(2q-1)}{q^2 + (1-q)^2} \tag{2}
\]

Since the third trader knows his signal, he also knows his expected value of the firm and this is different from the market maker’s expectation and, thus, from the trading price. If \( s_3 = H \) the investor is better off because he is buying at a price lower than his expectation of terminal value. However, if \( s_3 = L \), he expects to lose on a buy order. The expected loss depends on his expectation of terminal value after buying (manipulating) knowing his signal is \( s_3 = L \). This is:

\[
E(v_{\text{Manipulation}} \mid s_1 = s_2 = H, s_3 = L) = q + d(2q-1) \tag{3}
\]

Thus, his expected trading loss is:

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17 We lean on Cho-Kreps refinement in the event the off equilibriums sequence of trades, +1, +1, -1 is
\[ P_{s_2} = \mathbb{E}(v | s_1 = s_2 = H, s_3 = L) \]  
\[ \text{or,} \]
\[ \frac{q^2 + d(2q - 1)}{q^2 + (1-q)^2} - q - d(2q - 1) \]

For the investor to trade against his signal, he must make profits elsewhere. These come from the increased value of his inventory because the decision to increase capacity occurs when the probability that \( \theta = H \) is higher.

The gain from trading when \( s_3 = L \) if there is no manipulation means that \( d = 0 \) and,

\[ \mathbb{E}(v_{\text{No Manipulation}} | s_1 = s_2 = H, s_3 = L) = q \]

Thus, the total gains from manipulation will be:

\[ \mathbb{E}(v_{\text{Manipulation}} | s_1 = s_2 = H, s_3 = L) - \mathbb{E}(v_{\text{No Manipulation}} | s_1 = s_2 = H, s_3 = L) = d(2q - 1) \]

It follows that the gains on inventory from manipulation must outweigh the losses in order to induce the trader to herd:

\[ I^* d(2q - 1) > \frac{q^2 + d(2q - 1)}{q^2 + (1-q)^2} - q - d(2q - 1) \]

or,

\[ I^* > \frac{q^2 + 1}{d(2q - 1)} + \frac{q}{q^2 + (1-q)^2} - \frac{q}{d(2q - 1)} - 1. \]
**Proposition 2:** The optimal level of inventory $I^*$ is a decreasing function in $d$. The higher the value increase from the induced decision, the lower the level of inventory the trader needs to make the gains from his inventory exceed the losses from trading against his signal.

Proof:

$$\frac{\partial I^*}{\partial d} = \frac{-q^2}{d^2(2q-1)} + \frac{q}{q^2 + (1-q)^2} + \frac{q}{d^2(2q-1)} \quad (10)$$

For $0.5 \leq q < 1$, $\frac{\partial I^*}{\partial d}$ will be less than zero.

**Proposition 3:** $I^*$ is a decreasing function in $q$. When the quality of private information is better, it reduces the uncertainty of bad outcomes and makes expected gains from the inventory bigger.

Proof: A closed-form solution cannot be obtained. Simulated values of $q$ between 0.5 and 1 reveal that $I^*$ is decreasing in $q$.

**Proposition 4:** Since economies/firms with more concentrated share holding are more likely to see such manipulation, similar projects will be more valuable when located in such economies.

Proof: This follows from the fact that $P_{0,\text{Manipulation}} > P_{0,\text{No Manipulation}}$ for all $d > 0$. Or,

$$\frac{1}{2} + \frac{d}{2} (2q-1) > \frac{1}{2} + \frac{d}{2} \left( q^3 - (1-q)^3 \right) \quad (11)$$

Both $P_0$ prices are derived in the appendix.
E. When Managers are Risk Averse

To this point, we have exogenously assumed that firm managers will respond to a string of three buys by increasing firm capacity. However, that raises two questions. Why is it in the manager’s interest to do so? Why does the manager not respond by increasing capacity after just two buy trades rather than three since the third trade is non-informative (at least to the market maker)? While it is not unreasonable to argue that the manager may have inferior updating ability to a market maker and may not fully comprehend the implications of a third buy, we next show that even when the manager has similar updating ability, manipulating prices is optimal for traders/shareholders. All that is needed is some difference between the objective function of traders/shareholders and managers.

In the empirical test using data about the Indian election, this divergence is natural. While shareholders care about the value of their firms, the government is concerned not only about firm values but also about keeping its other constituents happy. Some of that may be achieved by increasing firm transfers at the expense of increasing firm value. However, the necessary divergence can exist also under much more common circumstances. For instance, we next show that assuming a risk averse manager and risk neutral shareholders is enough to achieve the manipulation equilibrium in a completely rational setting. We distinguish the sequence of trades such as buy, buy, sell (BBS), from the sequence of signals 

HHH, because the manager only observes trades and not the signals. The first two elements of BBS and HHL are interchangeable since only trader three manipulates and buy, buy, implies HH. However the third B could come from either an H or L signal.
In the previous section risk neutral stockholders trade to maximize expected firm value, \( E(v) \). Thus, they prefer the manager increases capacity if at least two receive \( H \) signals. A risk averse manager, though, maximizes expected utility and cares about not only expected value but also the variance of potential payoffs. Since the unconditional variance after expanding capacity is higher, a sequence of buy, buy, sell may not be enough to entice the manager to expand if conditionally higher expected returns are dominated by conditionally higher variance. However, a range of parameter spaces may still exist for which the manager may be enticed to increase capacity if trader three were to buy (instead of selling) with an \( L \) signal even if the manager knows the buy trade is uninformative about the trader’s signal. Here we use the notation \( BBB' \) with \( B' \) indicating the third trade of buy is uninformative due to possible manipulation. Thus, \( BBB' \) provides the same information as \( BB \), which has both higher conditional mean and variance than \( BBS \). Managers will increase capacity conditional on \( BBB' \) if the higher conditional mean dominates the higher conditional variance. For this space, through manipulation shareholders would be able to entice the manager to accept the value increasing expansion, which he would not have without manipulation. Specifically, we represent the manager’s expected utility function as:

\[
EU(v) = E(v) - \frac{1}{2} A \sigma^2(v) \tag{12}
\]

where \( A \) equals the managers degree of risk aversion.\textsuperscript{18}

There are four scenarios we need to analyze. The first two scenarios occur after a signal sequence of \( HHL \), where we assume manipulation is not possible. First, we need to determine expected value and expected utility when trades are \( BBS \) (no manipulation)
and the manager chooses to increase capacity. Second, we need to determine expected value and expected utility when trades are BBS (no manipulation) and the manager chooses not to increase capacity. This will allow us to identify parameter spaces where the manager will not expand in response to this trading sequence.

For the third and fourth scenario, we investigate the manager’s behavior after a signal sequence of HH, where manipulation is possible. We are interested in whether there are subsets in these parameter spaces where the manager can be induced to increase capacity if trader three manipulates by buying instead of selling. In other words, is it possible the manager will expand capacity after a BBB' (possible manipulation) sequence of trades but will not after a BBS (no manipulation) sequence.

Recall, with BBS the expected terminal value when the manager increases capacity is equal to \(-d\) with probability \(1 - q\) and equal to \(1 + d\) with probability \(q\). Thus for the first scenario with BBS and increased capacity, the manager’s expected utility is:

\[
EU(v) = q - d + 2dq - \frac{1}{2} A (1 + 2d)^2 q (1-q)
\]

For the second scenario, with BBS and no increase in capacity, the terminal value equals 0 with probability \(1 - q\) and 1 with probability \(q\); and the manager’s expected utility is:

\[
EU(v) = q - \frac{1}{2} A q (1-q).
\]

It is easy to show that for high enough risk aversion, the second scenario dominates. Shortly, we provide a numerical example that shows this happens at quite small \(A\).

**Proposition 5:** Given trading sequence BBS, the manager will choose not to increase capacity if:

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\(^{18}\) We could explicitly introduce \(\alpha\) to represent managerial ownership. However, since we are comparing across different scenarios, doing so will not change the conclusions of the paper. The only constraint we
\[ A > \frac{2q - 1}{2q(1 - q)(1 + d)} \]  

(15)

Proof: This follows from calculating the level \( A \) such that equation (14) > equation (13).

**Proposition 6:** Given trading sequence BBS, the level of risk aversion \( A \) above which the manager chooses not to increase capacity is decreasing in \( d \) and increasing in \( q \).

Proof:

\[
\frac{\partial A}{\partial d} = \frac{1 - 2q}{(1 + d)^2 2q(1 - q)} \tag{16}
\]

For values \( 0.5 \leq q < 1 \) and \( d > 0 \), \( \frac{\partial A}{\partial d} < 0 \).

\[
\frac{\partial A}{\partial q} = \frac{(1 - 2q)^2}{(1 + d)2q^2(1 - q)^2} + \frac{1}{q(l - q)(l + d)} \tag{17}
\]

For values \( 0.5 \leq q < 1 \) and \( d > 0 \), \( \frac{\partial A}{\partial q} > 0 \).

Next, we consider the third and fourth scenario of signal sequence HH (and thus a buying sequence of BB), and the manager choosing to increase or not increase capacity. Here, since the third trade is uninformative for the manager, he bases his expectation of terminal value solely on the signals implied by the first two trades, i.e., HH. Thus, the terminal value of a share when he increases capacity is \(-d\) with probability \( \frac{(1-q)^2}{q^2 + (1-q)^2} \) and \(1 + d\) with probability \( \frac{q^2}{q^2 + (1-q)^2} \), leading to an expected utility of:

need is the manager does not trade his shares.
$$EU(x) = \frac{q^2 + d(2q-1)}{q^2 + (1-q)^2} - \frac{1}{2} A \left[ \left( \frac{q(1-q)(1+2d)}{q^2 + (1-q)^2} \right)^2 \right].$$ \hfill (18)

If the manager chooses not to increase capacity, his utility is simply:

$$EU(x) = \frac{q^2}{q^2 + (1-q)^2} - \frac{1}{2} A \left[ \left( \frac{q(1-q)}{q^2 + (1-q)^2} \right)^2 \right].$$ \hfill (19)

**Proposition 7:** Given trading sequence BB, the manager will choose not to increase capacity if:

$$A > \frac{2q-1}{2q(1-q)(1+d)} \left[ \frac{q^2 + (1-q)^2}{q(1-q)} \right]$$ \hfill (20)

Proof: This follows from calculating the level $A$ such that equation (19) > equation (18).

**Proposition 8:** By manipulating, shareholders are able to induce managers with higher degrees of risk aversion to accept value improving investments.

Proof: Without manipulating, managers will accept new investment (expansion) when they observe BBS as long as their degree of risk aversion satisfies $A < \frac{2q-1}{2q(1-q)(1+d)}$, as given in Proposition 5. But with manipulation, managers will accept expansion when they observe trades BBB (as they never observe BBS), as long as their degree of risk aversion satisfies $A < \frac{2q-1}{2q(1-q)(1+d)} \left[ \frac{q^2 + (1-q)^2}{q(1-q)} \right]$ as given in Proposition 7. It is easy.
to show that \[ \frac{q^2 + (1-q)^2}{q(1-q)} \geq 2. \] Thus, for a given \( q \) and \( d \), managers who are twice as risk averse will accept value increasing investments with manipulation versus without.

**Proposition 9:** By manipulating, shareholders are able to induce risk averse managers to accept value improving investments for lower quality information \( q \) about future outcomes.

Proof: Follows from proof of Proposition 8.

**Proposition 10:** Given \( A \) and \( q \), the gains from manipulation are decreasing in \( d \).

Proof: Here we calculate the difference between the expressions in Propositions 5 and 7. Subtracting equation (15) from equation (20) yields a difference function of:

\[ \frac{2q - 1}{2q(1-q)(1+d)} \left[ \frac{q^2 + (1-q)^2}{q(1-q)} - 1 \right] \]

Calculating the derivative of this function with respect to \( d \) yields:

\[ (-1) \frac{2q - 1}{2q(1-q)(1+d)^2} \left[ \frac{q^2 + (1-q)^2}{q(1-q)} - 1 \right] \]

Because \( q > 0.5 \), this derivative is negative, implying that an increase in \( d \) will actually reduce the value of manipulation. The intuition here comes from decomposing the effect of \( d \) on both the expected value and variance portion of the manager’s expected utility. The expected value portion of the manager’s utility increases at a smaller rate in the no manipulation case than in the manipulation case. However, an increase in \( d \) gives rise to a larger rate of increase in the variance portion of the manager’s utility under
manipulation than under no manipulation. The variance effect dominates the mean effect.

Figure 1 shows the interplay between the manager’s risk aversion $A$, the quality of information $q$, and the expansion size $d$. Risk averse managers take the decision desired by risk neutral shareholders for parameter spaces to the right of each surface shown. Since the manipulation surface lies to the left of the no manipulation surface, managers with higher degree of risk aversion will take the decisions desired by shareholders when there is manipulation. Thus, shareholders are better off by manipulating prices in the parameter space between the two surfaces. For instance, for $q=.7$, managers with risk aversion of over 2.2 would accept the shareholder’s desired decision in the presence of manipulation, while without it only managers with risk aversion of less than 1 would. In other words, given $q$ and $d$, managers in the manipulation setting will take value increasing decisions for larger levels of risk aversion as compared to the no manipulation setting.

II. Empirical Evidence from the Indian Stock Market

We next turn to an examination of the Indian stock market around the time of the election. First, we describe the setting and relevant details of the election process itself. Next, we examine stock market returns both pre- and post the general election.

The Indian elections were called a few months early, before the term officially ended. The ruling coalition, National Democratic Party (NDP), expected to significantly increase its strength in the new parliament. This optimism was based on an enviable economic record with annual GDP growth rates hovering around 8% and exceptionally
good relations with its persistent enemy and neighbor, Pakistan. Also, Atal Bihari Vajpayee, Prime Minister and leader of the major party in the ruling coalition, BJP, was projected by polls to be by far the most admired leader cross-sectionally.

All early polls projected a runaway victory for the ruling coalition. The opposition consisting of the Congress party and its allies, bruised in the previous election, was expected to shrink further. The opposition coalition, named Democratic Progressive Alliance (DPA), and was led by Sonia Gandhi, Italian-born widow of a previous Prime Minister, Rajiv Gandhi. She was known to be working hard to mobilize the opposition’s base, but was not considered a serious threat because of her foreign birth. Even though she had acquired Indian citizenship as far back as 1983, the common view was she would not be embraced by the Indian masses. In addition, the DPA platform was more socialistic and anti-business. This was not seen as a popular platform. Pre-election polls showed 51% of the electorate favoring Vajpayee to 28% for Gandhi.

However, the final results declared before the market opening on Friday, May 14th, surprised all pundits. Not only did the NDA lose its majority in Parliament, but its largest party, BJP, got fewer seats than the congress party, making that party the one likely to be invited by the Indian President to form the next ruling coalition. The poorer masses of the country had voted for the more socialistic agenda of the Congress party and its allies. The allies were well known and included the Communist Party of India.

The market reaction was swift and steep, dropping 6%, when the markets closed on Friday, May 14th. Figure 2 provides a timeline of market movements in relation to Sonia Gandhi’s prime minister candidacy. Figure 3 shows the daily market returns and volume traded for the Sensex or BSE 30 index. This is an index from the Bombay Stock
Exchange that tracks 30 large, liquid firms across many different industries. The same size market declines can be found in Figures 3a, 3b and 3c that track other Indian market indices. Figure 3a gives returns for the S&P Nifty Index that is comprised of 50 large, liquid stocks across 25 different sectors. It accounts for 56% of the total market capitalization of the Indian market. Figure 3b contains data from the S&P Nifty Junior Index that consists of the next 50 stocks after the main Nifty Index. These are stocks that are also, large, liquid, and spread across many sectors. The Nifty Index dropped 8% and the Nifty Junior dropped 11% on May 14th. Finally, we include a third index, the S&P Midcap 200 Index, in Figure 3c. It is a market-value weighted index of 200 mid-capitalization stocks, and its returns are similar in magnitude to the S&P Nifty Index.

After the market closed on May 14th, as anticipated by most, Sonia Gandhi was unanimously elected as the congress party leader, which de-facto made her DPA’s candidate for Prime Minister. There were extraordinary emotional outbursts both in support as well as in opposition. On Saturday the 15th she decided to accept the candidacy and the Associated Press made this press release. “Gandhi is almost certain to become the fourth member of the Nehru-Gandhi dynasty to lead India at the head of the party . . . She is expected to ask President A.P.J. Abdul Kalam in a few days for permission to form a new government. After that formality Kalam would swear her in so she can prove her majority in a confidence vote in Parliament.”

Apparently, the market did not appreciate her becoming PM and reacted extremely negatively when it opened on Monday, May 15th. The Sensex return on that Monday (-11%) was almost twice as bad as on the previous Friday. The market-wide
drop was once again widespread – across all industries, all sizes of firms, and all stock. The Nifty Index and the Nifty Junior Index both lost another 12%.

In Table 3, we explore volume changes on the days surrounding the election results, and compare them with average volume changes on a sample of control days. Specifically, we calculate the average daily volume over a control period of July 14, 2003 through March 31, 2004. Over this 180-day period, average volume for the five largest Sensex return days was 36,370 shares traded. Average volume on the five largest negative Sensex return days was 41,440. Note that the May 14th market drop of -6% is accompanied by higher than average volume (7,960 more shares), but the largest market drop of -11% on May 17th is actually accompanied by lower than average daily volume (7,440 fewer shares). During market trading in the first day after it was announced Sonia would become PM, the market drop of -11% was accompanied by 18% less volume, or more than one standard deviation less volume as compared to our control period. Additionally, the trading volume of 34,000 on May 17th is smaller than the volume on every one of the five largest negative return days over the control sample.

It is hard to argue there was some other event that caused such a drop. DPA’s party platform was well known and expected to remain the same no matter who headed the coalition, except for minor changes in emphasis. The coalition members were well known before the outcome (because of various alliances entered into so members of the coalition did not contest seats against each other). After the election, all coalition members appeared comfortable (at least publicly) letting Gandhi be PM. There was no news of a holdout or arm-twisting which affected the ability of DPA to govern under her. The Congress Party, which she headed, was by far the largest party in the coalition
making it unlikely any other party would get the Prime Ministership, and she was the undisputed head of that party.

The sharp loss in the value of the stock market sent the Congress Party into an emergency session, and on May 18th Sonia Gandhi “stunned” India by announcing that she had refused the offer to become the Prime Minister. There was much consternation as well as celebration. The market rebounded with an 8% return for the Sensex on the following day, once it was announced that Sonia Gandhi had refused the offer of prime minister. The Nifty and Nifty Junior Indices gained 8% and 9%, respectively, on the same day. The Sensex recovered a further 3% on May 19th, coming close to where it had been on the previous Friday’s close. On this day it was announced that Manmohan Singh, the architect of Indian prosperity under a previous Congress government, would likely be PM. The market seemed to have achieved its desired outcome.

We now turn to a discussion of events in India during the year following the election. Sonia Gandhi was elected president of the Congress Party (one of the many parties that made up the entire DPA coalition). News reports began to report that Ghandi, and not the official Prime Minister Manmohan Singh, was the one making major decisions. In August 2004 the Times of India reported, “UPA chairperson Sonia Gandhi is the best informed person about what is happening in the Manmohan Singh government...Ministers, especially those of the Congress variety, know who is the ‘boss’.” In March 2005 the Times of India reported that Gandhi continued to make important decisions. Most recently, she selected a new chief minister for the state of Bihar. However, there were no extreme price drops in the Indian market when these news articles appeared discussing her evident power in comparison to Singh. The largest
market decline on May 17th seems to be driven mainly by a strong dislike by the markets of Ghandi as PM. Whether this dislike was driven from a personal disdain for Gandhi and her background, or from a fear of her impact on the Indian economy is an interesting question. We turn to an analysis of long-run returns to try to answer it.

We measure one-year stock returns, covering the period from April 2004 to March 2005. We start in April 2004 because the market had started to decline even before the general election was over. Intermediate opinion polls had projected there was a possibility that the DPA coalition could win, and the market suffered small declines on this news even in April. However, the outcome was obvious by the morning of May 14th and the markets should have reflected most of this information by the 14th close. The only new (though not unexpected) piece of information to come out over that weekend was Gandhi’s formal selection as the future Prime Minister. Though this was not expected to affect the policies of the incoming government, the market dropped another 11%.

Given the market recovered within just two days of Gandhi refusing the offer of PM, suggests this drop was orchestrated with the sole intent of achieving this. Also, given the 11% Monday drop came separately from the 6% Friday drop is consistent with the Friday drop representing the business communities concerns with the incoming government’s policies (something that was now done), and the 11% drop as a strong signal about the market’s dislike of Gandhi as PM (something that could still be affected). It is also consistent with the Friday 6% drop being a first attempt to encourage Mrs. Gandhi to withdraw, and the 11% as a dramatic second attempt to achieve the same.

In either case market traders appear to have voluntarily incurred substantial trading losses
to force Gandhi to withdraw. Some if not all of it was achieved through trades much below fundamentals. Was it personal or business? Long-run returns on trader inventories may be one way to measure if traders later benefited from trading against fundamentals in those first two days after the election.

Figure 4a gives the monthly returns for the Indian Sensex Index, the U.S. S&P 500, and the MSCI World Equity Index. The world index consists of 23 developed market country indices, including Germany, Hong Kong, Japan, the U.K., and the U.S. Note that the Sensex returns drop dramatically (-16%) in the election month of May, while the S&P returns decline by only 2%. The world equity index actually increased 0.7% during this same month. This implies that the May returns in India were not driven by some global macroeconomic shock. It was a country-specific event.

Figure 5b charts the cumulative total returns to the same three indexes, also from April 2004 through March 2005. The Indian market has outperformed both of the benchmark indices over this past year, with a cumulative return of 16% versus a 5% return for the S&P 500 and an 8% return for the world index. This is even more remarkable given the large negative return the Indian market sustained in May in comparison to the S&P 500 and the MSCI World Index. The Indian market has certainly prospered since enduring some of the largest market declines in their stock market history in May 2004. If traders maintained sufficient inventories after selling some of their holdings at a substantial loss during the two eventful trading days in May, they would have recouped more than their losses within a year.

III. Conclusion and Discussion
We present a rational model of price manipulation in which traders willingly manipulate prices in an attempt to influence decisions that feedback into fundamental value. They recover the losses from manipulation through an increase in the value of their remaining share holding. This comes about if the resulting decision increases fundamental value. The model provides guidance about conditions which make it more likely to observe such value-enhancing manipulation. The Indian General Election of 2004 provided a rare candidate for such a test.

The election unexpectedly brought a new coalition into power. This outcome was fully known on a Friday morning and the stock market adjusted. Over the weekend, the identity of the future prime minister was revealed. The candidate, though controversial, was not a surprise. Neither was her selection expected to impact the policies of the new government. On Monday morning, though, stock markets registered their biggest single day drop, with smaller volume than on surrounding trading days. The drop was confined only to the Indian markets. By the end of the day the candidate withdrew in favor of a more acceptable alternative. Her supporters were dismayed. The markets, though, quickly recovered and continued to climb to record levels less than a year later. Apparently, through a drastic drop, markets were able to induce a change of decision that turned out to be quite favorable for business.

An interesting question we cannot answer is whether Gandhi gave in too quickly. It is questionable whether the market would have been able to continue applying such pressure for an extended period of time. If she had delayed her decision to step down by a week, the market may have returned to a more realistic (even if lower) level and she would probably be PM.
Another question is whether markets would have the kind of ex-post gains if Gandhi had become PM. Her stepping down signaled at least two things. She was not desperate to become PM at any cost; and the new government took signals from the business community seriously. Both suggested the new government was likely to work in partnership with business and this signal probably caused some of the post-election gains.
Proofs for Prices in Table 1

Without manipulation, each trader trades according to his signal. This implies he will buy one share if his signal is $H$ or sell one share if his signal is $L$. A trade sequence of $+1$, $+1$, $+1$, implies that each trader has a high signal. The price $P_{+1,+1,+1}$ simply reflects the expected value $v$ of the firm given three $H$ signals. Firm value $v = 1 + d$ if $\theta = H$ and $-d$ if $\theta = L$.

$$E(v|s_1 = s_2 = s_3 = H) = (1 + d) \Pr(\theta = H|s_1 = s_2 = s_3 = H) - d \Pr(\theta = L|s_1 = s_2 = s_3 = H)$$

By Bayes’ Theorem,

$$\Pr(\theta = H|s_1 = s_2 = s_3 = H) = \frac{\Pr(s_1 = s_2 = s_3 = H|\theta = H) \Pr(\theta = H)}{\Pr(s_1 = s_2 = s_3 = H)} = \frac{q^3}{q^3 + (1-q)^3}.$$ 

Similarly,

$$\Pr(\theta = L|s_1 = s_2 = s_3 = H) = \frac{(1-q)^3}{q^3 + (1-q)^3}.$$ 

Thus,

$$E(v|s_1 = s_2 = s_3 = H) = \frac{q^3}{q^3 + (1-q)^3} + \frac{d(q^3 - (1-q)^3)}{q^3 + (1-q)^3}.$$ 

Now we turn to $P_{+1,+1}$. The market maker will form prices in the following manner:

$$P_{+1,+1} = P_{+1,+1,+1} \Pr(s_3 = H|s_1 = s_2 = H) + P_{+1,+1,-1} \Pr(s_3 = L|s_1 = s_2 = H).$$ 

Since the
\[
\Pr(s_3 = H|s_1 = s_2 = H) = \frac{q^3}{q^2 + (1-q)^2} + \frac{(1-q)^3}{q^2 + (1-q)^2},
\]
and the
\[
\Pr(s_3 = L|s_1 = s_2 = H) = \frac{q^2(1-q)}{q^2 + (1-q)^2} + \frac{(1-q)^2 q}{q^2 + (1-q)^2},
\]
we have \( P_{+1,+1} = \frac{q^2 + d(q^3 - (1-q)^3)}{q^2 + (1-q)^2} \).

For period one prices, we have:
\[
P_{+1} = P_{+1,+1} \Pr(s_2 = H|s_1 = H) + P_{+1,-1} \Pr(s_2 = L|s_1 = H) = q + d(q^3 - (1-q)^3)
\]
Finally,
\[
P_{0,\text{NoManipulation}} = \frac{1}{2} P_{+1} + \frac{1}{2} P_{-1} = \frac{1}{2} + \frac{d}{2} \left(q^3 - (1-q)^3\right).
\]

Deriving the prices for the other sequences of trades in Table 1 is a straightforward process.

Proofs for Prices in Table 2:

With manipulation, it is easy to show that the first and second traders do not trade against their signal. They do not increase their probability of being correct about the underlying state. However, when the first two traders buy, thereby revealing their \( H \) signals, the third trader can increase his probability of being right by also buying when his signal is just \( L \). This implies that under the manipulation equilibrium, the third trader buys independent of his signal. His trade will be non-informative about what his signal is, and \( P_{+1,+1,+1} = P_{+1,+1} \). We then have,
For period one prices we have:

\[E(v|s_1 = s_2 = H) = (1 + d) \Pr(\theta = H|s_1 = s_2 = ) - d \Pr(\theta = L|s_1 = s_2 = )\]

\[= (1 + d) \frac{q^2}{q^2 + (1-q)^2} - d \frac{(1-q)^2}{q^2 + (1-q)^2}\]

\[= \frac{q^2 + d(2q-1)}{q^2 + (1-q)^2}\]

For period zero,

\[P_{0,+1} = P_{+1,+1} \Pr(s_2 = H|s_1 = H) + P_{+1,-1} \Pr(s_2 = L|s_1 = H)\]

\[= q + d(2q-1)\]

For period zero,

\[P_{0,\text{Manipulation}} = \frac{1}{2} P_{+1} + \frac{1}{2} P_{-1} = \frac{1}{2} + \frac{d}{2} (2q-1)\].

Deriving the prices for the other sequences of trades in Table 2 is a straightforward process.
REFERENCES


Table 1
Prices under No Manipulation

Prices in 3\textsuperscript{rd} Period:

\[ P_{+1,+1,+1} = \frac{q^3}{q^3 + (1-q)^3} + \frac{d(q^3 - (1-q)^3)}{q^3 + (1-q)^3} \]
\[ P_{-1,-1,-1} = \frac{(1-q)^3}{q^3 + (1-q)^3} \]

\[ P_{+1,+1,-1} = q \]
\[ P_{-1,+1,-1} = 1 - q \]
\[ P_{+1,-1,+1} = \frac{1}{2} \]
\[ P_{-1,+1,+1} = \frac{1}{2} \]

Prices at time \( t = 0 \):

\[ P_0 = \frac{1}{2} + \frac{d}{2} (q^3 - (1-q)^3) \]
Table 2
Prices under Manipulation

Prices in 3rd Period:

\[ P_{+1,+1} = \frac{q^2 + d(2q - 1)}{q^2 + (1 - q)^2} \quad \quad P_{-1,-1} = \frac{(1-q)^3}{q^3 + (1-q)^3} \]

\[ P_{+1,-1} = q \quad \quad P_{-1,+1} = 1 - q \]

\[ P_{+1,0} = q \quad \quad P_{-1,0} = 1 - q \]

\[ P_{+1,-1} = 1 - q \quad \quad P_{-1,+1} = q \]

Prices in 2nd Period:

\[ P_{+1} = \frac{q^2 + d(2q - 1)}{q^2 + (1 - q)^2} \quad \quad P_{-1} = \frac{(1-q)^2}{q^2 + (1-q)^2} \]

\[ P_{+1} = \frac{1}{2} \quad \quad P_{-1} = \frac{1}{2} \]

Prices in 1st Period:

\[ P_{+1} = q + d(2q - 1) \]

\[ P_{-1} = 1 - q \]

Prices at time \( t = 0 \):

\[ P_0 = \frac{1}{2} + \frac{d}{2}(2q - 1) \]
Table 3  
Daily Volume

Panel A: Summary statistics on daily volume over control period

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<thead>
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<th>Value</th>
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<tr>
<td>Median</td>
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<td>Standard Deviation</td>
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<tr>
<td>Maximum</td>
<td>51,200</td>
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<td>N</td>
<td>180 days</td>
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Panel B: Daily volume for large return days and sample period

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<th>Negative Return Days</th>
<th>Positive Return Days</th>
<th>Sample Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Vol.</td>
<td>Ret. %</td>
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<td>-------</td>
<td>--------</td>
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<td>3/15 2004</td>
<td>38,400</td>
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<td>1/22 2004</td>
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<td>1/21 2004</td>
<td>43,200</td>
<td>-2.77</td>
</tr>
<tr>
<td>Mean</td>
<td>41,440</td>
<td>-2.91</td>
</tr>
</tbody>
</table>

This table uses the Sensex/BSE 30 index as the source data for stock market returns and volume. The Sensex is an index from the Bombay Stock Exchange that includes 30 companies traded on that exchange. The companies are selected based on high liquidity, large market capitalizations, and balanced industry representation. The control period uses Sensex data from July 14, 2003 through March 31, 2004.
Figure 1: Manager’s Risk Aversion as a Function of Information Quality and Expansion Size

The graph plots surfaces above which managers accept expansion, in the quality of information, $q$, size of expansion, $d$, and co-efficient of risk aversion, $A$, spaces. The surface above and to the right represents the upper bound on $A$ below which the manager accepts expansion without manipulation. The lower surface represents the upper bound on $A$ below which manager accepts expansion with manipulation. Manipulation is value enhancing for the parameter space between the two surfaces.
Figure 2: Timeline of Market Movements and Indian Election Events

This figure uses the Sensex/BSE 30 index as the source data for stock market returns. The Sensex is an index from the Bombay Stock Exchange that includes 30 companies traded on that exchange. The companies are selected based on high liquidity, large market capitalizations, and balanced industry representation.
Figure 3: Bombay Stock Exchange Index Returns and Volume

This figure uses the Sensex/BSE 30 index as the source data for stock market returns. The bar graph shows the volume of shares traded each day, and the line graph gives the corresponding daily market return. The Sensex is an index from the Bombay Stock Exchange that includes 30 companies traded on that exchange. The companies are selected based on high liquidity, large market capitalizations, and balanced industry representation.
These figures use the S&P Indian market index returns. Figure 2a shows the returns for the S&P Nifty index which includes 50 large, liquid stocks across 25 sectors. It represents 56% of the total market capitalization of the Indian market. Figure 2b uses the S&P Nifty Junior index which comprises the next best 50 stocks on the matching criteria after the original Nifty index stocks. Figure 2c gives the S&P Midcap 200 – a value-weighted index of mid-capitalization stocks.
These figures use the Indian Sensex Index, the U.S. S&P 500, and the MSCI World Equity Index. The Sensex is an index from the Bombay Stock Exchange that includes 30 companies traded on that exchange. The companies are selected based on high liquidity, large market capitalizations, and balanced industry representation. The MSCI world equity index is formed from the market indices of 23 developed countries, including Germany, Hong Kong, Japan, the U.K., and the U.S.