

SINGLE-PRICE AUCTION SYSTEM FOR ISTANBUL STOCK EXCHANGE

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Abstract

In the single-price auction system, for a predetermined period of time, all the buy orders are collected to form a negatively sloped demand curve and all the sell orders are collected to form a positively sloped supply curve in order to get an equilibrium price and maximum amount of quantity transaction, as a result of the interaction of these two curves again in a predetermined time instant. The aim in this work is to enlighten the reader about the different applications of this system in different stock exchange markets all around the world, to comment on the advantages and disadvantages and to investigate its suitability to Istanbul Stock Exchange (ISE).

Key Words: Single-Price Auction System, Continuous auction system, ISE

1. Introduction

Electronic stock trade system has partially started in ISE on 3rd December 1993 and became fully functional with all stocks tradable on an electronic environment after 21st October 1994. This system has increased transaction speed and amount considerably, but with increased interest of investors at the end of year 1999 and start of year 2000 this increase has reached top levels and the system began to be pressured insistently. ISE management has considered the complaints of brokers of not being able to deliver the orders to the system on time and decided as an intermediate solution step to accept the delivery of orders with diskettes for the first session after 28th April 2000 and for the second session after 13th August 2001 until the start of Express-API system. Before the application of delivery of orders with diskettes, it was observed that accumulated orders of overnights caused high transaction volumes and some days it was also observed that not all the transactions could be processed. In these days the brokers preferred to differentiate their customers and gave priority to the ones with higher trading volumes and postponed the ones (mostly small investors) with lower volumes. This situation, however, gave rise to high volatilities in the morning hours (Küçükkocaoğlu, 2003). After the date 4th April 2002 the order transmission through Express-API system has started and the system has started giving faster responses with no difficulty. Although, it is observed that this situation has a positive effect on the liquidity in the start of sessions, the returns of ISE market during the day continued to show a W shaped curve, i.e., at the start of the session high, at the middle of session low and at the end of the session high returns (Küçükkocaoğlu, 2004).

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The finding in the literature that investigates returns during the day is that for most of the cases the stock prices are active at the start and end of sessions. Additional findings show that returns, total transaction volumes, volatilities, buy-sell orders, the price difference between buy and sell orders at the opening and end is significantly higher than the rest of the day. These anomalies are particularly observed in the first 30 minutes of the first session and in the last hour before the closing session leading to difficulties in effective price formation¹.

According to Wood, McInish and Ord (1985) and Harris (1989) one of the main reasons for the increase in the prices at the end of the day is the price difference between buy and sell that reaches its highest levels at the end of the day and that the prices at the end are formed mostly by buying orders.

For the increase in return and volatility, Admati and Pfleiderer (1988) state that accumulation of orders at the end of the day might be the reason.

According to Miller (1989) the reason for the increase in prices at the end of the day is the desire of index fund managers to increase the prices of stock belonging to the index in order to increase the index.

According to Amihud and Mendelson (1991) there are two type of reasons for the high return and volatility at the start of the first session. One of them is the accumulated information overnight and the other one is the different types of starting systems for the stock exchange markets.

Brock and Kleidon (1992), Gerethy and Mulherin (1992), Hong and Wang (2000) interpret the reason for the increase in the volatility at the end of the day as the escape of investors from risk after the close of the market by decreasing their positions in the stock market.

Madhavan, Richardson and Roomans (1997) explain the reasons for the increase in prices at the end of the day as the announcement of new information to public, information based order flow, accumulated orders during the day, market makers effort to control the price of the stocks they posses, insider information, arrival of date of maturity for time deposits and cancellation of contracts, concentration of brokers on buy-sell transaction at the closing time of the market.

Another reason for higher prices at the opening is the finding of Madhavan and Panchapagesan (1999) on anomalies in opening and closing prices. Extreme unsystematic increases in closing prices cause the prices to be higher the next day.

Cushing and Madhavan (2000) mention three reasons for the increase in prices near the close. First reason for the realized anomalies near the close is that buy-sell orders are supported with high transaction volumes. Second reason is excessive buy-sell orders of institutional investors and the third reason is the due time of derivative products near closing time of the session and their impact on the closing prices.

According to Block, French and Maberly (2000) institutional investors are the reason for the high return at the start and close of the market. Institutional investors give their orders more

¹ References for emprical works are Wood, McInish and Ord (1985), for teorethical works are Cohen, Maier, Schwartz and Whitcomb (1981), Admati and Pfleiderer (1988), Foster and Wiswanathan (1988), McInish and Wood (1988).

frequently in the following 30 minutes after the open and 30 minutes before the close of the market.

According to Zorlu (2000) high volatility in prices during the day can decrease reliance to the brokers and the market. The same situation is also true for institutional investors. This situation will cause difficulties for the funds buying or selling at considerable higher or lower prices than the average prices during the day. High price undulation during the day increases risk for the stock exchange investors and this requires higher risk premiums. It is also possible for investors with high transaction volumes to try to form artificial prices to protect themselves from this kind of risks. In this situation the stock exchange market will be adversely affected and also a crime according to law will be committed.

According to Hillion and Suominen (2001) the reason for volatility increase near close of the session is the increased difference between buy and sell orders and investors benefiting from price differences who want to close their positions. In addition, in markets where the “hidden order” option is available among the orders manipulative movements to increase stock prices is frequently observed.

As mentioned in our previous work (Küçükkocaoğlu 2003), in ISE some trading investors try to manipulate movements on closing price by using brokers or through their mediation. As long as the closing price is used as a performance measure, the continuation of such movements is inevitable.

In order to prevent the realized unsystematic and extreme price movements in opening and closing sessions and to decrease the volatility supporting these increases when considering the above mentioned findings it is beneficial to go through how opening and closing price mechanism is needed to be arranged in the ISE. In this subject the most suitable and radical solution method would be to put special methods into action that arrange opening and closing price formation.

The aim in this work is to inform the reader about the different applications in Amsterdam, Arizona, Athena, Brussels, Euronext, Frankfurt, Hong Kong, London, Luxemburg, Korea, Kuala Lumpur, Madrid, Milan, NYSE, Paris, Taiwan, Tel Aviv, Toronto, Tokyo and Vienna stock exchanges and Nasdaq over the counter markets implemented Call Market (single-price auction session) system, to evaluate the advantages and disadvantages of the system and to investigate its applicability to ISE.

In this context, section 2 describes the call auction procedure with an example, section 3 mentions the different applications of the call auction procedures, section 4 presents empirical findings on the advantages and the disadvantages of electronic call auction procedure, section 5 discusses its applicability to the ISE and concludes.

2. Call Market (Single-Price Auction System)

Single-price auction system is a session type where buy and sell orders are sent to the system, for a predetermined time length after which again in a predetermined time instant, all the buy orders are processed to form a negatively sloped demand curve and all the sell orders are processed to form a positively sloped supply curve to combine these curves and to execute the suitable orders. The intersection of both curves gives the price and quantity of trade.

The distinction of single-price auction system from the continuous auction system already used in ISE is that even if the buy-sell orders match each other while arrival to the system they are not processed until the arrival of transaction time. The aim in the system is to process the most possible orders at the same time and at “process price”. The entire buy orders same as or above this price and the entire sell orders same as or below this price will only be processed at this “process price”.

In order to concretize the process of call market system and price formation, in the table 1 below there is a sample of buy and sell orders and the prices they contain send to the system. Table 1 is made up of seven columns. The first column contains time send of the buy orders, the second one contains buy orders amount in lot, third one contains cumulative total of buy orders, fourth one contains suggested price for each buy/sell order, fifth one contains cumulative total of sell orders, sixth one contains sell orders amount in lot and the last one contains time send of the sell orders. Responding to the accumulated orders during the night will take place according to price and time priority as shown in the table in the following minutes after opening.

The suggested call market for ISE is for the determination of opening and closing prices, therefore, the price mechanism given in Table 1 is made up of prices expected to be processed at transaction time. In ISE the morning session starts at 9:30 and in the first 15 minutes participants send their orders through diskettes and Express-API also named as “electronic order transfer”. However, the orders send to the system in this time period cause fluctuations in returns and increase volatility (Küçükkocaoğlu, 2004). The aim in single-price auction system is to reduce these fluctuations to minimum.

Table 1. Accumulated orders in suggested call market for ISE

Time of buy order	Buy order amount (Lot)	Buy order cumulative total	Price	Sell order cumulative total	Sell order amount (Lot)	Time of sell order
01:30	50	50	2500	900	250	08:30
04:45	100	150	2400	650	150	09:25
08:55	200	350	2400	500	50	08:15
09:20	100	450	2300	450	100	09:20
07:15	150	600	2200	350	250	07:35
09:18	250	850	2200	100	50	01:18
08:45	50	900	2100	50	50	03:45

In the table above buy and sell orders are listed between 2100TL and 2500TL in increments of 100TL by price time priority. These orders are listed from highest to lowest price for buy orders and from lowest to highest for sell orders. Cumulative order totals are calculated from top to bottom in buy and in the opposite direction in sell orders. In ISE’s present electronic order transmission system, the session will start at 9:30 to process these orders according to

price-time priority then these orders will have to wait until orders are entered to the system and then at the end time of this process they are going to be matched according to price time priority. If we assume that order entrance time ends at 9:45 and the orders are arranged according to price time priority by the system then the system will proceed to the price matching stage. In this stage the opening prices for selected stocks for the first session and for this price the buy-sell orders met by the system will be determined. The sample given in the table above shows the unique call market opening price of 2300TL and hence the price above which all the buys and below which all sell orders are met. At 9:45 at this announced price a total of 450 lots from investors who accept to buy at a price of 2300TL and above, and from investors who accept to sell at a price of 2300TL and below will be processed. Unmatched orders will be transferred to continuous auction system and will be waiting for matches in this session.

The call market example explained above can be performed before the start of continuous auction session but can also be performed in the continuous auction session or at the end of it. In this context it is beneficial that the call market system is performed in the opening (especially in the first) and closing sessions (especially in the last).

3. Different Application of Call Market

Call market system contains a pricing mechanism as explained above, but different application of this system is present in different markets. In this part information about different applications are presented.

3.1. Paris Bourse

The Paris Bourse uses call auction procedure to open and to close the market. There are three primary reasons why the Paris Bourse introduced the call auction procedure. These are to enhance market quality and efficiency, to improve price discovery and to reduce transaction costs.

The Paris Bourse is divided into four parts (i.e. markets). The first market is the *Premier Marché*, comprised of the most liquid stocks. The second market is the *Second Marché*, made up by mid-cap stocks. The third market is the *Nouveau Marché*, comprised of high growth stocks, and the fourth is *Free Marché* where there is minimum regulation and free market conditions are in force.

To keep the transparency of the stock market at high levels, traders have the ability of entering, modifying as well as deleting their orders at the Pre-Call Auction Phase. At the Auction Phase, however, nobody can modify or delete his orders.

The Paris Bourse introduced the call auction procedure to determine the opening prices of the markets in 1986. It utilizes the electronic call auction procedures to open the market at 10:00 a.m. and to close the market at 5:05 p.m. Transactions of less liquid stocks with call auction procedure runs twice a day, opening prices are set at 11:30 a.m. and closing prices are set at 4:00 p.m. At *Free Marché*, pricing with call auction takes place at 3:00 p.m. and at *Nouveau Marché*, pricing with call auction takes place twice a day 10:30 a.m. for the opening and 4:30 p.m. for the closing of the market.

The auction procedure consists of two phases in the Paris Bourse.

a. The Pre-Call Auction Phase

Orders are accumulated in the centralized order book from 8:30 a.m. to 10:00 a.m. for the opening session and from 5:00 p.m. to 5:05 p.m. for the closing session. Traders can enter, modify and delete their orders at this phase, however, no transaction takes place.

Studies on the pre-opening period found that in the last 10 minutes before the opening, indicative price moves towards to the opening price. This movement suggests that price discovery at the pre-opening period is effective (Thomas and Demarch, 2001).

At the same time, opening prices maximizes trading volumes with minimum cost and very few unmatched orders are transferred to the continuous auction system.

b. The Auction Phase

Opening and closing prices are determined by the call auction procedure at 10:00 a.m. and 5:05 p.m. The last equilibrium price becomes the official opening and closing price. Orders are executed with this equilibrium price. Plus the price above which all the buys and below which all the sells are met in this phase. From 10:00 a.m. to 5:00 p.m. trading is continuous, however, orders can be accumulated for the closing call auction phase.

3.2. Tel Aviv Stock Exchange

Tel Aviv Stock Exchange has started its computerized trading in 1991. In 1997, the new trading system, the Tel Aviv Continuous Trading has introduced. As the oldest call auction pricing mechanism user, transactions of the call auctions procedures at the Tel Aviv Stock Exchange described below.

a. Determination of the Opening Prices

In this market the orders are collected between 8:30 a.m. to 10:00 a.m. The opening phase for shares, conducted with the call market method, begins at 10:00 a.m. and lasts about one minute. In this phase, it is not possible for the prices to deviate more than 10 percent from the closing prices in the previous day. Orders not executed in the opening phase are automatically transferred to the continuous trading.

b. Determination of the Closing Prices

Continuous trading runs until 3:30 p.m., in the phase, price fluctuations are unrestricted. At the closing price phase which runs from 3:30 p.m. to 3:45 p.m., closing prices are calculated as the volume weighted average of the prices discovered towards the end of the continuous trading. One of the main reasons for the use of the volume weighted average rather than the call auction mechanism at close, lies on the traders' tendency of transaction at close, closing with a call auction is very unattractive at Tel Aviv Stock Exchange. This lies on the call market

(auction) rules of the Tel Aviv Stock Exchange. For example, traders on the continuous auction could be anonymous but the traders on the call auction should be known. Orders sent to the call auction mechanism are smaller than the orders sent to the continuous auction mechanism. Traders can place larger orders at the continuous auction mechanism. It is also easy to manipulate the stock prices at the continuous auction mechanism than the call auction mechanism. Plus, traders have the freedom of buying and selling stocks at their desired price levels at the continuous auction mechanism (Bronfeld, 2001). Trading closes at 3:45 p.m. and no orders may be submitted until the pre-opening phase of the following trading day.

3.3. Frankfurt Stock Exchange

Buy-sell orders in Frankfurt stock exchange are processed in two different structures named as Xetra and Xontro. Processed stocks in electronic trade containing Xetra operating system are matched using continuous auction. In each session start single-price auction session is implemented. In Xontro system trade is performed in session saloon through specialists (Makler) processed stocks and pricing is again determined from the specialists for the stock they are responsible. However, when the stocks start to show new trends with high volatilities during the day the price formation mechanism is reformed using single-price auction session. Traders can enter, modify and delete their orders at this phase. New information on order flows on the current order status is provided continuously and an indicative auction price is displayed for the possible execution. It is the price that would be fixed and declared if price determination were conducted at that time. The auction price is determined by the system and it is set to maximize the amount of shares that trade.

3.4. London Stock Exchange

In London Stock Exchange before and after the continuous auction system single price auction system is applied to determine opening and closing price. In addition, in case of an extraordinary movement in the prices of a stock the continuous auction is stopped and traders will have chance to reevaluate their investment decisions which could last for 5 minutes, than the price determination phase switches to the call auction mechanism. The London Stock Exchange uses call market mechanism to improve price discovery, to offer an efficient pricing and to prevent the manipulative movements on stocks. Another use of the call market mechanism on the London Stock Exchange is to determine the closing price to prevent the price level deviations and trade size changes. If this closing price determined on the call auction does not fit into these rules than the closing prices are calculated as the volume weighted average of the prices discovered at the continuous trading phase.

3.5. Athena Stock Exchange

Call market is applied to determine the prices for stocks traded in Athena Stock Exchange to stocks under surveillance, with small liquidity or with small capitalization in specific hours every day. In addition, opening and closing prices are determined using single price auction sessions.

3.6. Hong Kong Stock Exchange

For all stocks traded in Hong Kong stock exchange before the start of continuous auction at morning between 9:30-9:45 orders are collected afterwards the collected orders are matched between 9:45-10:00 to determine the opening price that allows the maximum amount of trade. In addition, the system accepts buy sell orders that are equal to the price obtained from single-price auction system.

3.7. New York Stock Exchange

In New York stock exchange besides the single-price auction session before the continuous auction in any time period single-price auction session can applied by responsible stock exchange experts during the day.

3.8. Nasdaq Over the Counter Market

Nasdaq is a over the counter market so there is no opening protocol. Officially the market operates between 9:30-16:00 but using Nasdaqs electronic communication system SelectNet before opening and after the close a similar session as single-price auction session is performed.

4. Advantages and Disadvantages of the Single-Price Auction System

4.1. Advantages of the Single-Price Auction System

4.1.1. Decreases Price Fluctuations

In continuous auction system orders entered with different prices give rise to fluctuation and changes in stock prices and quantities in the order process book. These transactions are realized in different prices increasing the volatility of stocks and also allow the continuity of volatility by buying a stock at a lower price and selling it at a higher price or the opposite way round. On the other hand in the single price auction system price fluctuations are reduced by the multiple matching of orders with one price.

4.1.2. Enables Effective Market Formation

One of the main critiques to the diskette order transmission system is that in stocks with insufficient passive orders, in the stage with diskette transmission manipulative price movements are very easy to carry out and therefore formation of an effective market is hard to ensure. It is also possible to observe manipulative movements in continuous auction system in stocks with low capital and small openness to public and limited daily transaction volume. In this stage, single-price auction system enables market formation in one price with accumulated orders during the day or night. As a result of this fact price changes are minimized. While for each entered active order it is possible affect the market but it is not possible to affect single-price auction system with active orders. Markets effectiveness becomes a matter of primary importance and not the orders effectiveness in price formation.

4.1.3. Attracts Institutional Investors Attention

In works done about the single-price auction system, it is observed that this system is preferred by institutional investors because all the orders are passive, when priced logical orders of large amount by investors are met by the system which is an advantage compared to continuous auction system (Cohen and Schwartz, 2001). In continuous auction system orders of large amount send to the system give raise to disturbance in market equilibriums and excessive fluctuations in stocks prices. However, single-price auction system prevents that signal that could bring the market in disequilibrium, because the accumulated order in the system are not announced at the same time if there is not enough match to the passive orders send to the system the process is not being realized and this allows for effective price formation.

4.1.4. Increases Liquidity

In works done about transparency in stock exchange markets it is observed that the orders send during the continuous auction session are affected by news and sudden changes in active and passive structures in orders waiting to be met (Madhavan, Porter and Weaver, 2001). Changes of this type adversely affect the liquidity of stocks. However, news broadcasted during the single-price auction session increase the order number and hence the liquidity increases because during the session there is no transaction. In addition, in the time passed until the end of the session the broadcasted information will be available for more investors, the information will be evaluated and then the price entered to the system is more rationally determined (Kalin, 2002).

4.1.5. Eases Order Transmission

Investor who have the depth information in continuous auction system have the ability to change the prices while small and nonprofessional who do not have that information are usually unable to change the prices. However, in single-price auction system the depth and content of orders are not given to investors, movement to change the prices are not allowed because all transactions are going to be processed at the same time.

4.1.6. Decreases Process Load in Continuous Action System

On their work about Frankfurt stock exchange Kehr, Krahn and Theissen (2001) observe that 10 percent of all orders are met in single-price auction system. Considering that continuous auction system compared to single-price auction system allows opportunity for longer buy sell orders single-price auction session applied only in specific time periods during the day meets 10 percent of all buy sell orders send during the day ensures to investors and also to intermediate institutions great convenience.

4.2. Disadvantages of the Single-Price Auction System

4.2.1. Does not Allow Active Processes

The greatest disadvantage of the single-price auction system is the session process call time instant that allows for transactions. The system does not allow for active transactions. On the other hand in continuous auction system the investors are able the make transactions at an instant time (Woodward, 2001).

4.2.2. Decreases Price Elasticity

Leaving low transaction volume stocks outside the continuous auction system and allowing them to be processed in single-price auction session in one or two sessions determined prices and depending on these narrow price limits, if there is an event that could affect the market order entrance, will prevent any transactions of these stocks. However, if there are events that might affect the market, in sake of preventing the shrinking of stock traded in the single-price auction session, some rules may be formed to overcome this problem. For example, in New York Stock exchange market if in the orders entered to the system extraordinary situations are detected then the continuous auction for this stock is stopped and single-price auction session is applied (Kalm, 2002).

4.2.3. Might Cause Insufficient Participation

Depending on high percentages of investors giving importance to active transaction in investor profile or insufficient number of investors preferring to be in single-price auction session might cause the single-price auction market to be formed with insufficient depth. Especially, it should not be expected from the investors who are price makers in the continuous price auction to participate in single-price auction session aiming to determine closing price.

5. Result

On their work on Paris stock exchange Hillion and Suominen (1998a, 1998b, 2001) investigated manipulative movements towards the closing time of the market and identified the reason for the closing price manipulation as stock market representatives. Competent authority in Paris stock exchange considered Hillion and Suominen's work and to prevent closing price manipulations, to determine closing price in a different way, to remove the observed price and volatility anomalies, in June 1998 they changed transaction times and closing method². After this change the result for all stocks implemented single-price auction system is that the new price mechanism has a more effective closing price and it is observed that closing anomalies decreased to low levels (Thomas, 1998).

According to findings of Amihud, Mendelson and Murgia (1990), who worked on prices and volatilities of the continuous auction system after the single-price auction session in Milan stock exchange, if continuous auction system is used in the opening session the volatility of stock came out to be high, on the other hand if single-price auction system is used than it came out to be low. Keeping in mind that single-price auction system determines the price of a stock exactly using supply and demand it is the most efficient system for price formation.

If in ISE single-price auction system is applied before opening and closing then the following facts will be observed:

- i. Accumulated order load of ISE members at the start of the session through various channels (all buy-sell systems resources are directed to order collection process because orders are not processed during the collection stage) sending in a short time to the single-price auction system with more intense order flow and the system will find

² Single price auction system is first applied in Paris stock exchange in 1986 to determine opening prices. In May 1996 it is applied for stocks with low transaction volume, in July 1998 it is applied for all stock to determine the closing price.

the matching price with maximum transaction. Again a single-price auction session at the close of the market will prevent active price movement at close of the market, closing price with one lot, and will enable fair closing prices

- ii. Before the start of diskette session the reason for the activity in the first 15 minutes of the day was reasoned as the market not being too deep. After the start of diskette order transmission price movements have considerably decreased but order transmission using Express-API method has slightly cancelled that positive effect (Küçükkocaoğlu, 2004). The decrease in the price movement at the start of the session depends on the application of single-price auction system.
- iii. Before the start of the single-price auction session cancel ability or improvability of the accumulated orders in the system depending on market conditions is possible in this system, but after the start of the session it is not possible to make any interventions. This kind of opportunity is considered to form a more effective price formation.
- iv. Attempts to increase the prices of stock prior to close of the market will be prevented.
- v. Portfolio evaluation and performance of stock market representative according to closing price will with the prices formed in single-price auction system be more effective and fair.
- vi. ISE will obtain a transaction method that is accepted by many stock markets worldwide and with this system price movements and volatility during the day will be minimized.

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