DAVID AND GOLIATH: DISPLACING A PRIMARY MARKET

HOW THE START-UP NATIONAL STOCK EXCHANGE SURPASSED INDIA'S LARGEST STOCK MARKET, THE BOMBAY STOCK EXCHANGE, IN ONLY ONE YEAR.

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When a liquid market exists for some security, an attempt to create another market for that same security tends not to do well. There is a "natural monopoly" character to a market that has entrenched liquidity. When a second market tries to compete with the first, it is difficult to attract away the order flow. From the viewpoint of a market user, the second market is illiquid on the day that operations commence, so it is efficient to continue sending orders to the entrenched market. If this happens, the second market is illiquid, and this illiquidity deters further orders.

These arguments are consistent with empirical experience. Internationally, second markets have had difficulty displacing the liquidity of an entrenched market. For example, the Chicago Board of Trade (CBOT) and New York Futures Exchange (NYFE) failed to take away market share or liquidity from the main stock index futures product of the United States, which is the Standard & Poor's (S&P) 500 at the Chicago Mercantile Exchange (CME). Similarly, the U.S. equity market has been dominated by the New York Stock Exchange (NYSE); alternative trading venues for NYSE-listed stocks have been unable to displace the NYSE as the most liquid stock market in the United States.

Debates about the natural monopoly of an entrenched securities exchange have significant implications for public policy. If an entrenched exchange is earning a rent on a monopoly, then there may be a case for antitrust actions, which diminish the costs to society. On the other hand, if the exchange industry is contestable and profits are hence kept in check, then the status quo may be acceptable.

In this article, we document one remarkable experience in which the second

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market was able to displace the entrenched liquidity of the first market. As of 1994, the Bombay Stock Exchange (BSE) was India's dominant stock market. It accounted for around 75% of the equity trading volume in India and dominated the public imagination.

In November 1994, a new market, the National Stock Exchange (NSE), opened for business. The new NSE was only a taxi ride away from the BSE (so naturally both exchanges were in the same time zone) and was competing for order flow in all of the same stocks. It took only one year for the NSE to surpass the BSE and become India's largest stock market.

This was a remarkable experience by world standards. The success of the NSE is in sharp contrast with the disappointing experiences that are conventionally observed; in other words, new markets are generally unable to displace entrenched markets. It is hence especially instructive to understand the combination of factors that were at work.

In this article, we take a closer look at this phenomenon, which gives many insights into the issues associated with a natural monopoly in financial markets. This experience is also of interest to international investors who trade in India's equity market, as the NSE is now India's main equity market.

THE STATUS QUO BEFORE THE NSE

Prior to the NSE, the equity market in India had three elements: the Bombay Stock Exchange (BSE), 20 smaller regional stock exchanges, and the Over-the-Counter Exchange of India (OTCEI). Of these, the BSE dominated. It typically accounted for 75% of the total trading volume of the country. It also dominated in terms of public visibility and its role in price discovery. For the most part, India's equity market was synonymous with the BSE.

The BSE and all major financial institutions were located in Bombay. In an environment where telecommunications infrastructure was primitive, this implied that the institutional order flow almost exclusively went to the BSE. The BSE has existed since the late nineteenth century, and the major institutional investors have existed since the 1960s, so there were close relationships between institutional investors and BSE member firms.

India's securities regulator, the Securities and Exchange Board of India (SEBI), was created in 1988 and only acquired legal standing in 1993. Hence, throughout the preceding decades, the BSE operated as an unregulated market. In this environment, a variety of murky market practices became prevalent on the BSE. These problems may be summarized as follows:

1. The exchange imposed entry barriers on new members, which led to high brokerage fees.
2. The non-transparency of floor trading led to a variety of other procedures through which BSE members cheated customers.
3. The location of the physical floor in Bombay and the lack of telecommunications infrastructure in India led to a concentration of the equity market in Bombay. Economic agents outside Bombay faced much higher transactions costs in accessing the market, owing to the layers of intermediation involved.
4. There was no formal approach toward risk containment in the settlement process. "Account period" settlement was used, which was like a futures market in that trades over a certain range of days were netted on a future expiration date to generate settlement obligations. As with futures markets, this allowed trading to be highly leveraged. However, there were no margins or a formal institutional apparatus for risk containment. The leverage was exacerbated by a market practice called *badla,* which allowed positions to be rolled from one settlement period to another. The market collapsed into a "payments crisis" from time to time, and exchange elders resolved these crises through negotiations and coalition formation.
5. Market manipulation was common and the BSE made no attempt to curb it.

6. There were serious conflicts of interest in terms of governance structures. The exchange was owned and run by the BSE members. The BSE members carried out the limited enforcement efforts of the exchange. If an investor had a complaint against a BSE member, the dispute would be judged by other BSE members. Few complaints were resolved in favor of investors.
7. The institutional investors in India are largely government-owned financial institutions, banks, and foreign banks. They had poor mechanisms for controlling the principal-agent problems that affected their employees. Hence, employees of institutional investors often collaborated with BSE members in a variety of schemes that profited themselves and the BSE members at the expense of their employers. These ranged from kickbacks for order flow to front running to the use of institutional assets for manipulative schemes that were run by BSE members. The employees of institutional investors and BSE members formed a close-knit community.[1]

The problems of the BSE listed above had been present for decades; however, they gained prominence in the context of the "Scam of 1992," which involved a 250% run-up of the stock market oiled by illegal leverage and bribes to banks and brokerages.[2] Prominent BSE members with close ties to institutional investors were highly visible as perpetrators of the scam. The scam gave fresh impetus to the voices that had long argued for radical change in India's equity market and hence helped shape a new agenda for reforms. In addition, in the early 1990s, India was opening up to international investors, and there was a sense among economic policy makers that sound market institutions would help attract greater flows of investment.[3]

In 1992 and 1993, SEBI made several attempts to obtain extremely modest market reforms, but the BSE did not cooperate. Initiatives, such as mandatory broker registration with the SEBI or a requirement that brokerage fees be unbundled clearly from transaction prices, led BSE members to go on strike.

This led the SEBI and the Ministry of Finance to decide that a new stock market was needed to set new standards for technology and market quality.[4] This new market would directly compete with the BSE for order flow on the major stocks of the country and stimulate improvements in market quality in India in two ways: (1) by offering a sound platform for equities trading and (2) by creating competitive pressure for the BSE to clean up its act.

DESIGN OF THE NEW MARKET

Every market launch is an attempt at obtaining liquidity through a viable market design. In this section, we describe the market design adopted by the NSE.

Governance

The NSE started with one highly unusual feature: it was a public sector exchange. There is no other prominent public sector exchange in the world. The governance structure adopted at the NSE consists of three layers:

1. The exchange is a limited liability company owned by public sector financial institutions, particularly the Industrial Development Bank of India (IDBI).
2. The shareholders appoint a board of directors and a management team. Brokerage firms do not own the exchange and are represented neither on the board of directors nor the management team.
3. Brokerage firms are franchisees of the exchange and express their views through membership on a variety of Exchange-appointed committees working on such things as market design and dispute resolution.

The governance structure of the NSE is an important departure from the traditional exchange, which is essentially a club of brokers. This structure predated the widespread interest in "demutualization" of exchanges that began in

1999 and is widely prevalent today. (For a discussion of demutualization, see the *New Issues* column on page 8.)

The government-owned IDBI played a leading role in the establishment of the NSE. The chairman of IDBI served as the chairman of the NSE, and the task of building the NSE itself was handed to a team of five that left IDBI for this purpose.

TRADING SYSTEM

The NSE learned a lot from the experience of the BSE (which was viewed as a failure of market design) and the failure of the OTCEI, an electronic exchange that was attempted in 1992. The key features of market design at the NSE were as follows:

1. Trading was based on order matching in an open electronic limit order book market.[5]
2. Satellite technology was used to reach locations all over India from a central trading computer located in Bombay.
3. The tick size was uniformly set at Rs.0.05 (about US$0.001 at current exchange rates) for all stocks.

Each of these decisions was the subject of intense debate at the time. A market without a market maker was an unproven idea, compared both with existing exchanges in India (BSE, OTCEI) and with exchanges abroad (NYSE, the London Stock Exchange (LSE), and so on). Remarkably enough, one important factor that led to the abandonment of the market maker was the question of market manipulation and market surveillance. The open electronic limit order book market was favored owing to its symmetry among all agents and the costs and complexity of monitoring market makers.

In the context of primitive telecommunications infrastructure, the choice of technology for distribution was an important one. Although unusual by the standards of international financial markets, the NSE chose to use very small aperture terminals (VSATs) for satellite-based communications, to alleviate concerns about reliability (satellite technology does not rely on faulty land lines or exchanges) and flexibility in deployment (satellite terminals can be placed anywhere, regardless of the existence of telephone exchanges).

The tick size on the BSE ranged from Rs.0.25 to Rs.1.00, and to the external observer it appeared that BSE members favored large ticks in order to put a floor on the spread and to maximize the earnings of traders on the floor. In order to favor the interests of investors and not intermediaries, the NSE chose a uniform tick size of Bs.0.05 for all stocks.[6]

PRODUCTS

The goal of the NSE was to compete with the BSE in equities trading. This meant that the NSE had to trade the largest and most important stocks in the country and do so as quickly as possible.

One path that could have been adopted was to obtain listings. This involved delays and risk; it would take time to persuade firms to sign listing agreements, and some firms could choose not to list. The NSE chose another path—it announced a list of stocks in which trading was "permitted." It was possible, under Indian law, for the NSE to add a stock to the permitted list without the permission of the firm, though the NSE obtained no revenues from doing this. The NSE also introduced a concept of listing and gradually did obtain significant listings; however, this was not allowed to become a bottleneck in obtaining the trading of important stocks.

There were 7,000 firms with equity listed at the BSE, most of which had abysmal levels of liquidity. The NSE chose to permit trading in the most liquid 1,200 firms.

SETTLEMENT

Prior to the start of the NSE, the BSE followed an "account period" system in which trades made in a single account during each two-week trading period were netted. Only those trades not cancelled by opposite trades (that is, buys by sells) as of each "expiration date" resulted in settlement and the exchange of shares for cash. In practice, the system of *badla* diluted this further, and administrative lapses led to the occasional "clubbing" of two fortnights into one settlement (in other words, trades were netted over a month and then one settlement took place). In addition, most of the 7,000 shares traded on the BSE did not feature centralized settlement through the clearinghouse; for 6,900 of them, settlement took place bilaterally between BSE members, which greatly increased the administrative complexity and settlement risk. The BSE clearinghouse was legendary for its inefficiencies.[7] From the perspective of a user of the market, when shares were sold, it took from one to three months before money was obtained.

Modern ideas in market design emphasize rolling settlement, so that trades are netted within the day and settled a few days later. Since settlement in India was done using physical share certificates, rolling settlement would have been cumbersome. The NSE chose a middle road: a netting period of only one week, using physical share certificates, with a highly efficient implementation. The settlement system on the NSE operated as follows. Trades took place from Wednesday morning to Tuesday evening. The net open position on Tuesday evening led to obligations for brokerage firms to bring in funds or securities roughly a week later.

It should be noted that within the one-week netting period, equities trading at the NSE was similar to a futures market. Short positions could be entered into as easily as long positions. When trades took place, there was no attempt to determine whether traders could deliver the shares or the funds.

These short intervals—a one-week netting period, with processing of funds or securities within one week after Tuesday—were considered unattainable by many experts at the time, given the inefficiencies of the movement of funds in India's banking system and the use of physical share certificates. However, the NSE managed to run this settlement cycle flawlessly. From an investor's point of view, if shares were sold at the NSE, money was reliably obtained with a lag of five to ten working days (depending on the day of the week). This was a major advance compared with the prevailing market practice on the BSE.

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CLEARING

Futures-style settlement, without futures-style financial safeguards, involves significant counter party risk. On the BSE, counter party risk was handled by appealing to the kinship and ethnicity that bound the BSE members together. When a BSE member failed on his payments, there was an attitude of accommodation; delays were accepted, and fellow members cobbled together short-term loans to help the member who was in distress. This took place in the context of a repeated game and served to give the community as a whole a remarkable robustness, as each BSE member frequently suffered from delayed payments but could appeal for help when he was in distress himself.

This state of affairs was, of course, highly undesirable when viewed from two external perspectives: that of the users (investors who sold shares often got their money late) and that of new brokerage firms (which might not be selected on the basis of kinship and ethnicity).

The NSE ignored ethnicity in its efforts to recruit intermediaries, so there were no such bonds binding the NSE brokers together. In addition, the NSE's satellite technology attracted brokerage firms from all over India, in contrast with the BSE's location in one building in one city. Hence, these traditional methods of risk containment could play no role at the NSE.

The NSE's stated goal was to produce modern institutional arrangements that focused on prices, not on strategic games in a context of ethnicity and kinship. Hence, there were no accommodating brokerage firms that were unable to fulfill obligations on time.

In the early months, the NSE exhibited a remarkable naiveté on the complexities of risk containment. The rapid success of electronic trading led to an entirely unexpected growth in volumes and open exposures. The extreme speed with which exposures could be built up with electronic trading was also unexpected. Equities trading started at the NSE in November 1994, and by November 1995 the NSE was the largest equity market in India (see Table 1).

This led to a fresh effort to think about the problems of clearing at a more basic level. The NSE correctly diagnosed its problems as those of a futures market; the risk-containment problems faced in futures-style settlement are exactly those seen in futures markets. This led the NSE to build a classic futures market institution—the futures clearing corporation.

The National Securities Clearing Corporation (NSCC), a wholly owned subsidiary of the NSE, was created in April 1996. It embarked on the enterprise of requiring collateral in the form of initial margin and mark-to-market margin. It became the legal counter party to the net settlement obligations of each brokerage firm and fulfilled these obligations to the counter parties when a brokerage firm defaulted. This provided an unprecedented regime of reliability in the settlement process in India's equity market.[8]

Intermediaries

The NSE set out to recruit intermediaries from all over India. This was in contrast to the BSE, which was a closed club and did not accept new members. Brokerage firms on the NSE could be individuals or limited liability firms, and the capital outlay required to become an NSE member was roughly Rs.10 million (about US$233,000).

The NSE was able to tap into the individuals and firms, particularly those outside Bombay, with significant knowledge about financial markets, for whom the price (Rs.10 million) was much lower than a seat on the BSE. In addition, the NSE's superior trading technology made it possible for brokerage firms to be on the NSE without relocating to Bombay (in contrast with the BSE floor, where every member had to physically trade on the floor). At the same time, the most prominent firms on the BSE also chose to become NSE members.

Charges and Revenues

When a stock was "permitted" to trade, the NSE earned no listing fees. Since all major stocks were permitted, the NSE could not require a significant charge when a company sought a formal listing. Hence, the NSE's revenues from listings were near zero.

Of the Rs.10 million that was required to obtain NSE membership, a significant fraction was pledged with the NSE in cash, and

Table 1
Chronological Establishment of the NSE

Event	Date	Elapsed time (years)
Idea first proposed	June 1991	0
Decision to build market	November 1992	1.4
Managerial team in place	January 1993	1.6
Market design readied	May 1993	1.9
Regulatory clearances obtained	December 1993	2.5
First intermediary enrolled	January 1994	2.6
Start of trading	November 1994	3.4
Takeoff	November 1995	4.4

the NSE earned interest from these deposits. This was the primary source of revenues for the NSE in the early months.

Finally, the NSE charged a single fee of one basis point (0.01%) for trading volume. For each million rupees of trading volume, this fee (charged to both buyers and sellers) gave the NSE revenue of Rs.200. This fee, which became the prime revenue source for the NSE, was dropped to 0.004% by 1998.

OBSERVED OUTCOMES

Using the market design documented above, the NSE was successful in obtaining a large pool of intermediaries. Trading began on November 3, 1994, and within less than a year, the NSE was the largest stock exchange in India (see Figure 1). The use of satellite technology was a strong success. There was a steady stream of new satellite terminals set up so that by January 2000, there were 9,000 trading computers linked up through 3,000 VSATs.

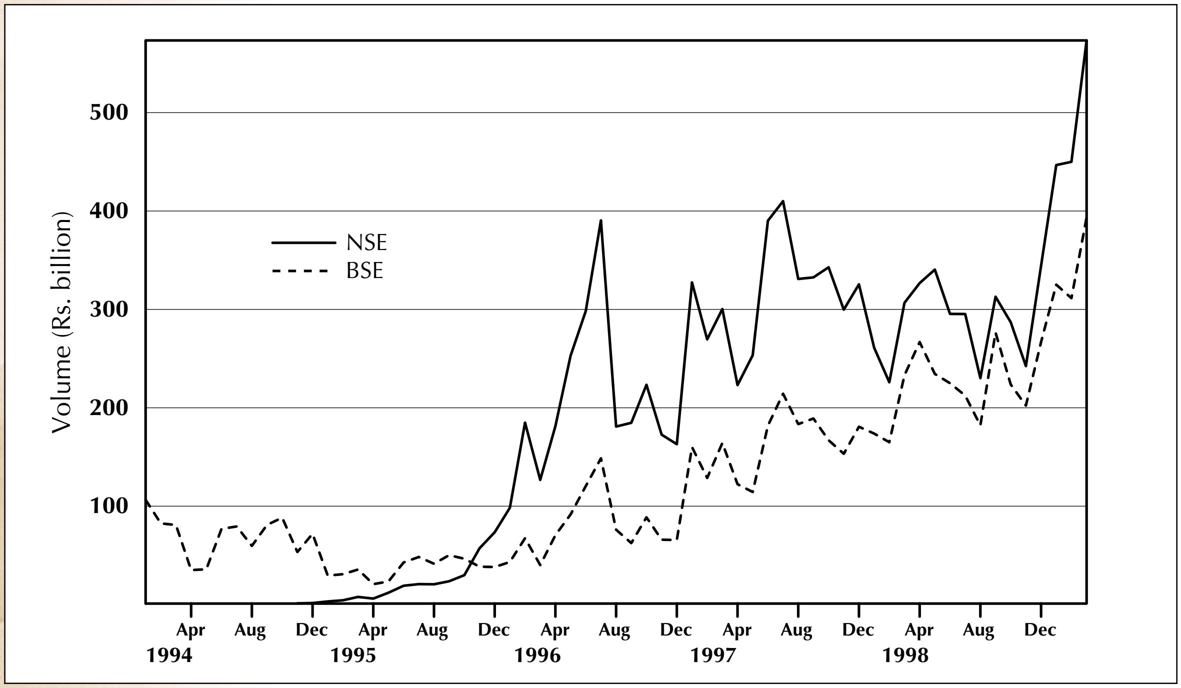
The NSE trading started with zero listings, but gradually firms chose to obtain listings. Listing fees were very small, and listing primarily served as a way of formalizing information flows from the firm to the exchange and thereby to the market. By March 1999, around half of the 1,300 traded companies had chosen to list.

In November 1994, there was an average of 893 trades per day. This rose to above 310,000 trades per day in March 1999. The peak trading intensities on the NSE are summarized in Table 2. This makes the NSE one of the largest stock exchanges in the world when measured by the number of trades per day.

The rise of the NSE had a major impact on the BSE. Because of the rapid growth of the NSE, the BSE was compelled to undertake a remarkable reforms program that addressed many of the weaknesses that had persisted for decades.[9]

Investors all over India benefited from the NSE's ability to deliver lower transactions costs in trading and a more efficient market. Existing brokerage firms, particularly on the BSE, lost significant revenue. Their revenues dropped sharply in percentage terms, though the enormously larger trading volumes did

Figure 1
Trading Volume on the NSE and the BSE



make up a significant part of this loss. A back-of-the-envelope calculation suggests that the average revenues of a BSE member firm dropped from Rs.50 million per year in 1994 to Rs.33 million per year in 1996. The drop in profits would be much sharper owing to the greater expenses of being a BSE broker in 1996. The price of a seat on the BSE dropped from Rs.45 million in 1994 to Rs.25 million in 2000, giving an average annualized return of -12.5% over this six-year period for BSE members. Such losses would justify significant investments in political lobbying efforts on the part of the BSE.

In contrast with the experience of futures markets worldwide, even after the NSE became the largest market, the BSE was not reduced to insignificance. The BSE was relatively successful in obtaining order flow in Bombay, and the NSE was relatively successful in obtaining order flow from outside Bombay. The closely knit community of institutional investors and BSE members located in Bombay continued to flourish, even after the advent of tighter spreads at the NSE and the participation of foreign institutional investors.

Until 1995, the policy environment supported reforms in the equity market. However, from 1995 onward, changes in the political economy led to a policy climate that was significantly more conservative. There was a reversion to trading through *badla,* the unique brand of leveraged trading that flourished at the BSE (which had been banned by the SEBI in December 1993). Hence, as of 1999, while the NSE was the largest market, trading volume on the BSE was only 20–40% behind.

LESSONS

The success of the NSE is quite remarkable. As with all market launches, there are undoubtedly many characteristics that are unique to this particular experience, and we must exercise caution in generalizing from it.

Favorable Initial Conditions

The initial conditions faced by the NSE could not have been more favorable. The incumbent market was universally considered incompetent—it was viewed as a market "of BSE members, by BSE members, for BSE members." There was a significant mass of intermediaries and market users who found access to the BSE very expensive. The securities regulator was sympathetic to the NSE. As far as the core market design was concerned, the NSE is an economist's ideal market featuring free entry into intermediation and an open electronic limit order book. For India, the rise of the NSE was an important step away from financial markets as strategic games among a small group of insiders and toward a more Walrasian vision of a market of numerous, smaller players. The focus was on prices and not on strategic behavior.

The NSE's stated goal was to produce modern institutional arrangements that focused on prices, not on strategic games in a context of ethnicity and kinship.

Table 2
Peak Trading Intensity on the NSE

	Value	Date
Traded value	Rs.71.4 billion (US$1.64 billion)	January 5, 2000
Number of shares traded	165 million	October 13, 1999
Number of trades per day	651,968	January 5, 2000
Average number of trades per minute	1976	January 5, 2000

Reduced Costs

It is useful to ask this question: Why did a single market order go to the NSE in the early weeks, when the market impact cost on the NSE was obviously higher? To understand this, we have to consider the total transactions costs faced by users of markets, over and above market impact cost alone. There are a host of other costs—denial of access, overt or covert brokerage fees, unreliability of clearing and settlement, unfair dispute resolution—that users face in addition to market impact cost. The NSE was highly successful in reducing all these so that it was efficient for a user to place orders on the NSE even though the market impact cost there was initially higher. Once these orders started coming in, the network externalities of each order helped to pull in other orders.

Effective Governance Structure

The NSE's experiment with governance structures—that of a stock market that is not owned by brokerage firms but is a limited liability firm that recruits brokerage firms as franchisees—is likely to be a lasting contribution. In recent years, exchanges like LSE and NYSE have also talked about radical surgery to their ownership structure, moving away from the exchange as an association of brokerage firms through a process of demutualization.

State-Run Stock Market

That the NSE is a public sector organization has two interesting facets. The first is the idea that a liquid market has many features of public good and that there could be a role for the State in launching and running markets. The second aspect is the contrast between the success of the NSE and the routine failure of the Indian State in building institutions. The NSE was just fortunate enough to have been started by an unusually good team that made many extremely good choices on questions of policy formulation.

Accessing Order Flow Outside the Traditional Financial Sector

The NSE experience tells us something about the opportunities for harnessing order flow from the myriad economic agents that are excluded by traditional financial markets organized as clubs—owing either to physical location (pre-technological markets using physical floors) or entry barriers to intermediation.

Strength of Social Structures

At the same time, the resilience of the *community* of stockbrokers and institutional investors in Bombay has proved to be remarkable. By the traditional reasoning, when the NSE spreads became tighter than those of the BSE (by late 1995), the order flow to the BSE should have dropped to near-zero levels. This did not happen; economic agents continued to suffer higher transaction costs by trading at the BSE. Many foreign investors in India continue to suffer higher transactions costs by sending orders for stocks to the BSE even though the NSE's liquidity is obviously superior.

Following are two explanations for this:

1. The close relationships built by traditional intermediaries in the preceding decades when financial transactions only took place in an environment of trust that was slowly developed over years may continue to have a major impact on how individuals choose to place orders.
2. In developing countries, institutional investors have limited skills in binding the objectives of their employees with their own goals. When employees obtain significant private benefits, they may not reallocate order flow into a trading mechanism based on an attempt to minimize transactions costs.

Political Economy Matters

The final lesson of the NSE experience is the importance of political economy. The NSE's ability to undertake a radical reform agenda was made possible by an environment of support from the SEBI and the Ministry of Finance that lasted until 1995. After this, the ability of the NSE to innovate in market design dropped sharply, with a change of regime that turned the SEBI into a more conservative organization that was more influenced by the interests of the brokerage community than the goals of market design from an economy-wide perspective. Such an outcome is what political scientists would expect given the diffused benefits of liquid and efficient markets in the entire economy, as opposed to the focused benefits for intermediaries from obtaining relatively inefficient and illiquid markets.

IMPORTANCE OF POLITICAL ECONOMY

Does the liquidity of an established securities exchange generate a natural monopoly? On one hand, the NSE's success is an example of breaking the lead of a dominant exchange, suggesting that the advantage of a dominant exchange is not insurmountable. A closer look at the NSE episode yields a somewhat different picture. The NSE displaced the BSE under an extreme set of circumstances in which the BSE's market design was highly faulty, and the NSE was able to innovate in offering a radically different set of ideas about how the stock market should work. It is hard to imagine any other country in the world where such an extreme opportunity to improve upon an incumbent exchange is to be found.

Indeed, the difficulties successfully faced by the NSE *after* its spreads became the tightest in India are quite remarkable. The close social web that binds institutional investors and traditional brokerage firms in India was an important part of the competitive advantage of the incumbent exchange, which enabled sustaining an order flow to the BSE even when its spreads and impact cost were inferior. Agency conflicts play a role in this phenomenon, where significant private benefits inure to employees of institutional investors who are in a repeated game with member firms of the incumbent exchange.

Finally, this experience shows the importance of political economy. From 1994 to 1996, the NSE was able to execute radical surgery to market design in India in the areas of trading, clearing, and settlement, which was made possible by political support for a radical reform agenda. After the cessation of this political support, the reform process in India's equity market essentially came to a halt.

ENDNOTES

1 For a more detailed treatment of these problems, see A. Shah, *Institutional Change on India's Capital Markets,* 3-4 Economic and Political Weekly XXXIV 183–94 (1999) and A. Shah & S. Thomas, *Developing the Indian Capital Market, in* India: A Financial Sector for the Twenty-First Century 205–65 (J.A. Hanson & S. Kathuria eds., 1999). Empirical evidence about the functioning of the traditional BSE is found in S. Thomas, "An Empirical Characterisation of the Bombay Stock Exchange" (1995) (Ph.D. thesis, University of Southern California). For a further treatment of India's securities markets, see A. Shah & S. Thomas, *Securities Markets, in* India Development Report 1997, 167–92 (K.S. Parikh ed., 1997); T. Endo, *The Indian Securities Market* (1998); National Stock Exchange of India Ltd., *Indian Securities Market: A Review* (1998); and Centre for Monitoring Indian Economy, *Capital Markets* (1998).

2 D. Basu & S. Dalal, *The Scam: Who Won, Who Lost, Who Got Away* (1993).

3 In the aftermath of the East Asian Crisis, it is commonplace to think of unsound financial markets coupled with large foreign capital inflows as a dangerous combination insofar as weak markets may engage in resource allocation of a poor quality. However, in India in the early 1990s, that was not a primary concern; the focus was on the extent to which improvements made to market mechanisms could attract larger capital inflows.

4 For a look at the policy analysis in the Ministry of Finance, see M.S. Ahluwalia, *Reforming India's Financial Sector: An Overview, in* India: A Financial Sector for the Twenty-First Century 29–56 (J.A. Hanson & S. Kathuria eds., 1999) and P.J. Nayak, *Regulation and Market Microstructure, in* India: A Financial Sector for the Twenty-First Century 266–304 (J.A. Hanson & S. Kathuria eds., 1999).

5 I. Domowitz, *The Mechanics of Automated Trade Execution Systems,* 1 Journal of Financial Intermediation 167–94 (1990).

6 Recent market microstructure research suggests that there may be tradeoffs in the tick size, in that there can be an "optimal tick size" below which liquidity could be hurt by reductions in the tick size (J. Angel, *Tick Size, Share Prices and Stock Splits,* 52(2) Journal of Finance 655–81 (1997) and V.R. Anshuman & A. Kalay, *Market Making with Discrete Prices,* 11(1) Review of Financial Studies 81–109 (1998)). Such an idea did not, however, play a role in the NSE's choice of tick size.

7 In late 1998, an employee of an internal auditor walked into the clearinghouse and walked out with a bundle of physical share certificates, without the knowledge of the clearinghouse staff.

8 A. Shah & S. Thomas, *Rethinking Prudential Regulation, in* India Development Report 1999–2000 at 243–55 (K.S. Parikh, ed., 1996).

9 Some evidence about these changes is found in A. Shah & S. Thomas, *How Automation and Competition Have Changed the BSE* (technical report) (1996).