The Relevance of Quantitative Analysis Models in the Nigerian Capital Market

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Abstract

The welfare of a man is mostly dependent on the exchange of goods and services. This paper seeks to examine the relevance of quantitative analysis models in the Nigerian Capital Market. Exchange of securities in the capital market was give birth to by trade by barter. The Nigerian Capital Market is a place of investment trading. This paper attempts to identify theories and context on which it can be used in the Capital Market. Thus, quantitative analysis models identified are applied in the Nigeria Capital Market. Their relevance and implications for the market are identified, as well as conclusions and suggestions on methods to improve the betterment of investors even in this period of recession in Nigeria.

Key Words: Capital market, Trade, Quantitative models, Securities

1. Introduction

At the very beginning, the behaviour of prices in the security market, the patterns of trading activities seem to be complex, and that, it is and this can provide useful insight to price behaviour. When examined closely, it is clear/crystal clear that equilibrium price of stocks does not come out of a 'black box'. Two stages affect price discovery in a market with respect to market participant's behaviour. We have the micro stage and macro stage, the micro stage is where the market participants hold potential trade needs based on their personal reasons, and decide to place orders in the market; while the macro stage, is a situation where orders are accumulated in the market and of course, execution of trades. Market structure affects decision making at the micros stage and price discovery affects it at the macro stage. The whole process is affected by these two stages; thus, price discovery is affected in the market with respect to changes in the behaviour of market participant.

Early works were observed to investigate issues relating to the stochastic nature of supply and demands, but today's work looked more on the information aggregation properties of prices and markets (O'Hara, 1995, 2003).Her work is the current backbone in the market theory. Investment trading like shares have gone high and taken large proportion of family household's financial assets in the world, not excluding Nigeria (Wikipedia, 2016).While government banks that are insured and or bonds or treasury bills are relatively stable, there is a wide fluctuation in the stock prices. And this has a great effect both on the individual investors and the whole economy. This issue now is most urgent and relevant to our Nigeria economy today, because many new entries have come into the stock market since we have unprecedented flood of private placement and public offers now. Quantitative Analysis Models has become necessary tools to be applied in the Nigeria Capital Market. Stocks prices skyrocket with little reason, and placement just as quickly, and people who have turned to investing for their children's education and their own retirement become frightened, sometimes, there appears to be no rhyme or reason to the market, only folly (Ahlstrom, 2001).In the year of Nigerian Independence, Efficient Market Hypothesis (EMH), was advanced, as one of the most important hypothesis in financial economics, this hypothesis is put this way, 'only changes in fundamental factors' such as profits or dividends ought to affect share prices. It has been argued to be a largely theoretical academic viewpoint which predicts that little or no trading should take place (not so in real-life) because prices are already at or near equilibrium with all public knowledge having been priced in.

Study has shown that, the hypothesis of efficient market was challenged, through the study of how prices can deviate from, or converge towards information efficient equilibrium prices with respect to strategic rational participants (Biais, Glosten, Spatt, 2004).Like in any other business, the stock market is quite unforgiving of amateurs, and non-experienced investors rarely have the assistance and support needed. Thus, investors do or may temporarily pull financial prices away from their long-term trend level.

There is the issue of high and low prices of stocks in Nigeria, because of excessive optimism and excessive pessimism. The over-reaction from excessive optimism may drive prices high, and excessive pessimism may drive price low. In two thousand and eight, there was heightened popularization of margin buying whereby investors were encouraged to borrow money from banks at interest for acquisition of stocks, in view that, it would rise. At the change of policy, unprepared investors were at crossroad, and as such other factors led to the collapsing of stock prices, losses, and not able to meet with banks terms of repayments.

Quantitative Analysis tools become necessary for use, to enable for proper understanding and evaluation of price determinants in the capital market operations. This paper is aimed at sensitizing and contributing to the prospects of investors. At this period of recession, this paper will identify the relevance and implication for the market.

2. Related Literature

2.1. Nature of Markets.

Markets vary in sizes, range, location, types and humans with respect to traded goods and services. It is made up different systems, institutions, procedures, social relations and infrastructures whereby persons' trade with one another, to exchange goods and services. It is the nature of demand for a product. It refers to a situation where communication exists between buyers and sellers, of various forms to determined prices. Its fundamental function ensures that buyers and sellers find each other and have a trade opportunity at any time; directly or indirectly (intermediaries).We have dual markets, the legal markets and the black (illegal) markets. Markets consist of the physical market place, commodities market, and financial markets. Financial market is the concern of this paper. It is the trading of financial assets, and it includes the money market, foreign exchange market, and capital market (our concern in this paper).The capital market is defined as the market where securities are sold; in this market companies and governments can raise funds.

The capital market is dualized: the primary and secondary markets. The primary market is a market where new stocks and bond issue are sold to investors, while the secondary market is the market where already existing securities are sold and brought by investors. Stocks or equity are traded privately or publicly at agreed price in the equity or stock market. These are explicit or implicit rules that govern the trading mechanism not minding the setting, and these rules gives the market prices (O'Hara, 1995).Our concern in this paper is to address the relevance of quantitative analysis models in the capital market with respect to stocks of the secondary market, quoted in the market. In Nigeria, we have the Nigerian Stock Exchange (NSE), that deals with stocks, and it facilitates trade in securities by providing a market place (real or visual) and real-time trading information on the listed securities. Nigerian Stock Exchange (NSE) serves as a clearing house for each transaction; it collects and delivers the shares, and guarantee payment to the seller of securities. Thus, the play between the buyer and the seller with respect to default on transaction are basically eliminated; all kind of risks are eliminated.

2.2. The Structure and Design of the Market.

The Structure and Design of a Security Market should make clear how to organise the trading with respect to frequency, location and order flows; whether the market should be a call or a continuous market. If market is continuous, state how it should be opened and when it should be halted; if need arise. The market should be made clear as to whether it should an order-driven auction market or quote-driven dealers market. The order-driven auction market relies on limit orders to provide immediacy, and the quote-driven dealers market relies on dealers' quote to provide immediacy.

There should be degree of transparency of quotes and trades; the minimum tick size at which quotes are made and at which trades take place; and alternatives possible types of orders should be touched. The trading process is determined by the market design, and liquidity would describe the market quality, the level of bid-ask spreads, and volatility. Thus, we say there is a good market design.

2.3 Markets Location

There are three-fold markets locations, it could be centralised or decentralised or computerised (automated).Exchange can be done on physical locations where trading is done on a floor by open outcry (in Nigeria, It is known as Called-over System); automated trading is where information received, processed, displayed, and transmitted to agents electronically; it is this type that is used in Stock exchanges and Commodity exchanges (where trades simultaneously enter valid bids and offers).Over-the-counter (OTC), also known as decentralised type of stock exchange is made up of network of computers, with trade done electronically via traders. Trades are done by dealers or market makers by means of Global Satellite Mobile (GSM) – Telephone and Computers during search, marching, and bargaining process. It is observed that market transactions are transparent, and trading rules that improves market are easily and well monitored in the automated market. The centralised and computerised continuous auction trading markets is found and done in the Nigerian Stock Exchange (NSE) and others over the world. A market location has been greatly influenced by technology, and its basis function of bringing buyers and sellers' together are met, and has little change over time.

2.4 Types of Orders

There are dual types of orders in the market; we have the market order and the limit order. Immediacy is financial intermediation services provided in the market, to trade immediacy – a demander of immediacy – is done by placing a market order, to trade the best available price – bid price if selling; and ask price if buying. Bid and ask prices are introduced by suppliers of immediacy (Demsetz, 1968).While market orders are executed when submitted per trading protocols or rules of priority as determined by price, time, and volume; limit orders give and sets maximum price for purchases and minimum price for sales. The Nigerian Stock Exchange is an order - driven market – prices and quantities are fixed together. The size of orders varies from small to medium and large. Small and medium orders follow the standard process foe executing trades; while large orders require special handling. Large orders are block trades done in segments, often pre-negotiated 'Upstairs' by a broker who identified both sides of trade before taking it to a trading floor so as not to deviate from exchange rules. Today, Nigerians consider orders more than N1, 000,000 units in volume, or N500, 000 in value of trade executed in a stock by an investor as a large order.

2.5 Categories of Traders.

The Investors or Customers are the elements in the market, and are the ultimate demanders and providers of immediacy; we have the brokers or market agents who receive and transmit orders from customers, and the dealers facilitate trading based on their own account or as broker/dealer, and where the trading takes place – market facility. We have dual brokers – upstairs brokers who deal with Investors, and the downstairs brokers who process transactions on the trading floor. They are paid commissions; but dealers as principals earn revenues from the difference between their buying and selling prices. We have the following traders: Individual versus Institutional traders; active versus passive traders; liquidity versus Information traders; and public versus private traders.

2.6 Types of Market Structures.

The market is structured as dual - the auction market and the dealer market. These dual markets are further classified as pure auction market, call auction/periodic call auction market, continuous auction markets; and the pure deal as well as continuous dealer markets (Stoll 1978, 2003).With respect to the auction market, the frequency of trading distinguishes the markets per the degree of continuity in trading activities either as period call auction or as continuous auction systems.

2.7 Rules of Procedures in the Market.

The exchange market is guided by rules and regulations, as it relates to the interactions between the investors, brokers and dealers; and the mode of trading. The markets specify the order in which resting limit orders and dealer quotes executes against incoming market orders. The rules in the market could be: priority to orders with the best price, and second priority to the order posted first at a given price. Many markets follow price priority; but many modify second priority rules to accommodate large volume of transactions. Rules of procedures do not apply across the markets, when there are many competing markets, as such price priority tend to rule because market order will seek out the best price, time priority need not go across the markets with respect to each price. When the tick size is very small, time priority is meaningless (Harris, 1991).The tick size is the minimum allowable price variation in a security, usually determined by the exchange on which the security trades, and to which the working rules of procedures are therefore closely tied. We also have the price matching and payments for order flow.

2.8 The Process of Trading.

The market is charged with responsibilities of providing information based on past prices and current quotes. The process of trading in any market is quadruple: the information, the order routing, the execution, and the cleaning (IOEC-process); (Stoll, 2003).The above process of trading is guarded secret in the past, but today's transaction prices and quotes are provided in real-time over a Consolidated Trade System (CTS) and a Consolidated Quoted System (CQS).Thus, it calls for transparency and investors can determine the markets with best prices, and these, of course promotes competition. There are procedures for routing orders, and route orders are in return for payments; using mechanism for routing orders among different market systems. We have the third stage – the matching of incoming market order with a resting quote – the execution trading process; and the fourth stage – the cleaning and settlement. This in the Nigeria Stock Exchange (NSE) takes place based on T+3 (3 days after date of trading) and it is done electronically by book entry transfer of ownership of equities and cash payment of not amounts to the clearing entity.

3. Applications of Quantitative Analysis Models

Quantitative analysis models include Statistics, Optimization, Probability theory, Queueing theory, Game theory, Graph theory, Mavkor chain, Decision analysis, and Simulation, which are used to arrive at optimal or near optimal solution to complex problems. Quantitative Analysis known as Operations Research was traced beyond the ancient times of herdsmen and Gamblers to the Biblical times of Creation when man was driven from the Garden of Eden. (Agbadudu, 2006).It helps modern management to resolve problems and achieve its goals using scientific process. Model is a formalised way of doing things under specific assumptions which must not be violated. This application cuts across various disciplines were ranging from production processes, networking, road traffic management, freight transportation, and general scheduling. It is used in financial analysis, which give birth to market engineering, experiment economic, and quantitative behavioral finance. This paper focused on the forecast of price dynamics in the financial markets with respect to the theoretical models: Inventory, Asymmetric Information and Strategic Traders Models.

3.1Inventory Models

In this model, the trading process is a matching problem in which the market maker is faced with unbalance risk; it uses the price to balance supply and demand across time, with key factors being the inventory position and the uncertainty surrounding the order flow. We have in the models, German (1976), Stoll (1976), Amihudand Mendelson (1980), Ho and Stoll (1981, 1983).Included here are time series behaviour of prices and quotes, Roll (1984).Hasbrouck(1988, 1981, 2007), Huang and Stoll (1994, 1997), Madhavan (1995, 2000) Richardson and Roomans, (1997), Hasbrouck and Stafianos(1983).

Stoll Model:

The proportional discount of the bid price (P^b) from the consensus stock price (P) is given by:

$$\frac{P - P^b}{P} = \frac{C}{Q} = C$$

Where P is the consensus price, P^b is bid price, C is the amount of discount on trade and Q is amount of trade.
From the dealer's terminal wealth of optimal portfolio (W), if the dealer is ready to buy Q – amount of stocks at a discount of C, amounts is given by:

$$\bar{W} + (1 + \bar{r})Q - (1 + r_1)(Q - C)$$

$\bar{r}$ Where is return on the stock purchased

r_1 is cost of borrowing the fund to buy the stock.

The challenge is to derive C or equivalently, C_1; we can solve this through the dealer portfolio problem.
The minimum discount that the dealer would set us, such that the expected utility of the optimal portfolio without buying the stock EU (W); equals the expected utility of the portfolio with the unwanted inventory.

$$\bar{E}U(W) = EU\{W + (1 + \bar{r})Q - (1 - r_1)(Q - C)\} \text{ - - - - - - - } (1)$$

Taylor series expansion is applied to both sides, taking expectations, assuming r_1 is small enough to be ignored, and solving for C = C/Q, yields.

$$C = \frac{1}{z} Z \sigma^2 Q \text{ -(2)}$$

W_o
Where Z is the dealer's co-efficient of relative risk aversion W_o is the dealer's initial wealth σ^2 is the variance of return of the stock.
If the dealer enters the period with inventory of 1 amount in one or more stocks, the proportional discount for depth of Q can be shown to be

$$C = Z\sigma_1 QI + \frac{1}{2} Z \sigma^2 Q \text{ -(3)}$$

$W_o W_o$
Where $\sigma_1 Q$ is the covariance between the return on the initial inventory and return on the stock in which the dealer is bidding. If I < O and $\sigma_1 Q$ > O, the dealer may be willing to pay a premium to buy shares because they hedge a short position in the initial inventory. On the other hand, the dealer's asking price will be corresponding higher with an initial short position because the dealer will be reluctant to sell and add to the short position.

The relationship between the bid price (P^b) and consensus price for depth of Q and initial inventory I is given by:

$$\frac{P - P^b}{P} = \frac{Z}{W_o W_o} \sigma_1 Q + \frac{1}{2} Z \sigma^2 Q \text{ - - - - - - - - - - - - - - - -(4)}$$

and the relationship between the ask price (P^a) and consensus price for depth of Q and initial inventory I is given by:

$$\frac{P^a - P}{P} = \frac{Z}{W_o W_o} \sigma_1 Q I + \frac{1}{2} Z \sigma^2 Q \text{ - - - - - - - - - - - - - - - -(5)}$$

It should be noted that the inventory term enters with a negative sign in the ask equation since a positive value of I will lower the price a dealer will ask (Q being an absolute amount, long or short). The proportional bid – ask spread, if inventory costs were the only source of the spread is then given by the addition of equations (4) and (5).

$$\frac{P^a - P^b}{P} = 2C = \frac{Z\sigma^2 Q}{W_o} \quad \text{- - -- - - - - - - -- - - - --- --(6)}$$

When Q is the amount of trade, C is the proportional discount from customer price, Z is the dealer's coefficient of relative risk aversion, W_o is the dealer's initial wealth, and $\sigma^2$is the variance of return of the stock. In these models, dealers set bid and ask prices which cover their order-processing and inventory-keeping costs.

3.2Asymmetric Information Models

In this model, we have two classes: the sequential trade models and the strategic trade models. The determinants of bid-ask spreads in a competitive framework with different informed agents are examined by the strategic trade models. It is characterised by a probability structure where prices act as signals (semi-strong from efficiency) and market participants are confronted by Bayesian learning problem. With the degree of asymmetric information, there is an increase in bid-ask spread and decreases as time elapses and the market acquires information. In this model, we have Copeland-Galai (1983), Bagehot (1971), trading entails a cost associated with some investors having better information than others; and dealer cannot different between informed and uninformed investors. This model was expanded by Glosten-Milgrom in 1985, that dealer and uninformed investors learn what the correct price is, by observing the order flow. They assumed that an asset can take on two possible values – a high value, V^H, and a low value, V^L – with equal probability. The probability of informed investors (with correct value) isπ.

Let's assume there is risk neutrality, then informed investors value the asset at $\tilde{\alpha} = (V^H + V^L)/2$.

The ask price A is then the expected value of the asset conditional on trade at the ask price:

$A=V^H\pi + \tilde{\alpha}(1 - \pi)$
The bid price is:
$B=V^L\pi + \tilde{\alpha}(1 - \pi)$

Since informed investors trade at the ask (bid) only if they believe the asset value is $V^H(V^L)$, the ask price exceeds the bid price.

The bid-ask spread, is given by:

$A - B = \pi(V^H - V^L)$.

Where V^H is the value (high) of an asset.
V^L is the value (low) of the same asset.

π is the probability of informed investor's presence. This depends on the probability of encountering an informed trader and on the degree of asset value uncertainty. This model show that prices evolve through time as a martingale, reflecting at each trade the information conveyed by the trade. However, how prices will converge on informational efficiency was not addressed; but was dealt with by Easley and O'Hara (1987) – both informed and uninformed investors can choose between large or small trade. Information that is asymmetrically distributed and others know that others know more than them, there would be no equilibrium price where everyone holds the market portfolio (O'Hara, 2003).Pin Model was introduced to consider the link between return and an estimated of the probability of informed trading (PIN).It looked at the link between the numbers of buying and selling orders during the day.

With no informed trades, the link closes at 50/50 – fifty/fifty.(Easley, Hritkjaer and O'Hara, 2003).The recent information models, is of the new that priority of liquidity with market power will earn oligopoly rents. (Calcagno and Lovo, 1998), Faucault (1999) and (Naes and Skjeltorp, 2006). For the informed traders (Kyle; 1985) and uniformed traders (Admati and Pfleiderer, 1988).

4. The Relevance to the Capital Market

In those days, Investors preferred to invest in the Savings account with the first-generation banks for their yield-interest, because the Nigeria Stock Exchange (NSE) was not popular. Now, from the year 2003, governments have introduced different economic reforms that attracted different investors from agriculture through manufacturing to services. Pension funds up to the turn of several billions of Naira are now invested in Nigeria securities. Banking reform, which raised capitalisation and bring in mergers within 2007 and 2008, has brought excess money to the investors as returns. Most investors in Nigeria today, sees the capital market as the fastest place to make money they no longer invest in savings account but shifted grounds to stocks. Many take bank loans for equity purchases.

In this period of recession, market capitalisation has been going down; various reasons were advanced for the stock drive, which includes market correction, policy on FOREX, by Central Bank of Nigeria, ban on loans, bit by bit budget implementation, insurgency issues and economic instability. Stabisation measures were introduced by Central Bank of Nigeria, by meeting frequently – the monetary policy committee (MPC).With respect to computerized continuous exchange system, which uses a centralized clearing mechanism, the Nigerian Stock Exchange (NSE) has a high degree of transparency in terms of order flows; especially on quotes information, transaction prices, and volumes, though not so much on the traders' identity. In a bid to reduce excess inventory, some traders in the Nigerian Stock Exchange do carry out selective trades at the dealer's price. In the Nigeria Capital Market, there is significant spread and inventory effect in the transaction price; however, inventory effect is suggested to be weak.

Some dealers and brokers in the Nigeria Stock Exchange seem to prefer immediate reporting of trade as against late reporting for reason of more transparency, and for strategic reason such as, the desire to get information on unexecuted orders early enough. The table below is an extract from the Nigeria Stock Exchange that show the values of stocks quoted; use is made to demonstrate the Glosten-Milgrom Model. We consider the Agriculture and Breweries for illustration and understanding in the markets.

Extraction of Price List from the Capital Market

Security	Price	Price Change	High	Low	Trades	Volume
AGRICULTURE						
AFPRINT	1.77	0	1.69	1.69	1	5,000
FTNCOCOA	1.19	-0.06	1.19	1.19	19	2,577,775
LIVESTOCK	1.32	-0.06	1.35	1.32	10	218,875
PRESCO	5.78	-0.3	5.78	5.78	.5	176,046
BREWERIES						
GUINNESS	73.00	-2.99	75.50	72.50	51	254,162
INTBREW	4.61	-0.24	4.61	4.61	10	88,200
NB	31.35	-1.65	32.87	31.35	95	1,373,875

Source: Cashcraft Asset Management Limited (2016).

4.1 Application of Glosten-Milgrom Model

This model can predict the price for the next day and other days with respect to high and low value, with bid-ask spread by π (V^H- V^L).The downward trend price for the next day can be predicted as the difference between the stock closed price for the day and the bid-ask spread π (V^H- V^L).

From the breweries, let's consider the value of NB, using the model.

$V^H = 32.87$, $V^L = 31.35$, take $\pi = 0.5$, and the stock closed at 31.35.
The bid-ask spread, is given by: $\pi (V^H - V^L)$.
Therefore, we have $\pi (V^H - V^L) = 0.5 (32.87 – 31.35)$
$= 0.5 (1.52)$
$= 0.76$

The downward trend price for NB in the next day can be predicted as 31.35 – 0.76 = 30.59.Thus, the value of stock can be predicted downward or upwards as the case may be for any industry.

5.0 Conclusion and Recommendation

Inventory costs and asymmetric information costs are the first theoretical models that dealt with the spread between bids and ask prices. Both models determined prices. The spread will reflect or capture oligopoly rent in some recent models, if the providers of liquidity have market power. The latest trend is the innovations in communications and computer technology; it has led to the rapid emergence of order-driven trading systems. Strategic liquidity providers have private information or monopoly power; hence no single market is best for all participants.

In Nigeria, today, there is significant better data for research purposes because of the coming of transparent order-based trading systems. Therefore, there is open door for numerous empirical studies of the efficiency and cost of order-based trading systems in the future. Of course, the future will be bright and good for participants. The market that allows investors to trade when they are ready, minimises real costs of processing orders and risk bearing, and handle the challenges of wealth redistribution from the information and speedy traders to the uninformed and slow traders is referred to as successful.

Finding in the pre-trade transparency and post-trade transparency in the NSE have suggested respectively, that there is a decrease in liquidity when it is measured by volume of trade, cause limit order traders are less willing to submit orders in highly transparent system; and it is desired by dealers who see late trade reporting as very okay and beneficial because of advantage over the uniformed traders. The Nigerian Stock Exchange is an emerging market, which need to create awareness for investors that do not know the price dynamics movements. Our tertiary schools need to set-up a formal market system.

Finally, to reduce suspected cases of price fixing, insider trading and trade manipulations and bring back investors' confidence in the market; the agencies regulating the market need to enforce the rules of procedures in the Nigerian market.

References

Admati, A andP Fleiderer, P. (1988): "**A Theory of Intraday Patterns: Volume and Price Variability"**. Review of Financial Studies, Vol. q, Spring (pp 3-40).

Agbadudu, A.B. (2006): **"Operations Research, Mathematics and Social Sciences: The Link"** Inaugural Lecture Series 86. University of Benin.

Amihud, Y., and Mendelson, H. 1980): **"Dealership Market: Market Making with Inventory"**. Journal of Financial Economics, Vol. 8 (pp. 31-53).

Bagehot, W. (1971): **"The Only Game in Town"**. Financial Analysts Journal, Vol 27(pp12 – 14).

Biais, B., Glosten, L., and Spatt, C. (2004): **"Market Microstructure: A Survey of Micro foundations, Empirical Results and Policy Implications"** Journal of Financial Markets, Vol. 8, Issue 2 (pp. 217-264).

Calcagno, R., and Love, S. (1998): **"Bid-Ask Price Competition with Asymmetric Information between Market Makers"**. Working Paper, CORE., in
(http://www.studies2.hec.fr/jahia/webdav/site/hec/shared/sites/lovo/acces_anonyme/research/bid.pdf) 20/12/2008

Cashcraft Asset Management Limited: **"Price List by Sector"** in (http://www.cashcraft.com) 29/12/2016

Copeland, T., and Galai, D. (1983): **"Information Effects and the Bid-As Spread"**. Journal of Finance 38, (pp 1457-1469)

Demsetz, H. (1968): **"The Cost of Transacting"** Quarterly Journal of Economics, No.82, in (http://web.cenet.org.cn/upfile/100078.pdf) 22/12/2008

Easley, D., Hvitkjaer, S., and O'Hara, M. (2002): **"Is Information Risk a Determinant of Asset Returns?"**. Journal of Finance, Vol. 57 (pp 2182-2222)

Easley, D., and O'Hara, M. (1987): **"Price, Trade Size, and Information in Securities Markets"**. Journal of Financial Economics, Vol. 19 (pp 69-90)

Faucault, T. (1999): **"Order Flow Composition and Trading Costs in a Dynamic Limit Order Market"**. Journal of Financial Markets, Vol. 2 (pp 99-134)

Garman, M. (1976): **"Market Microstructure**". Journal of Financial Economics, Vol. 3 (pp 257-275)

Glosten, L., and Milgrom, P. (1985): "**Bid, Ask and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders"**. Journal of Financial, Vol.47 (pp 1127-1161)

Hagstrom, R.G. (2001): **The Essential Buffett: Timeless Principles for the New Economy.** New York. John Wiley & sons.

Hans, L. (1991): **"Stock Price Clustering and Discreteness"** Review of Financial Studies, Vol. 4 (pp 389-415)

Hasbrouck, J. (1991): **"Measuring the Information Content of Stock Trades"**. Journal of Finance, Vol. 40 (pp 179-207)

Hasbrouck, J. (1998): **"Trades, Quotes, Inventories, and Information"**. Journal of Financial Economics, Vol. 22 (pp 229-252)

Hasbrouck, J. (2007): **Empirical Market Microstructure**. Oxford University Press, in (http://pages.stern.nvu.edu/~jhasbrou/EMM%20Book/EMM%20Home.htm) 09/01/2009

Hasbrouck, J., and Safianos, G. (1993): **"The Trades of Market Makers: An Empirical Analysis of NYSE Specialist"**. Journal of Finance, Vol. 48 (pp 1565-1594)

Ho, T., and Stoll, H.R. (1981): **"Optimal Dealer Pricing Under Transaction and Return Uncertainty"**. Journal of Financial Economics, Vol. 9 (pp 47-73)

Ho, T., and Stoll, H.R. (1983): **"The Dynamics of Dealer Markets Under Competition"**. Journal of Finance 38, (pp 1053-1074)

Huang, R.D., and Stoll, H.R. (1994): **"Market Microstructure and Stocks Return Predictions"**. Review of Financial Studies, Vol. 7 (pp 179-213)

Huang, R.D., and Stoll, H.R. (1997): **"Dealer versus Auction Markets: A Paired Comparison of Execution Costs on NASDAQ and NYSE"**. Journal of Financial Economics, Vol. 41 (pp 313-357)

Kyle, A.S. (1985): **"continuous Auction and Insider Trading"**, Econometrics, Vol 53 (pp 1315-1336)

Madhavan, A. (1995): **"Consolidation, Fragmentation, and the Disclosure of Trading Information"**. The Journal of Financial Studies, Vol. 8 (pp 579-603)

Madhavan, A. (2000): **"Market Microstructure: A Survey"**. Journal of Financial Markets, Vol. 3 (pp 205-258)

Madhavan, A., Richardson, M., and Roomans, M. (1997): **"Why do Security Prices Change? A Transaction-Level Analysis of NYSE Stocks"**. Review of Financial Studies, Vol. 10 (pp 1035-1064)

Naes, R., and Skjeltorp, J. (2006): **"Is the Market Microstructure of Stocks Important?"**. Economic Bulletin 3/06, Vol. 77 (pp 123-132) in (http://www.norges-bank.no/upload/14403/artikler/microstructure%20stock%20market.pdf) 20/12/2008

O'Hara, M. (1995):**Market Microstructure Theory**. Oxford. Blackwell Publishers Ltd.

O'Hara, M. (2003): **"Presidential Address: Liquidity and Price Discovery"**. Journal of Finance, Vol. 58 (pp 1335-1354)

Parlour, C. (1998): **"Price Dynamics in Limit Order Markets"**. Review of Economics Studies, Vol. 11 (pp 789-816)

Roll, R. (1984): "**A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market"**. Journal of Finance, Vol. 39 (pp 1127-1139)

Stoll, H.R. (1978): "**The Supply of Dealer Services in Securities Marker"** Journal of Finance, Vol 33 (pp 1133-1151)

Stoll, H.R. (2003): "**Market Microstructure"**. Handbook of the Economics of Finance. Elsevier Science BV.

Wikipedia, the free Encyclopedia: **"Stock Market"**. (http//en.wikipedia.org/wiki/Stock market) 29/12/2016