24

DISCUSSION PAPER

An Introduction to the Microstructure of Emerging Markets

Jack Glen

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Jack Glen

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Foreword

Interest in emerging markets has grown remarkably in recent years, but detailed information on how these markets actually trade securities is not yet widely available. In order to begin filling this gap, this paper provides an introduction to emerging market trading and information systems, now commonly referred to as market microstructure. The recognition that microstructure plays a role in determining market success and behavior has led to increased interest in the subject in developed markets. Given IFC's interest in encouraging emerging market development, this study was undertaken in order to provide current and potential market participants with microstructure information that will allow them to understand better the markets.

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& Economic Adviser of the Corporation

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Abstract

Most discussions of security markets and asset pricing take trading system design as exogenous and as playing a relatively minor role in the overall pricing process. But more recently, interest in market microstructure has revealed the significant role that it can play in both market success and individual security pricing. Through its effects on market liquidity and the cost of trading in particular, microstructure can make a market more or less attractive, thereby encouraging market participation.

For investors unaccustomed to dealing with international markets, the diversity in microstructure that exists, especially in the emerging markets, may come as a surprise. This paper highlights that diversity by examining the microstructure of seven securities markets in six countries. Each is different, but many similarities also exist. Particularly noteworthy is the trend toward automation, a reflection of the interest in market innovation that characterizes these markets.

I. Introduction

Interest in the emerging markets as a source of high returns and diversification benefits has increased in recent years. One result of this interest is that estimated gross portfolio equity flows to emerging market countries doubled from $3.5 billion in 1989 to about $7.6 billion by year-end 1991, and reached $13.2 billion in 1993.[1] Unless conditions change dramatically, one can expect to see even greater interest in these markets in the future as experience leads to a better understanding of how the markets behave and who the market participants are.

One fundamental factor leading the wave of emerging market investment is an increasing volume of research on the markets, the listed companies and the countries. Once these markets were discovered, Wall Street analysts and investment banking firms have devoted significant amounts of resources to providing investors with ever-more-detailed reports and forecasts on where to invest. Hardly a day passes now without reference in one of the major financial publications to some emerging market development, something unheard of just a few years ago.

Despite this flurry of activity, however, much remains relatively obscure about these markets. One aspect of the markets that has been neglected in most of the available literature is a discussion of their trading structures, now commonly called market microstructure. Probably all institutional investors know that the New York Stock exchange uses a market specialist system, what types of trades are allowed and how the market functions, but that level of knowledge is largely missing for the emerging markets.

This paper provides an introduction to market microstructure in the emerging markets. Its goal is to sensitize readers to the importance of microstructure in achieving market success and to the amount of variation in microstructure that is possible. The importance of microstructure is explored by describing the role it can play in promoting market liquidity, something critical for market success. Microstructure variation is illustrated by examining a sample of seven markets from six emerging market countries. Those markets provide evidence of how much leeway market administrators have in designing a market.

The paper is descriptive in nature, not prescriptive. While theory suggests that market structure can have important effects on price and trading behavior, the models used by economists are much too simple to allow one to draw firm conclusions about which market structure is optimal. Still, one can learn much from the economic literature that exists and from understanding better how different markets are designed. With that in mind, the paper describes some of the important features of market microstructure and illustrates microstructure diversity through market descriptions.

The remainder of the paper is organized as follows. First, a general discussion of financial markets is presented, followed by an overview of microstructure which describes major market attributes and the importance of market microstructure to those attributes. Following that is an overview of the seven emerging markets and how they differ in their microstructures. A summary is followed by detailed descriptions of each of the markets in the market annexes.

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[1] World Bank (1994).

II. Financial Markets

Financial markets play an important role in capitalist economies by facilitating intermediation between savers and investors. The better they perform that service, the more likely it is that savers will be motivated to supply capital, thereby reducing its cost to investors, who themselves will be motivated to seek capital from the public rather than through their own savings. By facilitating intermediation, well functioning financial markets increase investment/savings rates, which translates into higher rates of economic growth. For that reason, it is important that financial markets be well organized and regulated.

Participants depend on financial markets to provide four basic functions. On both the investor and issuer side, markets are expected to provide information signalling on the value of financial instruments, which provides the basis for the emphasis in finance on market efficiency in processing information. This information role is critical as it provides the basis for investment and issuance decisions by indicating to participants the value (or cost) of individual instruments.

Investors also rely upon markets to provide savings instruments, which provide the second and third functions: storage of wealth and risk sharing through diversification.

The fourth function relates directly to the supply side of the market and the role of financial markets as a source of capital. The ability of markets to provide this fourth function, capital raising, makes them particularly attractive to developing countries where capital can be in short supply. In economies where markets have not developed, capital shortages inhibit development.

Economists recognize the importance of financial markets and separate fields of specialization have emerged in order to study the markets, their participants and their ability to provide the four functions just described. Corporate finance studies the issuers of securities and how the choice between different financial instruments is made. Capital market theory investigates the pricing of securities and the role of financial intermediaries. Market microstructure theory examines how securities are traded and the influence that trading systems have on market behavior and success.

Economic theory indicates that the ability of financial markets to attract private capital depends very much on the institutional nature of those markets, which is itself a function of the regulatory structure under which the market functions, as well as the market's microstructure. Regulation has obvious importance by dictating who can participate in the markets, what instruments can be traded and, to some extent, how much trading costs. Despite this obvious importance, regulation is taken as exogenous in this paper in order to concentrate exclusively on market microstructure.

A growing body of theory and empirical work shows the influence microstructure can have on market behavior. While much of that influence arrives through the effect of microstructure on information processing and transaction costs, the impact carries over to each of the other functions mentioned above as well, something described in more detail below. Given the importance of financial markets more generally and the impact that microstructure can have on their success, it behooves market participants, regulators and administrators alike to understand better at least the basic tenets of market microstructure. The next section describes in more detail the influence that microstructure can have on market behavior and attractiveness.

III. Market Microstructure Theory

According to economic theory, markets achieve optimal capital allocations through the classical risk/return tradeoff that is the keystone of modern finance. But this theory takes the market as a black box where information goes in and an efficiently determined price comes out. Increasingly, microstructure theory highlights the importance of stock market institutional features and trading mechanisms as important determinants of market behavior. These new theories suggest that policy makers and market administrators, through their choice of trading systems and other institutional features, can influence trading and price behavior. To the extent this also translates into more efficient determination of prices and lower transaction costs, then all concerned—both investors and securities issuers—are better off.

The idea that market microstructure influences price behavior may surprise many readers because markets are often taken for granted and assumed to be essentially the same everywhere with supply and demand alone determining prices. At a very general level that is true, but at another level microstructure can influence both supply and demand by making trading easier or harder, more or less costly, and by providing information to potential traders that influences their trading decisions and induces them to participate in the market. In short, microstructure can make markets more attractive.

Market microstructures are complicated and involve a number of important aspects of the trading process. They vary in the way transactions are handled—discrete versus continuous auctions, market-maker versus jobber markets, manual versus automated systems, on- and off-exchange transactions[2]—and in the types of transactions that are permitted—for example, limit orders and short sales.[3] Importantly, market structure determines the type of information available to market participants. Some markets provide nearly complete information not only on past transactions, but also on the outstanding supply and demand curves; in other cases minimal information is available. Also importantly, especially in the newer automated systems, microstructure dictates the manner in which incoming orders to buy and sell are matched, which determines, to some extent at least, the price at which trades occur.

The importance of microstructure arises from the role it plays in each of four fundamental market attributes: liquidity, efficiency, trading costs and volatility. Though closely related, each of these attributes is different and can be influenced by microstructure, the regulatory regime under which the market operates, as well as by the economic fundamentals which drive security prices. The remainder of this section defines these attributes and discusses the manner in which microstructure can enhance market success through its effect on them. Of course, markets are driven in large part by economic fundamentals which, regardless of the microstructure, play an important role in price and volume behavior, but which are not discussed in this paper.

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[2] Most of these terms will be defined in detail below.

[3] With a limit order, investors specify the price at which they are willing to buy/sell securities, and the order is executed if the market price reaches that level. By comparison, under market orders investors buy/sell at the current market price. Short sales involve borrowing a security from its owner and then selling it in anticipation of a price drop.

Liquidity, the ability to buy or sell both quickly and without substantially moving prices, is the key to market success. By reducing the riskiness of buying and selling securities, liquidity makes market participation more attractive, which has an impact both on prices and on the ability of the market to process information efficiently. Ultimately, liquidity dictates the success or failure of a market.

Economic theory suggests that microstructure is one determinant of market liquidity.[4] Empirical evidence has shown that liquid markets attract more market participants, thereby increasing prices and reducing the cost of capital.[5] For these reasons, microstructure decisions that affect market liquidity can have important consequences not only for attracting market participants, but through that, on the cost of raising capital in the market.

Both aspects of liquidity mentioned above—ability to transact quickly and without moving prices—are important to market participants. The speed with which transactions are consummated depends on two factors: the number of market traders and microstructure. For any given microstructure, the more traders there are, the more likely orders to buy/sell can be matched against other trader's orders. But market structure imposes constraints on trades regardless of the number of potential traders. For example, markets are open only during certain hours and days of the week. Even when open, some markets allow trades to occur only during periodic auctions, rather than continuously throughout the day. By limiting the number of trading hours and the manner in which traders meet, either continuously or at infrequent auctions, market microstructure has a direct impact on the liquidity of the market.

Liquidity goes beyond the physical ability to trade and also includes market depth, which refers to the ability to transact at the current market price. In a deep market, even large orders can be transacted at the current price. In contrast, when market depth is lacking, the larger an order, the more price will have to adjust to fill that order. Here again, microstructure has an important role to play. Continuous markets, which spread trades over time, may be thinner than markets which batch orders into a few periodic auctions. Thus, even though periodic auctions force traders to wait, auction markets can be deeper and more attractive as a result. For that reason, some markets combine the two market types of trading—continuous and periodic auctions—in order to promote both types of market liquidity. This tradeoff between market depth and the speed at which transactions can be made is only one of the many dilemmas that must be dealt with when designing trading systems.

Trading costs include both the fixed costs associated with a trade, such as taxes and commissions, as well as the major cost that the market imposes: the bid/ask spread, which is the difference between

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[4] Madhavan (1993) develops a theoretical framework that permits one to compare different trading structures. He finds that there are differences between the equilibrium behavior of continuous and periodic auctions, and between dealer and quote-driven systems. Periodic auctions provide better price efficiency in his model, but at the expense of continuity and higher information costs.

[5] Amihud and Mendelson (1991) examine the effect of liquidity on both fixed income and equity instruments. Their results show that liquidity has an economically and statistically significant impact on required returns. As liquidity increases, required return declines.

the price one pays to buy and the price one receives for a sale. The spread that investors pay for accessing the market reflects a combination of factors, including the differences of opinion held by buyers and sellers, but also including microstructure features. In some markets, for example, a single individual is responsible for quoting prices. This market maker has responsibility for ensuring market liquidity, but the risk associated with that activity is reflected in the bid/ask spread, which is the source of returns on the market makers inventory and for bearing risk. Alternatively, multiple market makers are possible and the competition this provides should reduce spreads. In other markets, no designated market maker exists, perhaps reducing spreads even further, but, with no individual responsible for making the market, investors are exposed to possibly reduced levels of liquidity. By adopting a microstructure that allows for competition among traders, or by assigning an individual market maker whose duty it is to ensure that trading is possible, microstructure can have a direct effect on trading costs and liquidity.

Few topics have generated more discussion among financial economists than market efficiency.[6] Generally, markets are said to be efficient if they quickly and correctly incorporate information into prices. This is important because many traders are unable to devote time and resources to gathering information, preferring instead to depend on the market itself to properly reflect all available information in prices. For these uninformed traders, a market that is inefficient is also unattractive because it means that trades may be made at unfavorable prices. For that reason, markets that are more efficient will attract investors, which translates into increased market liquidity.

Microstructure has an important role to play in encouraging market efficiency, both through the information services that are provided to participants, as well as through the nature of the trading system itself. Without information on recent market activity, traders have to rely exclusively on the current market price as a signal of value. While the current price might be a sufficient statistic of true value in an efficient market, traders might also benefit from information on recent trading behavior. Information on volume, market depth and recent price movements can all provide important signals about market activity that investors employ to determine what trades to make. The availability of information reduces uncertainty and increases market interest, which leads back to liquidity.

An important innovation in microstructure, automated trading systems, has taken place in recent years and reflects, to some extent, the importance of information and the trading system on market efficiency. While a number of variations is possible, generally the new automated systems allow traders to input orders into a computer, which matches them against other outstanding or incoming orders. The transparency and objectivity of these systems is appealing, as is the market information that they make available. Because all trades are processed by a computer, market participants can observe volume and prices on a transaction-by-transaction basis, something nearly impossible without computer intervention.

But automated trading also has its drawbacks. Floor traders claim that information is lost by moving from the trading floor to the anonymity of a computer terminal. On the floor, traders have to develop a reputation for honesty in their dealing that may make them less likely to attempt to conduct trades at the expense of uninformed colleagues. Such is not the case with automated systems, where reputation can be lost as a control factor and informed traders can take advantage of the uninformed. Thus, the decision to adopt an automated trading system may eliminate some information available to

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[6] Fama (1991) provides an overview and ample references.

market participants, at the same time that it makes other information more readily available. The net effect on market efficiency and investor welfare is unclear, which makes the choice between automated and manual systems difficult theoretically. Despite that theoretical ambiguity, the trend, both in the emerging and developed markets, is toward the adoption of automated systems.

Volatility, which refers to the frequency and magnitude of price movements, is another market characteristic which can be influenced by microstructure. While prices are expected to vary over time to reflect changes in relative and absolute value, the concern over volatility is that short-term price movements do not correctly reflect changes in equilibrium value. The links to both liquidity and efficiency are obvious. For example, liquid markets have lower transaction costs, especially bid/ask spreads and, as a result, the observed sequence of trading prices will be less volatile as the natural bouncing of transactions between the bid and ask occurs over time. Similarly, in an efficient market, new information will be correctly and quickly incorporated into price and even though that may entail price jumps, price overshooting and deviations from the equilibrium price are reduced in efficient markets. Thus, holding all else constant, liquid and efficient markets will be less volatile than illiquid and inefficient markets.

Volatility obviously arises primarily from the economic fundamentals that drive prices. For that reason, even though microstructure can be designed to enhance liquidity and efficiency, volatility will remain. To isolate fundamental volatility from trading noise owing to asymmetric information or temporary order imbalances, market microstructure has been called upon. Circuit breakers (or price limits), which stop trading whenever price changes exceed a given level, are a good example. They are meant to provide a cooling-off period for the market so that information can be disseminated and processed by investors in order that economic fundamentals may prevail when trading is resumed. While circuit breakers may have their intended effect, something open to debate, their impact on liquidity is obviously bad. Once again, microstructure design involves a possible tradeoff between market attributes.

As noted throughout this section, microstructure can affect the success that a market has in intermediating between savers and investors through its effects on liquidity, trading costs, efficiency and volatility. Given the noted increase in interest in emerging markets and the enhanced competition that this has implied as countries vie for international capital, the perception that microstructure is important is growing as well. Emerging markets are taking steps to improve their attractiveness to international capital flows, partly by upgrading their microstructures. But market administrators need to weigh microstructure decisions carefully. Once adopted, it can be difficult to change from one trading system to another and, as pointed out, optimal microstructure design is not always obvious.

IV. The Markets

The remainder of the paper provides an overview of the trading systems of a set of seven emerging market exchanges: Bolsa Electronica de Chile (BEC, Santiago), Bolsa de Mercadorias y Futuros (BMF, Sao Paulo), Bolsa Mexicana de Valores (BMV, Mexico City), Bolsa de Valores de Sao Paulo (BOVESPA), Istanbul Stock Exchange (ISE), Jakarta Stock Exchange (JSE), and Stock Exchange of Thailand (SET, Bangkok). Six of these markets trade equities (and some debt and options), whereas the seventh, BMF, trades commodities and financial derivatives. The markets were chosen in order to provide both geographical diversity and a range of market sizes and structures. A close reading of what follows will confirm that a broad variety of trading systems is indeed present in the sample. Undoubtedly, the inclusion of additional markets would show even more permutations on the number of possible market structures. A set of market summary statistics is presented in Table 1.

As will be apparent to the reader of the market descriptions that follow, there is great variation in the manner in which securities are traded in these markets. Some of those differences have obvious importance, whereas the effects of others are more subtle. Given the emphasis that previous sections have placed on microstructure as a determinant of market success, one is tempted to accompany the descriptions with a judgement on the merits of a particular market design. That temptation has been avoided on purpose, despite its obvious appeal. These markets are complicated systems that involve a large number of often interrelated factors. Attempting to attribute success to one or two microstructure features would be, at best, misleading. Moreover, given that no known empirical work has been performed on the implications of microstructure on these markets, the sometimes subtle nature of the effects of microstructure design is best left for a more thorough analysis than can be provided in this paper at this time. For that reason, what follows is entirely descriptive in nature.

Table 1

Market Summary Statistics - 1992

	BEC	BMV	BOVESPA	BMF[a]	ISE	SET	JSE
Number Listed Companies	245	195	565	17	145	305	155
Market Capitalization							
Dollars (billions)	30	139	45	-	10	58	12
Trading Value							
Dollars (billions)	2	44	21	227	8	72	4
Turnover Ratio	6.7	31.9	31.5	-	68.3	153.6	41.2
P/E Ratio	13	13.7	-24.4	-	6.9	13.9	12.2
P/BV Ratio	1.7	2.8	0.4	-	1.3	2.5	1.6
Dividend Yield (%)	3.8	1.0	0.7	-	8.1	2.6	2.1

Source: IFC Emerging Markets Factbook 1993

a) BMF is a commodities and futures market and therefore the usual stock measures are not generally applicable. In the table, the number of types of contracts traded and total value of traded contracts is presented. For each contract there can be several different delivery dates.

Securities trading has two key elements that will be the main points of discussion here: the manner in which traders meet and conduct their activities—the trading mechanism—and the information that the exchange provides to them in the process. A third element—clearance and settlement of trades—is also of great importance, but will not be dealt with at length in this paper because it is an activity that generally occurs outside of the exchange and is managed by independent organizations in most countries. The discussion that follows is very general in nature. For details on the individual markets, the interested reader is referred to the individual market annexes.

Trading Mechanisms

A trading mechanism is a procedure which transforms individual orders into transactions. In the traditional Walrasian auction, all buyers and sellers meet simultaneously and price discovery continues until a market-clearing price is obtained; at that point the auction is over. The result is a price that reflects all information available to the participants, as reflected in their orders. Prices determined in competitive markets will resemble the classical Walrasian prices only to the extent that transaction costs are absent. To a large extent, market microstructure theory has concentrated on explaining how market structure introduces frictions into the market, thereby driving prices away from the true equilibrium prices.

The idea behind the Walrasian auction is approached in some stock markets through the use of call auctions, which are periodic auctions in which buyers and sellers submit orders, thereby determining both a supply and demand curve, the intersection of which determines the auction price. Periodic call auctions (or batch markets) are not prevalent in many markets these days, but the idea of a call auction is sometimes used for special situations, such as determining the market's daily opening price or the price of a transaction that would fall outside certain size or price parameters. In the markets described in this paper, call auctions are used only in special circumstances (BOVESPA and BEC) and to open the market (BMV).

More common in securities markets are continuous auctions, where trading occurs continuously throughout the trading session. Of course, there are different methods for conducting these continuous auctions, the main two being dealer markets and order-book markets. In a dealer market, one or more individuals are responsible for providing quotes at which they are willing to buy or sell a security. Dealer quotes determine the price at which transactions occur. The U.S. NASDAQ (over-the-counter) exchange is an example of an (electronic) dealer system. By contrast, in order-book systems traders place their quotes in (manual or electronic) order books, and then arriving orders are matched and transacted. Investor orders determine the prices at which transactions occur in order-book systems. The Tokyo Stock Exchange is an example of an order-book system. The New York Stock Exchange is a hybrid system, with market specialists who both make the market and process a public order book.

The theoretical difference between the two systems is significant. Under a dealer system, the dealer is responsible for maintaining the market and is rewarded for performing that function. As a result, bid-ask spreads reflect both the dealer's inventory level and information gathered from incoming orders. Under an order-book system, no individual has such responsibility and prices reflect only the information available to individual investors. The key issue is whether market-maker activities induce bid-ask spreads to be wider or narrower than they would otherwise be, and if market-makers reduce volatility both by holding inventories of stocks and by gathering market information.

All of the emerging markets described below have order-book systems. Two of those markets, BEC and SET, have completely automated order-matching systems; for JSE and (roughly half of the shares traded on) ISE the order books are manually maintained. In each of these four markets, the order book is the medium through which all transactions occur. The BMF, BMV and BOVESPA markets, on the other hand, are fundamentally continuous open-outcry auctions, with traders announcing their orders on the floor, but in each of these three markets there is also an order book available for market orders, even if that order book is not the principal route for orders to take. In several of these markets, however, certain traders do specialize in selected securities which, informally, provides some of the benefits of a market-maker: liquidity and information gathering.

Even within the continuous auction trading system, there is a large degree of variation in the way orders are processed, and in the nature of those orders. For example, orders can be market orders (to be transacted at the prevailing market price) or limit orders (with a specified transaction price). Different trading systems can handle those orders differently. For BEC, ISE, JSE and SET (and for some shares in BOVESPA) where there are order-book systems, there is no alternative to entering orders into the book; but for BMF, BMV and BOVESPA, where open-outcry auctions tend to prevail over the order book, traders can withhold orders from the book and match them on the floor in hopes of obtaining better prices.

Information Systems

In the classical auction, all information is incorporated into the single equilibrium (or true) price. But actual trading systems behave quite differently for two reasons. First, information arrives over time and can only be incorporated into the market price once it has been revealed through the orders that are placed and the resulting transactions. Similarly, information is often spatially dispersed. Traders on the floor may have important information unavailable to investors deciding what type of order to place and at what price. For these reasons, actual market prices can differ substantially from the true price, introducing unwanted volatility into the market. The manner in which information is gathered and broadcast by a market can thus influence price behavior. The more efficient a market system is in providing information on recent trades, the more quickly that information can be incorporated into future orders, promoting market efficiency and reducing price volatility.

The type and amount of information regarding trading volume and prices differs widely across the markets being described here. For example, the ISE, on those shares traded manually, provides floor traders with a complete record of the existing order book, as well as all transactions that have taken place in the current trading session; the BEC's automated order book also provides subscribers with complete order book information. In contrast, SET's automated order book provides an abbreviated version of the market, with the 3 best bid and offer quotes and the most recent transaction, as well as the day's high and low transaction. The JSE, which also has a manual order book that is in many ways similar to the one used by the ISE, maintains only the 2 best outstanding quotes at any time, together with the prior day's closing price. BOVESPA and BMV provide information on the last transaction and day's high and low transactions, but order-book information is limited to the single best outstanding quote, which is of limited value given the open-outcry nature of the markets.

The variety in information systems just described is a bit overwhelming, so summarizing the salient points may be helpful. Automated order processing permits dispersion of information equally across investors so that the differences in information available to investor groups are reduced substantially. However, each automated system is designed to provide a specified set of information and, inevitably, that information set is limited. Floor trading systems, by their very nature, discriminate in the information that they provide to floor traders versus other investors. But the level of information available to floor traders differs substantially from market to market and, in some markets, exceeds what is available in the automated systems. A strict ranking of these markets based on their information systems is not possible. Clearly, more information is better, but the extent to which the information is dispersed among market participants also plays an important role. In designing trading and information systems, the administrators in each of the markets have weighed these two features and, within the constraints imposed by economics and technology, have chosen the system they feel best suits their market's needs.

V. Summary

Despite the small number of exchanges involved, the individual market descriptions that follow highlight the diversity in trading and information systems that exist globally. Each of the markets employs a continuous auction system, but there the similarities end. Significant differences exist in the level of automation in matching trades: BEC and SET have completely automated systems, while BOVESPA uses an entirely automated system (but different from that used by either BEC or SET) for the majority of shares, but not for its high volume shares; ISE has recently automated roughly half of the shares that are traded; BMV is introducing an automated order-matching system for some of its low volume shares, whereas BMF, and JSE are entirely based on manual floor trading.

Also, the information systems available to traders vary widely between markets. BEC and SET make (nearly) complete market information, including the outstanding order book, available to all investors, something unavailable in many developed countries. ISE and JSE provide almost the same information, but largely to floor traders. For the floor trading systems of BMV, BMF and BOVESPA, by comparison, information on the most recent trade is available, but information on outstanding orders is known only to those standing on the floor who hear the outcries of other traders. Similar differences exist on price movement limitations and the types of trades allowed.

Interpreting the importance of these different systems is difficult. Despite its theoretical importance, ascertaining the empirical relevance of market microstructure is still in its infancy. While more and more empirical work is being performed on some of the major developed markets, interpretation of results is rendered difficult by the very complex nature of the structures involved. Moreover, empirical (and theoretical) work on emerging market microstructure has just begun,[7] leaving open the possibility that microstructure importance is either diminished or enhanced by the developing nature of those markets.

This paper has attempted to introduce the topic of market microstructure to those interested in the emerging markets. Hopefully, the information that is provided will encourage investor interest in these markets, thereby enhancing market liquidity. For market administrators and regulators, the hope is that the paper's contents will encourage them to think more about the implications of their microstructure decisions on market appeal and liquidity. Even though the jury is still out on how best to design market trading and information systems, all evidence, both theoretical and empirical, suggests that design has a significant impact.

The remainder of this paper consists of a set of market descriptions that arose out of visits to the seven markets and several brokerage firms affiliated with them. Unlike other market descriptions currently available[8], the emphasis is on trading systems rather than on the shares listed. By documenting the nature and diversity of the market structures of these increasingly important markets further, it is hoped that investor interest in the markets will continue to increase.

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[7] See Domowitz, Glen and Madhavan (1994) for an introduction to microstructure of the Mexican Stock Exchange and empirical work related to specific features of that market.

[8] See, for example, Park and Van Agtmael (1993).

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Bolsa Electronica de Chile

La Bolsa Electronica de Chile (BEC) began operations in 1989 as a competitor to the much older Bolsa de Comercio (BC). The BEC is a completely automated exchange with computer facilities located in central Santiago. Instruments traded include all shares and debt instruments traded on the BC, as well as foreign exchange. Aggregate statistics for the Chilean market are presented in Table 2. Among other things, the table documents the rapid growth in market share that BEC has captured from BC following its introduction.

Table 2

	1989	1990	1991	1992	1993
Number of Listed Companies	213	215	221	245	263
Market Capitalization					
Pesos (trillions)	2.8	4.6	10.5	11.3	19.2
Dollars (billions)	9.6	13.6	28.0	29.6	44.6
BEC Daily Trading Value					
Dollars (millions)	-	0.3	1.3	2.7	
BEC Market Share (%)	-	8.6	14.8	23.9	
IGPA Index	757.6	1166.7	2483.7	2733.5	3915.5
P/E Ratio	5.6	7.9	15.9	13.0	20.0
P/BV Ratio	0.9	1.0	1.7	1.7	2.1
Dividend Yield	9.5	5.0	3.5	3.8	2.7

Trading on the BEC occurs Monday through Friday between the hours of 9:30 am and 4:30 pm. Normal trading is continuous during those hours. In addition to normal trading, BEC operates a series of electronic auctions at different times of the day. Both normal trading and the auctions will be described in more detail below.

BEC provides order entry, order matching and market information services to subscribers, of which there are currently 55. All services are provided through terminals, of which there are about 70, located throughout Chile, some quite distant from Santiago. Subscribers are mostly brokers, but also include some institutional investors.

The Bolsa Electronica provides subscribers with two trading screens: one which displays only the best outstanding bid and ask quote for a stock; and one with all outstanding quotes, including order quantities. Also available is a complete list of the current day's trading activity, including price, time, quantity buyer/seller, delivery date and total value of each transaction.

Orders

Orders entered into the system can take a variety of forms. They can be either firm orders, which remain on the system for the duration of the trading session, or normal orders, which are retained by the system for only five minutes; firm orders can be canceled from the system after 10 minutes upon request. In addition, an order can be designated as either divisible or not, which determines if transactions involving only a fraction of the order amount can take place. Market order types are differentiated in the system by the color in which they are displayed on the screen.

Brokers who have matching buy and sell orders can transact them in the system subject to restrictions. First, both orders must be placed in the system at prices that are better than the existing best market quotes, i.e. inside the outstanding market bid/ask spread. And second, once entered, the system provides the market one minute to respond to the order. If no other market participant intercedes, the transaction is completed as entered.

Orders are matched according to well defined criteria. Price receives top priority on all orders, followed by time of entry; older orders have priority over subsequent orders. When an order is entered, it is matched with the best outstanding orders. Two examples help to clarify the matching system.

Assume that there are outstanding orders to sell shares of XYZ Corporation as follows: 5,000 shares at $100 and 5,000 shares at $110. If an order is put into the system to buy 10,000 shares (at market), the order will be executed in the following manner. The first 5,000 shares will be bought at $105 (the average of the $100 and $110 sell orders outstanding). The other 5,000 shares will be sold at $110.

Now consider an order to buy 15,000 shares (at market). The first 10,000 shares would be traded as just described. The remaining 5,000 shares would then remain in the system as a new buy order, at market

Auctions

In addition to the continuous trading of shares, six electronic auctions are held daily. Two of these auctions are for orders of listed shares that exceed 100 million pesos. Three of the auctions are for nonlisted shares, shares of companies that are in liquidation, and shares of companies that are having legal problems. One daily auction is held for blocks of listed shares that exceed 350 million pesos. In addition to these six, there exists the possibility for auctions for suspended shares (auction type 11), shares of companies that are in liquidation or face legal problems (auction type 12), and for shares of nonlisted companies (auction type 13).

There are two different auction types: concurrent auctions, in which all shares (as well as long- and short-term commercial paper and bonds) are auctioned simultaneously; and individual auctions in which only one stock is auctioned at a time. The individual auctions are used for blocks in excess of 350 million pesos and for auction types 11, 12 and 13. All other auctions are concurrent.

All auctions consist of three steps: inscription or entry, dissemination of information, and bidding. The time involved for each step depends on the auction type. Normal continuous trading takes place during the auction procedure.

For concurrent auctions, the inscription period begins at 9:30 am and lasts until the dissemination period begins, which differs for each auction type. During the inscription period, interested sellers of any stock enter the number of shares that they want to sell. During the 15 minute dissemination period, the sell orders are made available to all subscribers to see. Following the close of the dissemination period, subscribers are free to enter bids for the shares being offered. Once entered, bid quantities are made public, but bid price is not made public; competitors are given three minutes in which to respond with their own bids. The shares are sold after a period of three minutes has passed with no new bids being entered or when the time period defined for this auction type (15 minutes) expires. Shares are sold at the best possible price, with shares sold on the basis of offer entry time. Shares offered for sale through auction must accept whatever price is bid for them, which will always be a better price than the one asked for. The system will not accept prices that are lower than the one defined by the seller.

Individual auctions differ from concurrent auctions in three important ways. First, only one stock is auctioned at a time, and, second, the individual auction lasts only 25 seconds. Finally, once bidding for a stock begins, the price associated with each bid is made public.

Solicitations

Solicitations to sell any share in the future can also be entered into the system. Solicitations designate the date and time of the proposed transaction. Once entered, a solicitation can be withdrawn at any time, unless a responding order has been received, in which case that order must be accepted.

Price Movement Limits

As dictated by the Superentendencia de Valores y Seguros, which has national responsibility for regulating securities markets, price movements in the auction system are limited to 10 percent per day. Price movements in the normal trading system have no limits.

Bolsa de Mercadorias & Futuros (Sao Paulo Commodities & Futures Exchange)

BM&F is a privately-owned nonprofit organization established for the trading of commodities and financial instruments. Commodities trading began in 1917 in Sao Paulo with the formation of the Sao Paulo Commodities Exchange. BM&F was then founded in 1985 and began trading sessions in 1986; the two exchanges were combined in 1991. The Sao Paulo Stock Exchange (BOVESPA) was the founder of BM&F and continues to be an honorary member of the Board. Other members of the board include commodities brokerage houses, local traders, and clearing members. Agricultural commodities houses and brokers can be members of the exchange, but are not allowed seats on the board.

A variety of spot, forward, futures and options contracts on agricultural goods, gold and financial instruments are traded on BM&F. New contracts are added periodically when a perceived need exists and approval is obtained from the regulatory authorities. In 1992, total (U.S.$) volume for each of the major types of contracts was: interest rate futures ($131.4 billion), stock index futures ($33.7), gold contracts ($31.7 b), currency contracts ($29.8) and agricultural commodities ($0.4 b). There are a number of different contracts and delivery dates traded in each of these major categories. Futures are traded for 1 day interbank deposit interest rates, General Market Price Index, the BOVESPA stock index, gold, U.S. dollars, live and feeder cattle, coffee and soybeans. Options are traded for gold and U.S. dollars and options on futures are traded for arabica coffee. Forward contracts are traded for gold.

The exchange operates Monday through Friday, but floor trading hours vary for each contract. For example, the BOVESPA stock index future is traded during the same hours that BOVESPA trades: 9:30-13:00 and 15:00-16:30. Gold contract trading hours, however, are set to match the trading period in New York. Most contracts begin trading around 10:00, and trading for most contracts closes between 16:00 and 17:00.

There are 147 commodity brokerage houses that are members of the exchange, each of which is allowed 5 traders on the floor and an additional 4 runners. These houses are allowed to trade both for their own account and for customers, some for all contracts (65), others for only financial contracts (82) and agricultural contracts (36). Some houses are also clearing members (73), which allows them to perform clearance and settlement procedures. Local traders (62) are restricted to trading for their own account and for other authorized traders. Common members have no access to the trading floor, but are subject to lower transaction costs than the public. Non-members can also be authorized by the exchange to trade in specific contracts, always by associated brokerage houses.

Both buyers and sellers of any contract must guarantee ability to pay through the maintenance of a margin account. Margins can be held in the form of cash, interest bearing securities or gold. The amount of margin required depends on the nature of the contract and the position involved. For example, option contract margins are determined daily by the maximum between the average premium paid and a percentage of the underlying asset. Futures contracts margins have fixed quantities for each contract that are adjusted periodically according to changes in price. In addition, future contract margin requirements for hedgers are lower than for common traders. Margin requirements must be met with shares (stocks) by 17:00 on the trading day or with gold, cash or other liquid securities by 12:00 of the following day.

Outstanding positions at the end of each trading session are settled according to the day's settlement price, which is calculated according to formulae that reflect the nature of the contract. Cash settlement takes place on the following day with the buyer paying his broker, who then pays the clearing broker, who is responsible for paying the seller's broker, who pays the seller. Cash settlement of the mark-to-market process takes place on the following day with the debtor paying his broker, who then pays the clearing member, who pays the other party's clearing member, who is responsible for paying the creditor's broker, who pays the creditor. All payments can be done by electronic order through Central de Liquidacao e Custodia de Titulos Privados (CETIP), a privately-owned system which makes debits and credits in the accounts of financial institutions at the Central Bank.

Settlement upon expiration of a contract depends on the contract; gold, live cattle, coffee and soybean contracts must be settled by physical delivery, others must be settled in cash, while some contracts can be settled in either manner. Limits have been established on the open positions that can be maintained for all contracts. After the daily trading session closes, traders have one hour to register their clients with the exchange and indicate the clearing members involved. BMF uses information about commitments to monitor margins and open interest.

Floor Trading System

For the most part, trading is conducted by open outcry—*viva voz*. Traders with orders from clients or who trade for their own account meet on the floor and attempt to buy and sell by voicing their desired position. When a match occurs, the seller fills out a transaction card with the contract type, price, quantity, buyer and seller, which must be signed by both parties. The seller has ten minutes to report the trade to exchange officials who occupy booths at the edge of the trading floor. The card is delivered to the exchange officials through a slot in a card holding bin. As time permits, these cards are then fed into an optical scanner and read into the exchange computer system.

Cards may be rejected by the computer system for two reasons: the scanner is unable to read them properly, or the price and quantity involved exceed certain parameters. Inability to read the cards occurs when they are inaccurately completed, but corrections are easily made manually following a visual check of the card by the attending exchange official. Stray marks on the card can be removed or insufficiently dark marks can be reinforced. At times, however, correction requires input from the trading parties, which is sought through a runner. Inability to scan the cards properly can slow down the input process, but seldom causes significant delays or failure of the trade to be completed.

The exchange and the regulatory authorities—Comision Nacional de Valores for BOVESPA index futures and options and Banco Central for all other instruments—have also stipulated certain parameters on quantity and price change that every trade must satisfy. If the quantity of a transaction exceeds an amount specified for that contract, the transaction is rejected by the system. Similarly, if the price of a transaction is more than a certain percentage (depending on the contract and market conditions) above or below the most recent transaction, the transaction is rejected by the system. Once rejected, trades are taken to open auction on the trading floor.

Auctions are announced on the floor immediately prior to occurrence and are open to all traders. They take place during normal trading hours soon after a transaction has been rejected by the system and

normal trading continues during the auction. Bidding in the auction is restricted to minimum levels of participation. If no traders enter the bidding, the transaction is completed as originally entered into the system. Auctions are also used when a new contract is introduced or at the opening of a new delivery month on an existing contract.

There are three methods by which a trade can take place on the exchange. Normal trades are those trades that arise in the usual course of floor trading, as described above. Direct trades (cross trades) occur when a broker identifies both the buyer and seller prior to taking the trade to the floor. Direct trades must be announced on the floor and taken to auction. Finally, a broker with a position that needs to be filled can enter that position into the system as an order by means of an order card that is scanned by the computer. These orders can be placed during the normal trading session, as well as during the 15 minute pretrading order entry session. Once entered, the order is displayed on the video screens that surround the trading floor and any trader on the floor can take the order by contacting the originating trader. Once entered, orders can also be canceled by completing and entering a second offsetting order card.

Market Information

Once a trade has been accepted by the scanner it is entered into the exchange computer system, which feeds information to the trading floor video screens. For each contract, those screens provide yesterday's closing price and current day trading information, including: volume, number of contracts traded, opening price, last price, minimum price, maximum price and current best outstanding bid/offer price. Reported bid/ask prices represent only those orders placed into the system by card and may not be representative of existing floor prices.

Floor prices and transactions are also reported in a separate information system maintained by the exchange and reported offsite by vendors to subscribers. This second information system depends on information gathered by floor reporters employed by the exchange who report information on prices and transactions by wireless phones to data entry operators, who enter the information which is then transmitted to offsite locations.

Floor traders also have direct contact to their offices while on the floor by means of wireless phones provided to them by the exchange. These phones provide the traders with customer orders, as well as other market information obtained by the office.

Bolsa Mexicana de Valores (BMV)

The Bolsa Mexicana de Valores was established in 1907 and is the only exchange in Mexico. It is a private entity owned by 26 brokerage houses, each of which has an equal share of the capital. These brokerage houses are the only entities allowed to trade on the floor of the Bolsa, and they must be Mexican owned; no foreign brokers or traders are currently allowed in Mexico.

The Bolsa has two trading floors located in the same building; the main floor—Mercado de Capitales—is where private sector equities and fixed-income securities (debentures) are traded; an adjacent floor—Mercado de Dinero—trades government debt and private commercial paper.

The Mercado de Capitales is the larger of the two markets physically and in the volume of transactions, but the Mercado de Dinero trades more securities in terms of the value of transactions. Total value of transactions on the Mercado de Capitales in 1992 was 191.8 billion new pesos, compared to 10.9 trillion new pesos in the Mercado de Dinero. (Annuario page 26) Table 3 provides additional summary statistics for the Mercado de Capitales.

The increase in trading value observed over the reported period is due mainly to a higher value of traded shares in the industrial, commercial and services sectors, which represented 82 percent of total value traded in 1992. The remainder is represented by financial shares. In addition to the reported figures, the value of mutual funds traded on the Bolsa was $6 million in 1992. Fixed income securities represented only $11.4 million in total value traded in 1992.

Currently, 1230 securities are traded on the BMV capital markets floor. Of these, 884 represent equities and 346 are fixed income securities—bonds, debentures, silver certificates, and promissory notes.

Of the equity instruments, each company can issue as many as three different series of shares, each with different rights or shareholder bases. All series have full participation in the earnings of the firm, but each differs in its voting rights and shareholder base. Series A shares are available only to Mexican citizens, or to foreigners through a Mexican trust fund which assumes the voting rights. Series A shares represent at least 51 percent of the voting rights of all companies. Series B shares can represent no more than 49 percent of the capital and voting rights, but are available to all investors. Series C (or L in the case of financial institutions) shares have no voting rights, but are available to all investors.

Of the 884 equity instruments listed on the exchange, 476 represent mutual funds, 143 represent financial institutions and 265 represent the industrial, commercial and service sector. Of the 346 fixed income securities, 41 are bonds, 26 are certificates and the remainder are various other types of fixed income securities, including silver certificates. Thirty six of the equity instruments are also traded as Depositary Receipts (DR) in foreign markets.

Clearance and settlement of transactions are handled within forty eight hours. Settlement is arranged between individual brokerage houses. Clearance services are provided by Indeval, an independent entity owned by the brokerage houses.

Table 3

Bolsa Mexicana de Valores - Mercado de Capitales	1989	1990	1991	1992	1993
Number of Listed Companies	203	199	209	195	190
Market Capitalization					
Pesos (trillions)	61	96	303	433	624
Dollars (billions)	23	33	98	139	201
Trading Value					
Pesos (trillions)	15	35	96	138	194
Dollars (billions)	6	12	32	44	62
Turnover Ratio	33.3	44.0	47.9	37.0	36.8
BMV Index	418.9	628.8	1431.5	1759.4	2602.6
P/E Ratio	8.4	10.3	14.1	12.3	19.4
P/BV Ratio	0.9	1.0	1.8	2.0	2.6
Dividend Yield (%)	2.1	3.4	0.8	1.0	1.6

Trading System

BMV trading hours are 8:30 am to 4:00 pm Monday through Friday. Prior to the opening of floor trading, brokers may enter bids and offers into the exchange computer from 8:00 am to 8:30 am. Pre-opening orders entered into the computer can be crossed by the computer and transactions consummated. Transactions crossed during the pre-opening period are subject to the ± 5 percent price movement rule described in more detail below. If a pre-opening cross occurs, then the reference price for the beginning of the regular trading session is the pre-opening cross price.

The regular trading session begins at 8:30 am daily, which corresponds with the opening of trading in the New York market. Orders placed with brokers can be handled in two ways. One is to enter the orders into the exchange computer system by submitting a buy—Orden en Firme de Compra—or sell—Orden en Firme de Compra—order form with the exchange post, which enters the order into the exchange computer as soon as time permits. Limit orders entered into the system receive a time stamp that determines the order in which they are matched; the system operates on a first-come-first-served basis. Once entered into the system, orders are eligible for matching with all other orders, whether entered into the computer or not. The best outstanding bid and offer available on the computer are displayed on the video screens that surround the trading floor, and no trades can be crossed on the floor that violate these quotes. Floor transactions in excess of the offer or below the bid must first be crossed with the outstanding computer orders to the extent possible.

The second method in which brokers work orders is to hold them and attempt to fill them on the floor through open outcry. The trading floor is circular, with three exchange posts situated near the center where transactions and orders are processed. Video screens surround the perimeter of the circle and are arranged according to sector—financial versus other—and then within each sector alphabetically. Traders tend to congregate near the screen of the share for which they have orders, but transactions can occur on any part of the floor. Traders with orders announce their orders verbally to the other traders on the floor. If a matching order is identified, the traders complete a sale form—Ficha de Compra-Venta—which identifies the buyer, seller, share, price and quantity. One copy of the form is given to the buyer, one to the seller and one to the exchange post, where it is entered into the exchange computer as soon as time permits. Transactions consummated by open outcry must take place at a price inside the current best bid-ask spread. Otherwise, an outstanding limit order will take priority over one side of the floor transaction.

Only two types of orders can be placed: market orders and limit orders. Market orders buy or sell at the market price; limit orders buy or sell at the limit order price.

All transactions must occur on the trading floor. Brokers who have orders, either large or small, can search for and identify matching orders off the floor, but the resulting trade must be announced on the floor. Any outstanding limit or market orders that meet or better the announced price, must be included in the transaction and thus reduce one side of the announced transaction. Outstanding limit orders that better the announced price are transacted at the announced price.

Suspension of Trade

A reference price is established at the start of trading each day. If no transactions occurred during the pre-opening session, then the prior day's closing price is the reference price; if transactions did occur during the pre-opening session, then the last such trade determines the reference price. The reference price determines a range in which subsequent trades must occur. Trades outside a range of ± 5 percent of the reference price can result in a suspension of trade, but that depends on the behavior of price behavior up to that point. The first time that a quote would result in a trade outside of the 5 percent band, trade is suspended for one hour. At the end of that hour, trade is resumed and a new reference price is established at the level that caused trade to be suspended.

If prices continue to move in the same direction as the direction that caused the first violation of the 5 percent rule, and a quote is received that would result in a trade outside of the 5 percent band relative to the new reference price, then trade is suspended again, but this time for one and a half hours. At the end of the suspension period, trade is resumed and a new reference price is established at the level that caused trade to be suspended.

Subsequent price movements that continue the trend do not result in a suspension of trade; only two suspensions of trade are possible on any given day. Instead, prices are not allowed to move more than 5 percent from the third reference price of the day, except when a trend is reversed.

After a first, or second, suspension of trade, subsequent price movements can be in excess of the 5 percent rule, if the movement is against the previous trend. For example, if prices originally moved up by more than 5 percent and trading was then suspended, subsequent price movements downward can

exceed 5 percent of the new reference price, but can not move outside the 5 percent band surrounding the original reference price. Trade is suspended when price reversals occur, only when those reversals result in a price movement outside the 5 percent range from the day's opening reference price.

Trading is suspended on the floor for ten minutes each hour, beginning at twenty minutes past the hour. This pause allows the exchange clerks to enter all transactions and quotes into the computer so that video screen information is timely.

Information Systems

SIVA - System Integrado de Valuacion Automizado, provides information on exchange transactions, both internally and externally. Internally, it accumulates and displays the information provided to floor traders on the video screens located on the perimeter of the trading floor. This includes the most recent transaction information and the best outstanding bid and offer prices and quantities. Externally, SIVA provides similar information to member brokers at their off-floor offices, to the Comission Nacional de Valores, to the Central Bank and to a few international news services.

Mini-SATO - Currently, SIVA also provides some automated trading services. This includes orders entered into the system both during the pre-opening session, as well as during the normal trading hours. In addition, 63 low-liquidity shares are traded exclusively on the SIVA system. For those 63 shares, brokers input orders into SIVA from the floor and matches are handled by the computer. The automated-trading aspects of SIVA will be superseded by a new automated-trading system, SATO, which is expected to begin operations in 1993. The first phase of that system's implementation will include the same 63 shares currently handled by SIVA. Subsequent phases could include additional shares and an expanded network of terminals located throughout the country, and even internationally.

Market Surveillance

BMV began its current market surveillance system, VIHIA, in April 1990. It is modelled on the StockWatch system of the New York Stock Exchange and tries to identify unusual market activity that could be associated with insider trading or market manipulation. To accomplish that, the system monitors volume and price relative to historic levels and trends, as well as news releases. Unusual behavior triggers further investigation in order to link the behavior to changes in underlying fundamentals or activity by important individuals. In order to assist in the investigation, BMV maintains an extensive database of corporate financial information, as well as close relations with the listed corporations.

Bolsa de Valores de Sao Paulo

BOVESPA is one of nine Brazilian exchanges, but is by far the largest of those with trading volume of $13.3 billion in the first semester of 1993, representing 80.6 percent of total Brazilian volume. BOVESPA is a nonprofit association whose administrative board is elected by member brokers. There are 86 active members of the exchange and 51 accredited as Licensee or CATS Licensee. The number of floor traders permitted each member depends on the value traded by the firm; in addition members of other Brazilian exchanges may be permitted to have traders on the floor. Table 4 presents summary statistics for recent years.

There were 555 companies listed on the exchange in June 1993, including one mutual fund. Trading occurs Monday-Friday as a continuous auction during two sessions: 9:30-13:00 and 15:00-16:30. The majority of shares are traded on a computerized order entry and matching system—Computerized Automated Trading System (CATS)—while the 19 shares with the largest volume are traded by open outcry—*viva voz*—on the trading floor. The list of shares traded by open outcry can change over time as market volume changes.

BOVESPA has both cash and forward markets for shares. Shares traded in the cash market are settled in two business days; this represents about 88 percent of total trading volume. Investors also have the ability to trade shares forward, i.e. for delivery at from 30 to 180 days in the future, with settlement at the date of delivery; the forward market represents about 0.1 percent of total volume. Trading of options on listed shares, both puts and calls, is also permitted; options trading represents about 11 percent of total volume. Forward and option trades are handled in the same manner as cash trades both in the manner they are traded—CATS or viva voz—and in the processing of the completed transaction. Margin accounts and short sales are permitted, subject to some restrictions by the regulatory authority, and to the permission of an investor's broker.

Table 4

	BOVESPA				
	1989	1990	1991	1992	1993
Number of Listed Companies	592	581	570	565	550
Market Capitalization					
Cruzeiros (billions)	501.4	2,633.4	46,615.8	554,135.0	31,909,090
Dollars (millions)	44,368	16,354	42,759	45,261	99,430
Trading Value					
Cruzeiros (billions)	28.0	255.2	3,865.1	70,036.9	4,594,371
Dollars (millions)	16,762	5,598	13,373	20,525	57,409
Turnover Ratio	17.9	23.6	22.0	31.5	32.6
BOVESPA Index	6.1615	25.156	607.76	6,780.5	375,450.0
P/E Ratio	5.9	4.7	15.5	-24.4	12.6
P/BV Ratio	0.7	0.3	0.8	0.4	0.5
Dividend Yield(%)	0.7	9.4	0.6	0.7	0.4

CATS

The CATS system used by BOVESPA was adapted from the system developed by the Toronto Stock Exchange. Under CATS, member brokers have terminals in their offices which provide order entry and information services; each member is allowed four terminals, but may elect to have fewer terminals.

Buyers and sellers may choose among various types of orders, including market orders, limit orders and minimum fill orders, that can be placed to meet a variety of needs. Market orders specify a quantity of shares to be bought or sold at the current market price; limit orders specify both a quantity of shares and the price at which they are to be bought or sold. Minimum fill orders require that a minimum number of shares be transacted. Other order types include fill-or-kill, which requires immediate response by the market or the order is killed, and on-stop orders, which are held by the system until the stock trades at or through the order's on-stop price, at which time the order is triggered. Once entered, all orders remain outstanding until the end of the trading session, until filled, or until canceled.

Orders are executed by the system on the basis of price, time and type priority. Best price always has top priority, followed by order type, i.e. market orders have priority over limit orders, and then by time—first in-first out. As with any automated matching system, the manner in which orders are processed is well defined, but system specific. For example, if a market order to sell shares is received by CATS, only that portion of the sell order that can be matched with the best outstanding purchase order is filled, with the remainder left on the system at the same price, even if other purchase orders at lower prices are outstanding. By comparison, some automated systems would fill as much of the sell order as possible at any available price. Both approaches to the transaction have merit, what is interesting is the differences between even automated systems.

CATS also provides brokers with real time information on the market, including all outstanding orders, both price and quantity, as well as the quantity, price and time of the last trade for each share.

Viva Voz

Shares of the most active 19 shares—representing 81.8 percent of BOVESPA's total volume—are traded on the floor of the exchange by open outcry. The floor is separated into posts, with each sector, e.g. banking, assigned to a post; Telebras, which represents about 40 percent of total volume, is assigned its own post. Each post consists of a set of video monitors with market information (described below) and a counter, behind which exchange employees process orders and transactions.

Floor traders receive orders from their offices via a BOVESPA wireless phone network available to all floor traders. Orders are executed by identifying counterparties on the floor. When two parties agree to a trade, the seller completes a transaction card which identifies the security—company and type of share (cash, forward, option)—buyer, seller, quantity and price. This card is signed by both buyer and seller and then placed into a slot in the post, after which an exchange employee feeds the card into an optical scanner which transmits the information on the card into BOVESPA's computer system.

In some cases, the card is rejected by the scanner, requiring an exchange employee to verify that the card was completed properly. If the problem is due to the ability of the scanner to read the card, then the problem can be corrected by the exchange employee erasing stray marks on the card or by making

the entries on the card more pronounced. If the problem with the card is not obvious, then a runner is dispatched to find the parties in order to correct the problem.

A card may also be rejected by the system for reason of price or quantity. To assure smooth operation, the trading system is provided with transaction parameters for both quantity of shares and fluctuation of price and rejects any entry for a transaction outside those parameters. These parameters are determined by the Securities Commission and by BOVESPA and can be changed whenever necessary. Transactions that exceed one of these parameters are examined by a BOVESPA employee who includes them in a special registration procedure and informs the involved brokerage companies. Similar special procedures apply to CATS transactions, in which case the involved brokerage companies are informed by telephone. The special procedures consist of auctions that are described in more detail below.

Floor traders also have the option of placing orders into the system by means of an offer card. Orders placed in the system remain outstanding until matched on the floor or canceled. Orders are placed in the system and displayed on the video monitors in order to identify a counterparty, but owing to the nature of the trading system, most trading is done on the floor.

Floor traders have access to information entered into the system via video screens at each post. These screens display current information on each share, including opening, average and last transaction price, total daily volume and number of transactions and the best bid/offer outstanding. Note that the opening price is not equal to the previous closing price, but is the price of the first transaction reported for the day. Information entered into the system is real time in the sense that it is reported as soon as it is recorded in the system, but owing to the nature of the floor trading and the data entry, there can be a delay between the time of the transaction and the time at which it is reported. In addition, it is possible that the order in which transactions occur on the floor and the order in which they are reported by the system can differ slightly owing to the physical process of delivering cards to the exchange employee.

The exchange also has employees on the floor who report bid, ask and transaction information via wireless telephone to data entry operators located off the floor. That information is entered into an information system which is fed directly to broker's offices offsite. This information system is not available on the trading floor.

Auctions

The Brazilian securities regulatory authority—CVM—has issued an instruction that identifies several categories of trades requiring preannounced public auctions, instead of the usual continuous auction used in floor trading. Preannounced auctions are required in cases where either the number of shares being traded in a single transaction exceed a specified maximum, or the price of a transaction exceeds by a certain percentage the share's previous closing price. In both cases, the intent of the CVM is to ensure that significant transactions, i.e. transactions that either reflect large price movements or large volumes of shares, are conducted in a fair and open manner. The resulting auctions are announced on the floor from one minute to two days in advance, depending on the nature of the transaction. During the auction, normal floor trading continues uninterrupted.

The same instruction requiring auctions also applies to shares traded on CATS, except that on that system, auctions are conducted electronically and normal trading for the share is halted during the auction.

When a trade is stopped and taken to auction, the exchange can require the broker to reveal the name of the buyer/seller. If the same buyer/seller has been involved in other transactions with the same share, the previous transactions can also be annulled and subject to auction.

Settlement

Settlement is handled by Calispa, an independent company, which guarantees the settlement of each transaction. Delivery of securities occurs on the first business day following the trade, while financial settlement occurs on the second business day following the trade.

Istanbul Stock Exchange[9]

The Istanbul Stock Exchange was opened in 1986. It is a self-regulated organization governed by an Executive Council composed of the Chairman (appointed by the government) and four members elected by the members of the exchange. ISE has 174 members, of which 11 are investment banks, 51 are commercial banks and 112 are brokerage houses. Each member is allowed 4 floor traders, with the option to purchase floor access (from ISE) for an additional 4 traders.

The number of shares listed on the exchange is 1,303; of those, however, only 155 are traded. Applications to ISE for trading and listing are separate and, in fact, there are 5 traded shares that are not listed. Listing on ISE has legal consequences, in particular related to the tax rate paid on income, which induces companies to list their shares on the exchange, but not to apply for trading status. Table 5 presents relevant trading statistics for recent years.

Trading occurs Monday-Friday as a continuous auction in two sessions: during the normal session, 10:30-12:30, and during the odd-lot session, 9:15-9:45. During the normal session, only full lots of shares are traded, where a lot consists of 1,000 shares; odd lots are less than 1,000 shares. Trading during the odd-lot session mimics that of the normal session, except that trading is restricted to odd lots, primary market transactions, official auctions and stock rights. Odd lots can also be traded off the floor through registered brokers.

Orders placed with members can be either market orders or limit orders; market orders can be filled at any market price, whereas limit orders specify the price (or price range) at which the order is to be filled. There is no legal regulation of short selling in Turkey. Short sales do occur, but ISE can discourage the practice by requesting physical delivery of all shares sold.

On the trading floor, each share has a trading board upon which traders can post buy and sell orders. At the top of the board is the day's reference price, which is a weighted average of the previous day's transaction prices, as well as the upper and lower bounds on the day's price band, which is ± 5 percent from the reference price. Generally, trades may not occur outside of the price band, but on occasion, the exchange floor chief may increase the band to ± 10 percent following application to do so by at least three members. In addition, the floor chief can halt trading on a share if some significant event, such as the release of important company information, is to take place. Normally, trading on a share is halted for fifteen minutes whenever important company information is being reported.

The opening price for a share is determined by the first transaction price. Traders with orders to fill for a share queue in front of the trading board for that share and write their order once they reach the board. Buy orders are written on the left half of the board, sell orders on the right half. Each order must include the trader/member name, the number of shares/lots and the price. Orders are written sequentially from top to bottom of the board, which determines the time preference of orders with the

[9] The information reported here reflects the system encountered in September 1993 when my visit to the exchange occurred. Subsequent changes have taken place; 75 out of 155 shares are now traded using an automated order matching system. The objective is to automate the remaining shares. Also, selective information is now provided to international vendors for global dissemination.

same price. Most boards are actually covered with paper and when it is filled, a new piece of paper is brought out so that orders for a single share may occupy more than one page. These pages are kept by ISE and used as evidence in case of disputes regarding transactions.

Table 5

	ISE				
	1989	1990	1991	1992	1993
Number of Listed Companies	730	916	1,092	1,238	
Number of Traded Companies	50	110	134	145	152
Market Capitalization					
Lira (billions)	15,553	55,249	78,907	84,809	546,316
Dollars (millions)	6,783	19,065	15,703	9,931	37,496
Trading Value					
Lira (billions)	1,668	15,028	35,487	55,855	255,223
Dollars (millions)	798	5,841	8,571	8,191	23,242
Turnover Ratio	19.0	42.4	52.9	68.3	80.9
ISE Index	2,218	3,256	4,369	4,004	20,682
P/E Ratio	16.5	13.2	13.7	6.9	36.3
P/BV Ratio	6.7	4.0	2.3	1.3	7.2
Dividend Yield(%)	3.6	5.5	4.4	8.1	2.4

Orders written on the board are termed passive; active orders are those that respond to the written orders. For example, market orders are most likely active orders as they are a response to the orders outstanding on the board. A trader responds to a passive order by crossing out the order and signing his name as an indication that the order has been filled. Passive orders must be given price and time preference; orders must be filled at the best outstanding price and, within all passive orders at that price, orders must be filled in the order in which they were written on the board. Exchange employees monitor the boards in order to ensure that price and time preference are observed.

Orders written on the board remain outstanding until the end of the trading session, or until removed by the originating party. Not all orders can be removed. The last written orders (on either the bid or ask side) can be removed at any time for any reason, but previously written orders, i.e. other than the last written order, can be removed only if accompanied by an improvement in price, i.e. an increase in bid or decrease in ask. Active investors are not required to fill a passive order in its entirety; any number of lots can be taken from the order by crossing out the outstanding order amount, and then signing and writing in the remaining number of shares available. In some cases, it may require several active orders to completely fill a single passive order.

After the close of the trading session, the paper "boards" are kept by the exchange as a record of the days activities and can be used as evidence during any disputes about transactions.

Traders may have orders to both buy and sell a share and may prefer to cross those two orders rather than to fill them from the board. In order to do that, they must write both orders on the board, wait for three minutes in order to see if there is a response from other floor traders, notify an exchange employee of their intention to cross the order and then complete the transaction. If there are better-priced or previously written equal-priced orders on the board, those previously written orders must be first filled before any amount of the cross-order can be filled. If the cross-order involves a block trade (described below), the waiting period is 30 minutes.

After filling an order from the board, the active party to the trade is responsible for completing a "deal slip", which reports the trade to the exchange and to the passive counterparty. The deal slip reports the share name, total amount of the transaction, share price, buyer and seller. It is signed by the active party and then reported to the exchange. One copy of the slip is filed with the exchange, one with the passive party and one copy retained by the active party. Filing of the deal slip does not occur until after the close of the trading session. Following filing, the exchange provides a transaction log to each member detailing the day's trades. Clearance and settlement is based on the transactions reported in the log. Members who disagree with the log have the remainder of the day in order to dispute a trade. Settlement occurs on the following day with cash and delivery of the security through the ISE Settlement and Custody Company (ISESC), an independent entity owned by the ISE and (a subset of) its members. Much settlement includes physical delivery of the security, but increasingly, physical delivery is no longer needed as custody services are provided by ISESC.

Trades involving 10-20 percent of the value of a company's paid-up capital are considered to be blocks. Trades are limited to at most 20 percent of the company's paid-up capital. When a block order is submitted, the Chairman organizes one or more special sessions, within 3 days following the submission of the order, to enable execution of the order. Bids for block trades are written on the board without mention of amount. Block transactions can not be partially filled. Block transactions are not cleared by ISESC.

Market Information

Floor traders have access to all information written on the boards, which gives a complete picture of the outstanding order book. Of course not all orders are written on the board as actives choose to hold their orders until filled. In addition to the board, the floor also has video screens that display market information, including current index values for the composite, financial, and industrial indices. Trading value and volume information is also reported, but because deal slips are not reported to the exchange until after the session has closed, volume information represents only the volume of the odd-lot session. Current currency quotes are also presented on the screen.

In order to provide information that simulates real time trading, the exchange has reporters on the floor who cover one or more of the boards depending on the level of activity of a board. Reporters gather information on most recent transaction and best outstanding quotes, and enter that information into computer terminals. That information is then relayed through the exchange computer and transmitted to Reuters, Telerate and other information agencies. Subscribers to those services receive current information on market activity, and while such information is not directly available on the trading floor, many floor traders carry cellular phones that allow them access to the information indirectly.

Fixed Income Securities

In 1991, ISE began trading fixed income securities, including government bonds, Treasury bills and corporate bonds. The market is semi-automated, with members phoning orders into the exchange. These orders are then entered into the computer system, which matches the order with outstanding orders. Trading hours are 10:00-17:00, Monday-Friday.

Jakarta Stock Exchange

After decades of on and off trading, the current version of JSE opened in 1977. It is one of two Indonesian exchanges, the other being the Surabeya exchange. JSE is a limited liability company owned by 280 members, 228 of which are local stock brokerages. Members of the exchange elect the members of the Board of Directors, who number 5. Summary statistics are presented in Table 6.

The JSE operates as a continuous auction with trading taking place during two sessions on Monday-Thursday: 10:00-12:00 and 1:30-3:00; Friday trading is limited to a single morning session: 9:30-11:30. 161 shares are listed on the exchange.

Table 6

	Jakarta Stock Exchange				
	1989	1990	1991	1992	1993
Number of Listed Companies	57	125	141	155	174
Market Capitalization					
Rupiah (billions)	4,050.0	15,264.6	13,537.0	24,839.5	69,299.6
Dollars (millions)	2,254	8,081	6,823	12,038	32,953
Trading Value					
Rupiah (billions)	957.0	7,318.1	5,778.3	7,909.2	19,088.1
Dollars (millions)	541	3,992	2,922	3,903	9,158
Turnover Ratio	38.6	75.8	40.1	41.2	40.5
JSE Composite Index	399.7	417.8	247.4	274.3	588.8
P/E Ratio	56.6	20.3	11.6	12.2	28.9
P/BV	5.8	3.4	1.6	1.6	3.1
Dividend Yield(%)	0.0	0.5	0.0	2.1	1.3

The center of the trading floor is occupied by stock exchange employees who process transactions. Surrounding them are desks for the 260 brokers that are members of the exchange. Each broker has an equal voting share in the exchange. Brokerages are allowed 2 floor traders at no cost; a fee of Rp100,000/month is charged for each additional trader.

Floor traders receive orders from their offices via telephone. Many floor traders carry cellular phones on the floor. Orders are written on slips (pink - buy, white - sell) that the traders carry to the order boards that line the circumference of the floor. The order boards are white boards on which orders are written manually with colored markers.

Order boards display current market information on each of the listed shares. Each listed company is assigned a board; the physical location of each share's board is moved periodically in order to separate the most active shares so as to avoid congestion on the floor. The order boards begin each session with the previous closing price, recent dividend information—cum date, ex date, payment date, dividend amount—and number of foreign shares available.

Order boards are divided into an upper and lower half, with the upper half further divided into a left and right side. The previous closing price is written in the center of the upper half of the board. Once the market has opened, traders write bids below the previous closing price and offers above it; the quantity of shares being bid for and the identity of the bidder are written to the left of the bid price with subsequent bids at the same price written to the left of the previous bid. Offer quantities and traders are reported to the right of the offer price with subsequent offer quantities written to the right of the previous offer. Only the two best bid and offer prices are displayed at any time, although the number of traders who are willing to trade at each of those prices is limited only by the amount of space available on the board.

When a trader brings an order slip to the order board, two possibilities exist: the order matches with an existing order on the board, or no match occurs. If the order matches with an existing quote, an exchange official allocates the matching orders from the board and records the transaction on the lower part of the board. If the order does not match any outstanding order, the order is recorded on the board if it is competitive with the outstanding quotes and the order slip is deposited in the order box that hangs beneath the board. If not competitive with existing quotes, the order slip is placed in the order box without be written on the board.

An exchange official from the floor allocates all transactions on the basis of time priority; orders are filled from the board in the order in which they were written on the board.

With only two bid and two offer prices allowed at any time on the order board, the arrival of new quotes or the matching of existing quotes with incoming orders can change the information displayed on the order board. When a transaction occurs, orders matched from the order board are removed, which can open the board for new quotes at a new price. When this occurs, order slips previously placed in the order box may qualify for display on the order board, but with no time stamp at the time order slips are placed in the order box, floor traders must watch the order board closely and move quickly to record their orders on the board as soon as possible following a price movement.

Quotes that improve on outstanding orders can also be placed on the order board and will force the second best quote off the board. Exchange rules, however, limit quotation price movements to 200 Rupiah from the existing quotes; the minimum price movement is 25 Rupiah. Therefore, if a broker wants to move the bid/offer price by more than 200 Rupiah, it must be done through a series of price quotations, each no more than 200 Rupiah greater/lesser than the previous one, and with sufficient time between quotes to allow other traders to respond.

Once recorded on the order board, orders remain until either the end of the session, or until subsequent price movements or a match with an incoming order removes them from the board. Orders may not be canceled once recorded on the board.

Trades of less than 500 shares are traded on the odd lot order board. Blocks in excess of 200,000 shares are traded on the block order board. Procedures for both of these special boards are similar to the regular order boards, except that owing to the small volume involved, a single board is used for all listed shares instead of a single share per board.

A broker who has clients on both sides of a transaction can cross the trade on the cross-trade board, but the transaction price can not differ from the most recent transaction price.

Listed shares are limited to 49 percent foreign ownership. Once that level has been reached, foreign buyers must transact with foreign sellers. Transactions between foreigners for these restricted shares can carry a substantial premium above the free-market price and are reported on a separate order board for foreign shares. On the order board, foreign quotations are reported in red ink, whereas normal share quotations are reported in blue/black ink.

When orders are matched, an exchange official reports the price, volume and counterparties on the lower half of the order board. The seller is then responsible for preparing a Note Transaction document that contains trade information, which is then signed by both the seller and buyer. The seller must then affix a duty stamp (1000 Rupiah) and submit the Note to an exchange employee located in the center of the trading floor. The exchange employee is responsible for recording the transaction in a log and assigning a transaction number. Note Transaction information is then recorded on a personal computer by an exchange employee.

Suspension of Trade

The exchange can suspend trading on a share in cases where company-specific information could materially affect share price. In such cases, trading is suspended in order to allow the information to disperse through the market.

Off-floor Information Reporting

The exchange has established the Billboard Broadcasting System for reporting floor information to offsite locations. It is available by subscription. The service provides floor price and transaction information as reported by roving floor reporters. There are normally five or six of these reporters on the floor who circulate and report information via an in-house phone network to data entry personnel, who enter the information into a computer system that relays the information to subscribers.

Settlement

Settlement occurs between brokers on the fourth day following the transaction. At that time shares are delivered and cash changes hands. In cases where the seller is unable to present the shares on day t+4, the seller must go back to the floor and buy the shares in the cash market, which means that the shares must be purchased at a premium that is paid in order to secure immediate delivery. Transactions not settled on day t+4 are subject to a fine to the defaulting party equal to 0.25 percent of the value of the trade on days t+5 and t+6 and 0.5 percent on all subsequent days.

Stock Exchange of Thailand

SET was established in 1974 by act of government and is a nonprofit organization under the supervision of the Thai Securities and Exchange Commission. SET has a Board of eleven members, five appointed by the SEC and five nominated by the members, with the president of the Board appointed by the other members acting as an ex officio member. Membership is limited to securities companies licensed by the SEC, and must be approved by the Board. As of May, 1993, there were 40 member companies. Table 7 presents summary statistics for recent years.

Since April, 1991, trading on the SET has been handled through an automated order processing system—The Automated System of the Stock Exchange of Thailand (ASSET). Shares are traded Monday-Friday during two trading sessions: 10:00-12:30 and 2:30-4:00. There are 320 companies listed on the exchange, for a total of 359 shares. Ordinary shares, with total volume of baht 1.8 trillion, represented the bulk of trading activity in 1992. Unit trusts represented the second most important type of security, with 1992 volume equal to baht 8.4 billion. Some preferred shares, warrants, debentures and convertible debentures are also traded.

Table 7

	SET				
	1989	1990	1991	1992	1993
Number of Listed Companies	175	214	276	305	347
Market Capitalization					
Baht (millions)	656,842	604,566	897,159	1,485,019	3,325,393
Dollars (millions)	25,648	23,896	35,815	58,259	130,510
Trading Value					
Baht (millions)	344,778	584,154	767,056	1,830,026	2,201,148
Dollars (millions)	13,452	22,894	30,089	72,060	86,934
SET Index	879.2	612.9	711.4	893.4	1682.8
P/E Ratio	16.3	8.7	12.0	13.9	27.5
P/BV Ratio	3.1	2.1	2.1	2.5	4.7
Dividend Yield(%)	7.9	4.2	1.9	2.6	1.5

ASSET provides both market information and order entry and matching. All SET members have access to the order entry system, as well as to the information screens. In addition, ASSET information is distributed widely throughout Thailand via a public television station (channel 5), which provides online information regarding current market prices. Investors who are not members of SET can also subscribe to the ASSET information system, and individuals can access ASSET information through member broker trading rooms.

Orders entered into ASSET will be handled by one of two trading systems—Automatic Order Match (AOM), or Advertisement of Interest (AI)—depending on the nature of the order. Normal orders on the main board are handled through AOM, which matches orders and confirms transactions immediately. Orders can be of two types: limit orders (for a fixed number of shares at a stated price) and market orders (for a fixed number of shares at the current market price). Limit orders entered into the AOM system are sorted by price and time priority; when an order is entered into the system, it is matched with existing orders in the sequence in which those existing orders were received.

Matching of orders follows a well defined system. Market orders are matched at the best possible price, or prices if the order can not be filled at a single price given the existing order book. For example, a large order to buy (sell) will be matched against the lowest (highest) offer (bid) to the extent possible and then at subsequently higher (lower) prices until the order is completely filled or the order book is exhausted. Any portion of a market order unfilled by the existing order book will be displayed on the system as a limit order at a price one spread/tick better than the previous worst price on the order book.

ASSET screens provide information on outstanding orders—price and volume of the three best bids and offers—as well as information on the most recent transaction, the day's high and low price, the day's volume and percentage price change, and the previous day's closing price. SET market index price, volume and percentage change is provided on a real-time basis. ASSET also provides relevant market news, which can include corporate, national or international information.

Orders for less than 100 shares and large lots (exceeding the lower of $0.4 million or 10 percent of paid up capital) are handled on the Special Board using AI. Investors interested in quotes on the Special Board negotiate privately with the advertising party and then the order is put through ASSET at the negotiated price.

Foreign ownership of SET listed companies can be limited by law or by company rule. The Thai government has restricted foreign ownership of banks to 25 percent of voting shares and 49 percent of other strategic companies. In some other cases, companies have established their own rules that limit foreign ownership. Once these restrictions become binding, purchase of the shares by foreigners must be from existing foreign holders. These foreign transactions are handled on the foreign board through the AI system. A substantial premium may exist between the prices on the foreign and main board.

Orders can be entered into ASSET during the one-hour preopening entry session, as well as during the two trading sessions. The market opening price for each share is calculated (by the system) at the end of the preopening session in order to maximize the number of shares traded; if more than one price would do this, then the one closest to the previous close is chosen, if there is still more than one price, the higher one will be chosen. Once entered, orders stay on the system until the end of the trading session, or until canceled by the entering party.

Daily price movement is limited to 10 percent of the previous closing price. ASSET will not accept orders above or below the 10 percent limit.

Minimum price movement (spread) is determined by market price and ranges from 0.1 baht for stocks with a price less than 10 baht, to 6 baht for stocks with a price greater than 1000 baht. ASSET will not accept orders that violate the minimum price spread.

Set has introduced four supervision signs, displayed through ASSET, to inform investors about failure by listed companies to disclose required information, or of irregular price movements. Failure to provide required information, for example quarterly financial statements, will result in a Notice Pending Sign. Upon receipt of the required information, a Notice Received Sign will be substituted. In cases where price movement or volume is unusually large, a Designated Securities Sign will be displayed, which requires trades to be settled in cash before the subsequent trading session. Failure of a company to provide required information or irregular price movements can induce SET to place a Suspending Sign on the share and trading will be prohibited.

Transactions are settled on the third day following the transaction. Failure to deliver shares on time can result in fines and compensation for damages. In some cases, physical delivery of the shares occurs, but beginning in 1992, the Share Depository Center was established by SET, which provides electronic transfer of share ownership.

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