

CHALMERS



Technology's impact on financial markets

A case study of OM

*Master of Science Thesis
in the Management and Economics of Innovation Programme*

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CHALMERS UNIVERSITY OF TECHNOLOGY
Göteborg, Sweden, 2013
Report No. E 2013:016

MASTER'S THESIS E 2013:016

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Chalmers Reproservice
Göteborg, Sweden 2013

Executive summary

This essay details the history of exchanges and technology's impact on them. It particularly focus on the underlying logic behind the nature of exchanges and its monopoly tendencies as well as why trading has increased throughout time, especially from the 1970s and onwards. As a case study the report focuses on the Swedish securities market and the company OM, nowadays NASDAQ-OMX.

New York Stock Exchange was the first stock exchange set up in 1792. During the coming century the number of exchanges grew but with the telegraphs, telephones and later networks and the internet another trend became clear; the number of exchanges started to decrease. Meanwhile, the trading increased thousandfold. The report concludes that these trends are mainly due to two important concepts: The natural monopoly tendencies in securities trading due to liquidity being such an important factor (for the individual instrument) and a tremendous decrease in transaction costs enabled by new technologies and Moore's law governing.

The securities industry transformation could be seen upon in a broader perspective. Disruptive technologies have transformed many industries and left old giants seeing competitors rise and surpass them. One such technology was the introduction of NASDAQ and a wide area network for price quotas. Later, the Internet enabled exchanges to be fully electronic and investors could trade on all exchanges over the world. In addition and equally important was that technology enabled the clearing and handling of enormous number of transactions.

Set in this context, OM, in 1985 became the first to enter the Swedish option market. With the usage of cutting edge technology, as well as strong lobbying, OM became a success story both in Sweden, where OM acquired big brother the Stockholm Stock Exchange, and internationally through expansion. Alongside OM a Swedish financial IT cluster arose.

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Introduction

Stock markets have transformed rapidly since the introduction of the first stock market, New York Stock Exchange, in 1792. Around the globe and across markets, millions and millions of stocks, bonds and derivatives are changing owners by the minute.

In 1972, the trading volume at Stockholm Stock Exchange was still the same as it was in 1918. Then something happened: Technological innovation. With computers, both the market place and the clearing systems could be automated, lowering the cost of trade. Trading increased. However, the handling of the increased volume would not have been possible without Moore's law governing. Moore's law implies that at the same cost computer capacity will double in 18 months. As such, there was an infrastructure for an exponential increase in output.

Over the Atlantic, NASDAQ became the technological innovation that initiated the financial revolution, by becoming the first exchange that provided real-time stock quotes. With networks, the Internet and a huge demand/supply for trading the way the financial system works would never again be the same. Today, approximately 30-60% of the trading is so called black-box trading¹, i.e. computer algorithms that automatically execute trades.

In Sweden, as a way to circumvent the governmental monopoly Stockholm Stock Exchange(SSE) held, Optionsmäklarna (OM) and its founder Olof Stenhammar brought option trading to Sweden in 1985. In a struggle against stockholders, such as regulators, the government and the SSE, OM managed to crush the most enthusiastic expectations. After 1.5years OM made a profit of 150m SEK. Its growth required systems that could handle the increased number of transactions, both in executing the trade but also in handling the back-office activities required. With its technological advantage OM soon came to dominate the Swedish market and acquired SSE to expand its business to include trading of stocks. Alongside OM, a Swedish financial-IT cluster arose.

Aim of report

This thesis aims at analysing the broader technological impact on financial markets with the case study of OM, later NASDAQ-OMX, and Sweden. It also aims at drawing the linkages and the logic behind stock markets, monopoly and technology. To reach the overall aim, the report will strive to answer the following questions:

- Why the huge increase in securities trading throughout the world?
- What explains the natural monopoly tendencies in securities trading?
- Why did OM succeed?

The report will not get deep into technical details of systems nor have the intention of covering all financial markets. It will describe the most important market, the US, as well as the case study OM and the Swedish market.

¹ DI

The intentions of the report is to give the reader an understanding of how technology can transform a business as well as get a better understanding of the dynamics of the financial markets.

Structure of the report

Section 2, Method, describes the method used to reach the aim of the report.

Section 3, Theory and literature review, aims at giving a theoretical background and introduce important concept.

Section 4, Empirical review, presents the origin and growth of financial markets relevant for the report.

Section 5, Case study OM, tells the story of how OM grew and became NASDAQ-OMX.

Section 6, Analysis, analyses section 3-5 with focus on the nature of financial markets and technology's impact.

Section 7, Conclusion, wraps up the analysis.

Method

The subject was initiated through a dialogue with Jan Jörnmark, associate professor of the history of economics, who has dedicated lots of work into the impact of technology shifts. Technology's impact on the financial market is somewhat understood but not looked upon from a Swedish perspective and as such would bring valuable information to the research on technology shifts. Furthermore, a greater understanding of the dynamics of the financial markets, especially after the recent financial crisis, would be of interest.

An aim of the report was concretised and the work proceeded with the collection of data. The collection of the data was done with the aim of understanding the broad perspectives and covered the history of financial market, technology shifts in markets and the history of OM itself. When covering these topics, a couple of sub questions arose that lay the foundation for the analysis as well as fulfilling the aim of the report.

The reader should know that this is a qualitative report. The report has no intentions of covering all ground in the subject but rather to give a broad overview and build up the linkages and logic to fulfil the aim. It should be noted that a lot of the reasoning in the report is the authors own. To secure that the findings and analysis are correct, the results have been iterated with Jan Jörnmark.

Data collection

The data has been collected through various sources. Among them Databanks with public articles, books, internet searches, Wikipedia as well as interviews. As the report has used a wide variety of sources through different Medias, this enhances the reliability of the report. However, some of the internet sources should be looked upon with critical eyes as these, by some, is considered a less trustworthy source. However, it is the author's perception that the sources are reliable and that sources like Wikipedia rather should be raised above many other sources of information.

Theory and literature review

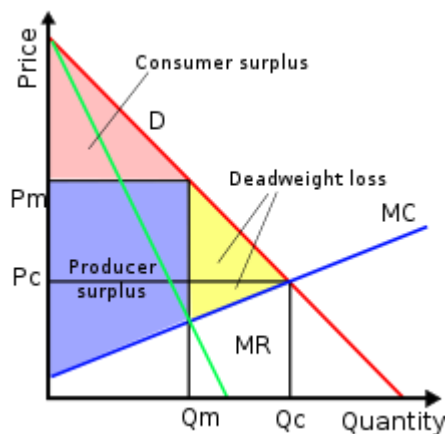
This section aims at giving the reader an understanding of the important concepts and theoretical frameworks that will be used later in the analysis and recommendation.

Monopoly

Monopoly exists when one player in the market produces all the output. It is called a pure monopoly if there is a monopoly without any close substitutes. The firm with monopoly will freely set the price, terms and conditions of an exchange due to lack of competition. In the opposite market situation, perfect competition, there is an infinite number of sellers producing an infinitesimally small quantity of output. The market will set the price and the firm will be a price taker.

A firm with monopoly power will still be affected by the traditional demand curve, but will typically set the price to maximize his profits. The monopolist will choose to produce at Q_m , where marginal cost is equal to marginal revenue, and set price at P_m . The reason for this is easiest understood by thinking what would happen if the firm chooses to produce one more unit. The marginal cost for that unit will exceed the marginal revenue of that unit with a resulting loss on the unit.

By setting this price the producer will gain a surplus seen in the graph, producer surplus. The lower half represents the normal profits that would go to a competitive firm. The upper half represents the additional economic profit going to the monopolist. The deadweight loss refers to the potential gains that neither went to the consumer nor the producer in a monopoly.



Source: wikipedia

A monopoly could be created through government interventions and regulations, but could also arise when there exists significant economies of scale in a market and a single supplier will maximise efficiency in production and distribution. This is called a natural monopoly. Often the largest supplier (and/or first supplier) will have the largest economies of scale benefits and/or will have travelled the furthest down the experience curve outcompeting current competition and making the barriers of entry for new firms too big to overcome. A natural monopoly could also be created through a new technology with Intellectual property rights or market lead time.

In a static economy, perfect competition would be the optimal for the consumer as he will benefit from lower prices. A static economy would require a certain amount of resources and a specific technology and would strive to optimise production with the three production factors; labour, land and capital.

According to Schumpeter, perfect competition is not optimal for the consumer. He argues that the perfect competition model is an abstraction and does not capture the essentials for economic growth and technological development: Innovation. Innovation is what makes the economy dynamic. In such an economy, firms will aim at obtaining monopoly through innovation, to reap huge profits. This is singlehandedly the strongest drive for development and innovation and these benefits will be larger for the consumer than reaching the equilibrium price. Schumpeter concluded his reasoning by stating that "perfect competition is not only impossible, but also inferior, and there is a reason not to set it up as a model for ideal efficiency."²

Transaction costs

Transaction cost is the cost of participating in the market. Search and information costs, to find out that the required goods are available on the market and who has the lowest price etc are examples of transaction costs. Another example is bargaining cost, which is the cost required to come to an agreement with the other party of the transaction such as drawing up an appropriate contract. Furthermore, there are policing and enforcement costs that arises to make sure the other party stick to the terms of the contract and take appropriate actions if this turns out not to be the case.³

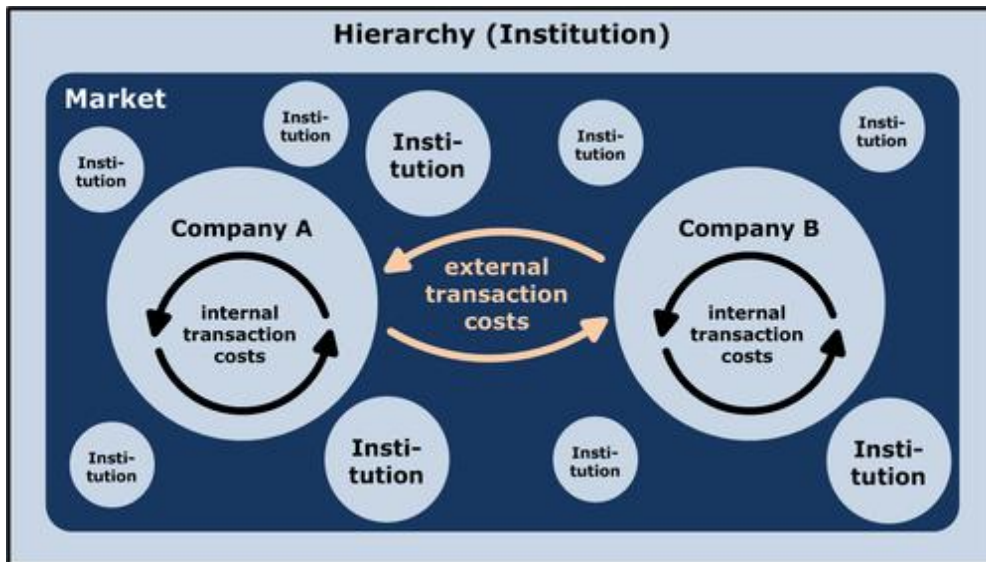
The concept transaction cost has its origin in 1937 and the thoughts of 1991 years Nobel Prize Winner, Ronald Coase. The concept was a result of Coase trying to understand why we have economic organizations. He started questioning why, if the market is such a good coordinator, so much of the economic activity in the market results in planning by companies. The explanation: transaction costs.

In order for an exchange to take place, the costs to execute should be low. These costs does not only involve the actual price of the exchange but also the costs related to gathering of information of available alternative, evaluate them, negotiate and make a deal and sign the contract. If every household would go through this process every time a transaction should be made, things would be too complicated and the implied transactions costs too high; exchange would not take place. By coordinating in a company these transactions costs can be decreased.

As a consequence the size of the firm will be a function of the costs of using the market. The model below tries to illustrate the relation between companies, institutions and markets to coordinate economic transactions:

² Schumpeter (1942)

³ Dahlman (1979)



Source: Wikipedia

In this model, the company will grow when the external transaction costs are higher than the internal transaction costs. If the internal transaction costs are higher than the external transaction costs the company will instead be downsizing (e.g. by outsourcing).

The external transaction costs could according to Coase e.g. be if a regulation was imposed, if a war took place or if communication costs increased. In such an economy with high transactions costs, the companies will be large and incentives for new technologies will be low. The period up until 1950 saw more regulation and several wars. These increased the transaction costs. Consequently the companies were big. Since 1950 markets became deregulated, resources and capital became available, political and economic stability spread, communication costs decreased and subsequently transaction costs decreased uninterruptedly. Companies that listened to the market and the consumer were able to prosper.

Innovation

Innovation is typically defined by a reference to a change in ideas, practices or object involving some degree of novelty or creation based on human ingenuity and success in application. The concept of success is composed of technical, commercial as well as economical success.⁴

Christensen defines technology as "the processes by which an organization transforms labour, capital, materials, and information into products and services."⁵ The definition of technology thus extends beyond engineering and manufacturing to encompass a range of marketing, investment and managerial process. With this concept, Christiansen argues that innovation refers to a change in one of these technologies.

As stated in previous section, Schumpeter claimed that innovations were the main reason for economic growth. In his concept of innovation there were:

1. New products
2. New production processes, i.e. new ways of producing
3. New markets, such as new countries and new customer segments

⁴ Granstrand (2006)

⁵ Christiansen (2002)

4. Access to new raw materials or new types of half fabricates
5. Large institutional changes, such as creating or dissolving monopolies based on liberalization or deregulation

The transistor could be said to belong to category 1-4 whereas the ongoing globalization creates 3 and 5.⁶

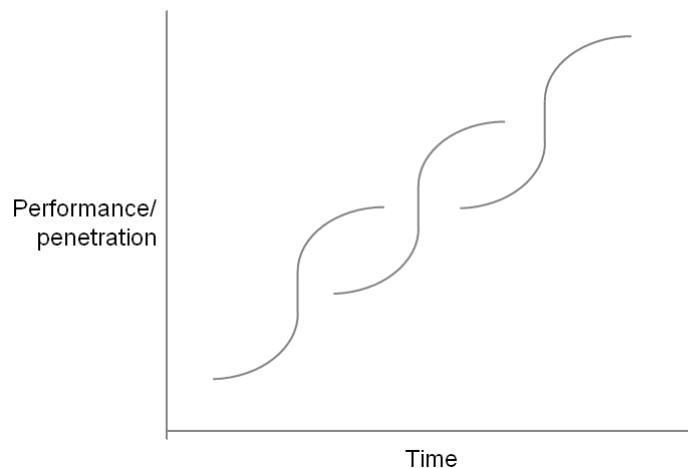
Product life cycle model is a framework for capturing the cash flows of a new product assuming it has a finite lifetime on a market. The stages include development, introduction, growth, maturity, saturation and decline. In development and introduction the cash flow will be negative. In the growth the cash flow will be positive and increasing and stays rather constant in the maturity stage before it starts to saturate and later decline. In this model the innovator of a product will typically experience a market lead time through patent and/or know-how protection (with following natural monopoly and high profits) before imitators copy with decreasing margins for the innovator.⁷

With a new innovation, the new is usually both better and cheaper because the innovator has a cost advantage and can set the prices below the old producers and still reap large profits. The profits are a signal to new actors to enter the market with the price creeping down to the innovators cost structure with the old producers being left behind unless they change technology. This process of creating a new technology, and destroying an old, is called creative destruction. One of the reasons why the old producers will have troubles in competing is because their assets are based on the old technology and these will become “worthless” if they change, this includes the current stock as well as the production units. Thus the old producer will stay conservative to a new technology and the speed of technology change will be a function of the balance sheet and the speed of depreciation.

An innovation is never a one-shot affair. Instead it triggers a swarm of mostly minor changes with some major subsequent innovation interspersed over time. As the technology matures the flow of subsequent innovations decrease illustrated in an S-curve. The logic behind the S-curve is that major innovations open up technological opportunities and increase marginal returns to technological efforts. The rate of progress is higher when the technology is far from its limits but will eventually slow down. A new technology will then find the market resulting in a pattern of stacked S-curves.

⁶ Jörnmark (2004)

⁷ Granstrand (2006)



Source: Granstrand

The new technology increases product performance and/or decrease costs. The incumbent firms sitting on the old technology response to the new one by quick improvement in product performance, called sailing effect, but will eventually be outrun by the new technology.

Within new product areas there is also a distinction between innovations in the product and the process, where the rate of subsequent product innovations decreases while the rate of process innovation first increases and then decreases.⁸

The speed of which you enter a market could be of great importance depending on if there is first mover or late mover advantages. If there is a first mover advantage, i.e. more benefit in doing something early, we have economies of speed. There will be a racing game between competitors to get the product out. With strong economics of speed the winner will take it "all". This could e.g. be due to natural monopoly tendencies, consumer lock-ins and/or establishing a better cost structure due to getting further down the experience curve.⁹ If on the other hand the late mover advantages are larger than the first mover advantages there will be a waiting game.

The Transistor

History

A transistor is an electronic component that can enhance analogue signals or switch between two positions as a reaction to a digital signal (more familiar 1s and 0s). The transistor really first entered the commercial market in the middle of the 1950s, one decay after the innovation was completed by Bell's Laboratories 1947. But the actual invention has its roots as early as 1925.

In the beginning of the 40s Bell Laboratories became concerned about the high failure rate and power consumption of vacuum tubes that were used as rectifiers and switching elements in the telephone systems. The development of the transistor started and in 1946 they initiated a project to produce transistors based on semi-conductor materials such as silicon or

⁸ Utterback and Abernathy (1975)

⁹ The experience curve refers to the decrease in unit cost the more you produce

germanium. The first major commercial application was the radio, 1955, later followed by computers 1958. The innovation kept improving, when parts became smaller and cost decreased. As the numbers of transistors increased an enormous amount of individual components were needed. For example, the first transistorized computer had 25000 transistors, 100000 diodes and hundreds of thousands of resistors and capacitors. The cost of putting these parts together and quality control far exceeded the cost of all the components.¹⁰

The solution was integrated circuits (ICs), a series of transistors, produced in one piece, connected and working together. The original invention traces its origin to Texas Instruments who managed to integrate the components on a single chip in 1959 and Fairchild that found a feasible way of connecting the components. More and more transistors were demanded by different industries and the next step in the development was the microprocessor, an IC with the power of a small computer.

Moore's law

In 1965, Gordon Moore, research director at Fairchild noted that complexity had doubled every year (later revised to every 18months) since 1959 and predicted that this would continue to do so. This trend or observation was named Moore's law. Basically this has the effect that the cost of the same capacity is cut by half every 18 months. In an economy where economics and firms fought against diminishing returns the transistor showed something the world has never seen before: an exponential increase in capacity.

Fifty years later the "law" still holds. In fact, the end of Moore's law has been predicted so many times it is an industry joke. Gordon Moore himself predicted 1997 that limits could be reached 2017. And indeed it looks as if there are some technological aspects that points towards the limits being reached.

This exponential improvement was due to three equally important factors: improvements in optical projections, ever-finer rendering of images and line-widths, and more clever use of the wafer area. Central for the fulfilment of Moore's law is the ever increasing, inexhaustible, demand for transistors as well as the lack of patent protection and venture capital acknowledging the transistor's potential in different application areas.

Impact on society

As new areas of usage became available, while costs constantly decreased, the transistor would turn out to affect many industries. The transistor directly affected the industries where it was part of the production. The new technology also indirectly affected most other industries due to improved communications and increased transparency which indirectly increased competition.

Except for Moore's law, other factors were also of importance in creating the growth. Privatization and liberalizations of industries and especially capital markets took away former bottlenecks. But globalization and the digitalisation where in many aspects in synchrony and lead to governments easing up on regulations and barriers and drastically created new ways of communicating. New markets in terms of countries, new products, other customer segments etc were created by the day.

¹⁰ Granstrand (2006)

Examples of transformed industries include the transistor radio that replaced the traditional radio and the electronic calculator that replaced the old adding-machine¹¹. It also changed the communication industry. Satellites filled the television with new material and news from all over the world. What earlier was thought as a niche market, the mobile, became affordable to most consumers. Not to mention the personal computer and the Internet that both reached a new market as well as transforming most other businesses.

The transformation was quick and with the new technology a lot of former great firms went out of business. Their old technologies simple could not stand the creative destruction that took place. Former balance sheet with old technologies now became useless. And even the ones with new technologies had balance sheet issues. With Moore's law governing, stocks became a large enemy, where products lost half of its value in 18 months.

Hardware versus software

The ever-increasing demand for hardware that transistors technology made available, lead to a demand for content, software, and in this interplay the demand for both increased.

The distinction between hardware and software is important to fully understand the effect technology have had on the finance sector and OM. The hardware is the apparatus, such as the personal computer, the transistor radio, the mobile phone or something similar. The software is what makes the apparatus work. The hardware is useless without the software, and the software has no use without the hardware. The software industry has grown in importance especially within the entertainment industry, such as games, music and video. And a lot of effort has been put into different technologies being able to communicate with each other with a result of hardware getting multiple uses. The computer can for example be used as television, to play games, make calls etc. This development has brought opportunities for ambitious entrepreneurs and firms.

Sustaining versus disruptive technology

Christensen called technologies that foster improved product performance sustaining technologies¹². These can both be incremental or radical in character. What they have in common is that they all improve the performance that mainstream customers in major markets have historically valued.

Disruptive technologies on the other hand start out with worse product performance and with a different value proposition than what previously has been available. But they have other features that a few fringe (and generally new) customers value. The products that come out of disruptive technology are typically cheaper, simpler, smaller and frequently more convenient to use.

Christensen argues that technologies progress faster than the increase in market demand. That implies that as time passes the sustaining technology will give customers more than they need or ultimately are willing to pay for. The implications are that the disruptive technology that currently may underperform relative to what the users in the market demand may be more than enough in the close future.

¹¹ See the story of the Swedish company Facit

¹² Christensen (2002)

There are at least three reasons why disruptive innovations are overlooked by successful firms and what makes these firms fail. Disruptive products are simpler, cheaper and generally promise lower margins, not greater profits. Second, disruptive technologies are typically first commercialized in emerging or insignificant markets. And thirdly if not most importantly, leading firms' most profitable customers generally don't want or can use the products based on disruptive technology. The implications are significant; the disruptive technology is for a small market with low margin customers and the firms that are best at listening to their customers and identifying products that will promise greater profitability will rarely make a case of investing in disruptive technologies.

The transistor is a typical disruptive innovation even though it was actually way more expensive in its initial phase than its competing sustaining technology: the vacuum tubes. However, the transistor found areas of usage due to its smaller size even though it was way more expensive. With Moore's law ruling though, it was not long before the prices dropped significantly.

Value networks

Christiansen claims that a firm's capabilities are forged within value networks, where the value network represents the organization where value is created. With the capabilities Christiansen claims that firms differ in their possibility to make money at different volumes, order sizes, margins, failures, product development cycles etc. Furthermore, he argues that organizations are far more specialized and context-specific than most managers are inclined to believe. With these assumptions he concludes that the new markets enabled by disruptive technologies will require different capabilities than the existing.¹³

In this context it is also valuable to mention competence enhancing and competence destroying innovations. Tushman and Anderson argued that innovations which destroy the value of a firm's existing competencies are very difficult to manage, because established firms are bound by traditions, sunk costs and internal political constraints. Consequently, firms will have difficulties in internally promote the competence destroying innovations, in which category disruptive innovations usually belong to.¹⁴

New economy / network economy

Eklund points out three specifics of this economy¹⁵

1. Products become more valuable the more people that have them. Telephones are good examples. A telephone on it's one is not valuable, rather the value of telephones increase the more people that have them. It is the same for computers (with Internet), faxes pagers etc. The law of decreasing marginal utility in consumption does not apply.
2. The unit cost decreases significantly in several of these industries. It's expensive to produce the first software, CD or movie but to produce more is almost free. The law of diminishing marginal returns does not apply.
3. In order for the products of the new economy to work it requires them to communicate effectively with each other. That requires standards, which make

¹³ Christiansen (2002)

¹⁴ Tushman and Anderson (1986)

¹⁵ Eklund (2002)

software, modems and email work together. The consumer will use the same software, modem etc as the other consumers. Thus, firms will have strong incentives to grow really fast to get a dominant position in the market. We have economies of speed. These markets often turn up to become monopolies. The technology keeps improving and new types of networks arises which means a new company will gain a monopoly.

As such, network markets often demonstrates negative supply curves due to great economies of scale, companies are initially almost willing to give away products in order to gain a market domination. Monopolies arises but are shattered by new monopolies arising from new technologies.

Critics argue that this is only representative for a very small part of the economy and that a regular economy with supply and demand factors holds for the rest.

Empirical review

This section establishes important financial concepts and details the history of the financial markets relevant for the report.

Finance sector's purpose and function

A financial market allows people/investors/companies to trade financial securities (stock, bonds, and options), commodities (metal, oil and agricultural goods) and other fungible items of value. In an efficient market the securities are traded at fair/market value, the true value of the security.¹⁶ Financial markets facilitate the raising of capital (debt and equity in the capital market), the transfer of risk (futures, options etc in the derivative market) and international trade (in the currency market).

It is not clear whether the finance sector proactively affects the real economy or if it is reactive to the growth of the economy. However, a well functioning finance sector is widely regarded as a prerequisite for economic growth and prosperity. A well developed financial sector is especially important for the growth of new, technology and knowledge based firms. These firms in general face difficulties in trying to obtain traditional debt financing due to a lack of real capital and the value of its human capital being hard to measure.¹⁷

Securities market

In the primary market for stocks and bonds companies can access capital outside the bank system. Through emission of stocks a company can obtain capital and as a consequence dilute its ownership. In the debt market the companies can complement the bank loans with the issuing of debt.

The stock market is different to the debt market. In raising debt a borrower borrows money with the obligation of paying back the principal in a certain amount of time and an interest on that amount. A stock is an ownership in a firm and as a holder you may thus be able to influence the way the company is run. As an owner you have the right to parts of the profit the firm makes. Stocks are in general considered riskier than debt.¹⁸

In order for investors to participate in the primary market they want to know that they later can sell the securities, in the so called secondary market. The easier it is to sell the security, the higher price investors are willing to pay. A liquid market will decrease the capital cost for the companies and the market's liquidity will become an important factor for capital allocation. The secondary market is also of great importance as an information provider. The price on the market will give information about the cost of new capital and what capital cost the company should use to evaluate their projects.

Furthermore, the stock market has an important function as a means of distributing ownership. If someone believes they can run the company better than the current owners, they will buy it¹⁹

¹⁶ Wikipedia

¹⁷ SOU (2000)

¹⁸ Ibid

¹⁹ Ibid

Definitions

Derivatives and options

A derivative is a security whose value depends on or is derived by an underlying security such as a stock, currency or natural resource. Derivatives are used as a way of distributing risk. Examples of derivatives include futures, warrants and options.

There are two kinds of options, call options and put options. A holder/buyer of a call option has the right but not the obligation to buy a security at a given price, the exercise price, at a specified period of time, the expiry date. The writer/seller has the obligation to sell this security at the exercise price at the expiry date. For this obligation the seller receives a premium. In comparison, a holder/buyer of a put option has the right but not the obligation to sell a security at the exercise price at the expiry date. The writer/seller has the obligation to buy this security at the exercise price at the expiry date. For this obligation the writer receives a premium.

When you buy an option you can “only” lose the invested capital. On the other hand, if you write an option the losses can have no boundaries. That’s why writing an option requires some sort of capital coverage (or in case of a call option you can own the underlying stock²⁰) in order to cover potential losses.

An option is usually valued with the use of the Black & Scholes formula. The formula takes into account the probability of the underlying security being above or below the exercise price. In comparison, a stock is usually valued through net present value calculation of future cash flows.

Arbitrage

Arbitrage is a profit obtained by simultaneously buying and selling an asset benefitting from a price difference in different markets for the same instrument. The net position of the transactions will be zero and the profit is per definition risk free. Thus, arbitrage is what economists would call a free lunch and traders will compete to take advantage of this. Equilibrium prices will be restored. Arbitrage will be possible when one of these conditions is met²¹:

- The same asset does not trade at the same price on all markets
- Two assets with identical cash flows do not trade at the same price
- An asset with a known price in the future does not, today, trade at its future price discounted at the risk free interest rate

In options, one can arbitrage from the differences in the price of a put and a call option of the same maturity and strike price. Put call parity implies that the value of a call gives a certain fair value of the put. To take advantage of this arbitrage possibility you will have to execute a series of transactions including buy/sell of the put, the call, the underlying stock and the present value of the strike price. Put call parity only holds for European options (European option cannot be exercised until expiration date as opposed to American options)

²⁰ This strategy of writing a call option and owning the underlying option is known as a covered call

²¹ Wikipedia

Clearing

Clearing refers to all activities from the time a commitment is made for a transaction until it is settled. These activities include reporting/monitoring, risk margining, netting of trades to single positions, tax handling and failure handling. Clearing is necessary because the speed of trades is much faster than the cycle time for completing the underlying transaction.²²

New York Stock Exchange

The New York Stock Exchange (NYSE) is the world's largest stock exchange by market capitalization. Its listed companies add up to a total of US\$ 12.25 trillion in market capitalization as of May 2010. In 2008 the average daily trading volume was approximately US\$ 153 billion.²³

Historically, NYSE has been organized as an auction with specialist bidding and selling on behalf of the investors (as well as performing own trades). The specialist is part of specialist firm. The specialist has to offer a bid and ask price on orders and execute all orders at the best price available. For this service, the specialist gets compensated by reaping the benefits of the difference in the bid ask spread.

However, NYSE is since 2007 a hybrid market. A hybrid market allows a stock broker to either have his order executed immediately in an automated electronic exchange, or to have it routed to NYSE's traditional live auction on the trading floor in the presence of a specialist broker. The automated system has the advantage of speed (often completing orders in under one second while comparable manual transactions take an average of nine seconds²⁴) whereas the live auction has the advantage of human interaction and expert judgment. Three months after its introduction 82% of all order volume was done through the automatic system²⁵. The NYSE is now working on redefining the role the specialists play in the market²⁶.

The history of NYSE

NYSE roots trace back to 1792. The exchange started as an effort to circumvent government regulation, something rather prominent throughout the history of financial markets. The government prohibited public auctions of stocks. To get around this a group of twenty four stockbrokers got together and arranged their own private auction. Since private auctions were never really heard of before, they could get around the legislation and form a cartel with commissions set at or above one-quarter per cent.

In the 19th century the stock exchanges were often local monopolies due to liquidity in the market being the most important competitor factor. The exchanges could not become national because at this time news and orders could only travel with the speed of horses and trains and the transactions costs were thus too big to overcome the liquidity advantage. Around 1880 the local exchanges started to face more serious competition after the introduction of the phone in 1876. Only one exchange per region was able to survive. Yet the transaction costs

²² Wikipedia

²³ Ibid

²⁴ Investopedia

²⁵ http://www.usatoday.com/money/markets/2007-07-11-nyse-traders_N.htm Retrired 2011-02-02

²⁶ http://exchanges.nyse.com/archives/2008/06/nyse_plans_to_revise_specialisttrader.php. Retrieved 2011-02-03.

were still huge and included costs such as phone cost and the physical delivery of the stocks. But as communication costs decreased, the number of exchanges continued to drop.

With time, NYSE grew larger and larger and became almost synonymous with the US equity market. The natural monopolies tendencies were so strong that NYSE brokers and the exchange could set commission rates above the competition as well as fail to provide customer-desired products and services that competitors provided.²⁷ One example is the Open Board of Stock Brokers that during the civil war introduced a continuous auction compared to NYSE which still had a call auction. These two later on merged, typical for the history of the exchanges.²⁸ Furthermore, the exchange pretty much existed without regulation until SEC, Securities Exchange Commission, was formed in 1934.

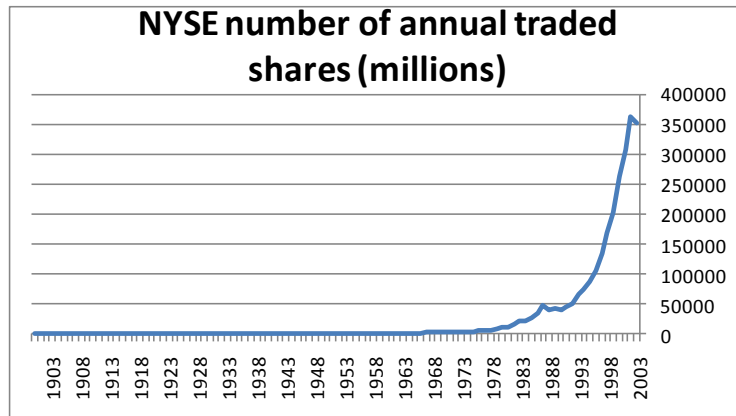
In 1971, the electronic quotation system NASDAQ entered the market for over the counter stocks. The history of NASDAQ is presented in the next section. NYSE responded to the electronic stock exchange competition by introducing DOT, Designated Order Turnaround, in 1976 and later on its follower SuperDOT. The system electronically transmitted all orders, except for the largest, from a brokerage house to a specialist and also recorded the trade's execution. The specialist could choose to execute the order to the quoted price or find a better price in the crowd. When the order was executed a response to the broker was sent and the broker could then call the investor and confirm the transaction. The system eliminated the need for the floor brokers, which basically ran around looking for the best price between the specialists and the other floor brokers.

DOT, by enabling traders to send simultaneously large numbers of trades to NYSE for immediate execution, had the effect of facilitation program trading, i.e. pursuing an investment strategy of simultaneously trading large amount of stocks and or futures. With time decreasing between order and execution arbitrage became possible. NYSE left the execution to specialist but automated most other handling and clearing, e.g. the paper flow. With more automation came increased volumes. Between 1975 and 1989, average daily volume on NYSE increased from 19 million shares to 165 million shares. This volume increase, enabled by the productivity increase, as well as a commission based pricing lead to dramatic increases in salaries for people in the sector and especially for the specialists that earned way more than the president. Wall Street was blossoming.

One of NYSE's larger competitors was American Stock Exchange. They did not compete directly though since the American Stock Exchange targeted smaller firms whereas NYSE was the exchange for larger firms. The natural monopoly tendencies are first and forth for the individual stocks. As the Amex stocks/firms grew and matured, they were often moved to NYSE. AMEX later on merged with the innovative NASDAQ.

²⁷ Blume (1993)

²⁸ Ibid



Source: Nyxdata.com²⁹

NASDAQ

NASDAQ lists approximately 3200 companies and has more trading volume seen to the number of stocks traded (not market capitalization) than any other stock exchange in the world.³⁰ The NASDAQ has been synonymous with new and aggressive companies that seek to challenge the traditional ways of doing business. In that sense, as a market, NASDAQ is the embodiment of the American dream. The listed stocks come from all areas of business, including technology, retail, communications, financial services, transportation, media and biotechnology.

The roots of NASDAQ goes back to 1920s when the National Association of Securities Dealer were created to prevent trading abuses by overseeing the over-the-counter market, i.e. the securities that do not trade on the floor of a brick-and-mortar exchange. Instead, shares of OTC stocks are bought and sold through a network of dealers, traders and institutional investors. As such, this market was fit for automation.

NASD's Automated Quotation system, the NASDAQ, first saw daylight in 1971 and was one of the first real-time wide area networks. The system could be compared to the Internet with the user continuously both updating and viewing information as stock prices changed and trades took place. NASDAQ became more than just a computer network; it also laid ground for the first online community.³¹ However, the system did not actually connect buyers and sellers. But it did help in lowering the spread and was therefore not very popular among brokerages that made a lot of money on the spread.³²

NASDAQ grew by adding trade and volume reporting and trading systems that could automatically execute orders. One of the first automatic trading systems, Small Order Execution System, was established in 1982. This system let traders electronically enter small orders (1000 stocks or less) that could be executed automatically and instantaneously against the prices broadcasted by NASDAQ dealers.³³ However, the execution of these orders did not

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http://www.nyxdata.com/nyxdata/asp/factbook/viewer_edition.asp?mode=table&key=2206&category=4 Retrieved 2011-01-20

³⁰ <http://www.nasdaqomx.com/> retrieved 2011-01-04

³¹ Ingebretsen (2002)

³² Wikipedia

³³ Ingebretsen (2002)

become mandatory until after the great stock market crash in October 1987, where market makers didn't let these order go through.

Even after the introduction of SOES, most trading was still done by the phone. However, the scene was turned around when NASDAQ became accessible through the Internet about two decades after its introduction. NASDAQ became open to millions and millions of Americans and people from all over the world. Day traders started making and losing thousands of dollars in a day. With the boom that followed, people in their 20s could take their start-up public and become multibillionaires. Millions of average American profited as well, and an incredible amount of jobs and wealth was created. In many ways NASDAQ was the driver of the Internet bubble and as such showed us what big effect the financial markets have on our economy.

In 1998 NASDAQ merged with Amex. This opened up for the trade of options, futures, mutual funds and bonds, all on the same network and that could be traded from anywhere in the world. However, the trading of options differ to stocks in that trading options often required an Amex like auction market because a single underlying stock will have a lot of options written on it at different exercise prices and expiration dates. As such, liquidity will be low and the market will have more use of a specialist.

In a series of sales in 2000 and 2001, NASDAQ went public and proceeded to list itself on its own exchange in 2002. It has continued its expansion plans and bought the ECN Instinet in 2006, Philadelphia Stock Exchange in 2007 and OMX in 2008. The NASDAQ-OMX group controls the NASDAQ, second only to NYSE in market capitalization, and operates eight stock exchanges in Europe and owns one-third of the Dubai Stock Exchange.³⁴

The quotes at NASDAQ are available at three different levels depending on your access. Level 1 is the simplest which will only show the highest bid and lowest offer. Level 2 shows all public quotes of markets makers and recently executed orders. Level 3 is used by markets makers and allows them to enter their quotes and execute orders.³⁵

Electronic communication network

An Electronic Communication Network (ECN) is a type of computer system that matches orders in private using prices from a public exchange.³⁶ Some of the ECNs are regulated exchanges, others are sidelines of brokers-dealers and others are unregulated.³⁷

ECNs' history traces back to 1998 when SEC authorized their existence. These networks increased the competition through offering lower transaction costs, giving clients full access to their order books and offering order matching at other hours than the traditional exchange hours. Examples of ECBs include Archipelago, Instinet and third-party Web developers like 3Dstocksharts.com that had devised their own quote displays that incorporated limit order from rival ECNs. ECNs had also incorporated software algorithms called smart order routing

³⁴ Wikipedia

³⁵ Ibid

³⁶ Ibid

³⁷ <http://www.investingonline.org> retrieved 2010-12-12

that automatically searched markets for the best price and then directed customer orders there.³⁸

ECNs required subscriber to have an account with a broker that provided direct access trading and could enter orders into the ECN via a computer terminal. The system would match orders and post unmatched orders on the system for others to view. The buyer and seller were anonymous. The trade execution reports listed the ECN as a party. These systems could also offer additional feature to subscribers such as negotiation, reserve size and access to the entire ECN book (instead of only the top orders)³⁹

As a response to the competitor threat NASDAQ faced, due to the ECNs, NASDAQ developed a new system called SuperMontage that had the same functionality as the ECN as well as being available to everyone.⁴⁰

Abolishment of fixed commission

Throughout stock trading history, investors and speculators have searched the market for profit opportunities. By today's standard, the securities industry could be regarded as a rather dirty business. Both market manipulation and specialist misbehaviour were common. SEC's formation in the beginning of the 30s was, as previously stated, an attempt to regulate and oversee the securities industry. However, SEC did not really significantly affect the regulation and financial landscape until the beginning of the 1970s. Previous to that, NYSE's natural monopoly tendencies were strengthened by own set up rules such as Rule 394, imposed 1939. This implied that all member brokers of NYSE should do all (!) their trading on NYSE only. The Rule was later renumbered 390 and existed to protect the NYSE from a third market, but was later loosened⁴¹ and abolished in 2000 under pressure from SEC⁴². At around 1970, SEC members at the time had a theory of how to cope with the industry: "The only way to regulate an industry as strong and effective and with so many bright people as the securities industry was to let competition work, as distinguished from regulation. We basically were not comfortable with regulation; we didn't trust how it could be turned or corrupted."⁴³ This reasoning was the start of removing the high fixed commission that had been governing NYSE.

The abolishment started with imposing a cut off limit. Above that limit competitive rates were allowed to rule. In the beginning this limit was set to \$500,000, but was later decreased. These changes were reluctantly accepted by the NYSE members. Yet, the pressure to abolish the rates persisted, became stronger and eventually the fixed rates were abolished in 1975.

The abolishment of the fixed rate put a significant competitive pressure on the industry and a lot of investment houses and brokerages went bankrupt. On the other hand, what these firms had failed to foresee was that the drop in prices drastically increased volumes. The ones who took advantage of this were the discount brokerages. These cut the rates by 80% and opened up a new market, the market for small and private investors. In order to cope with the massive growth these discount brokerages had to provide means of handling the large amount of

³⁸ Ingebretsen (2002)

³⁹ Wikipedia

⁴⁰ Ingebretsen (2002)

⁴¹ Blume (1993)

⁴² <http://financial-dictionary.thefreedictionary.com/Rule+390> retrieved 2011-02-01

⁴³ Blume (1993)

transactions. Technology became the solution. One such success story is the discount brokerage firm Schwab.

Schwab's business model was based on large number of transactions rather than big volumes, even though the big volumes eventually found their way to Schwab as well. The new competitor to the old big brokerages houses was based in California which was seen with black eyes of the people at Wall Street. To handle the huge number of transactions Schwab invested heavily in computer systems. The new market that arose could be referred to as a disruptive technology (and is one of the examples in Christiansen's famous book⁴⁴) as it found ways to compete with the big brokerages at Wall Street.

Growth of derivatives

The concept of derivatives first started to become significant with the breakthrough of Chicago's agricultural futures market in the 1960s. This was a response to the large fluctuations in agriculture price and derivatives became a way of mitigating and spreading the risk, both to cushion losses (for the farmers) and a way to speculate with minimal capital (for the speculators/investors).

The Chicago area became knowledgeable around risk and developed a risk culture of which could later be used in other areas than soybean and pork bellies futures. When the Bretton Woods system collapsed in 1971 corporate treasurers searched for a way to not stay sleepless over currency fluctuations. Suggestions of starting a currency futures market in New York were met with scepticism from the big banks. One banker claimed that the matter was "too ridiculous to discuss". Instead Chicago Mercantile Exchange opened a currency futures trade in 1972. A New York banker at the time told the Wall Street Journal "I'm amazed that a group of crapshooters in pork bellies have the temerity that they can beat some of the world's most sophisticated traders at their own game."⁴⁵

A liquid marketplace for stock options didn't really exist until the Chicago Board of Trade wanted to diversify beyond its agricultural futures products of the late 1960 and provide an exchange for stock options. With the intention of increasing competition, SEC in 1973 approved the Board of Trade to trade options. The first modern market for trading options, The Chicago Board Options Exchange, was created.

One thing that hindered the growth of the market was that institutional investors had no good way of pricing options and its risk. However, one month after its opening, Black and Scholes developed their, still used, formula for pricing options. Together with a growing demand, options trading thrived.⁴⁶ In 1977 put option were introduced.⁴⁷ Later, CBOE provided trading with futures on stock indexes. Initially these futures involved high costs at settlement due to commissions and the bid-ask spread. The trading in these prospered when the exchange instead introduced cash settling in 1981. Cash settling implied that instead of an actual change in ownership of stocks you settled with cash.

⁴⁴ Christiansen (2002)

⁴⁵ Blume (1993)

⁴⁶ Ibid

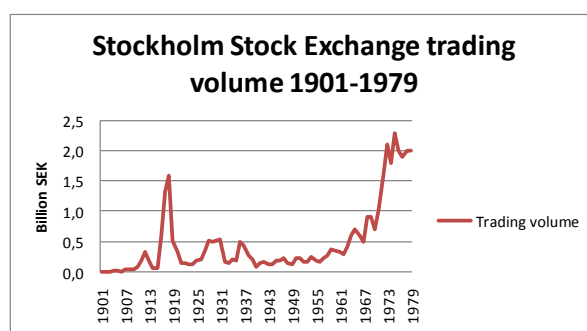
⁴⁷ Blomé (1990)

The index futures and index options also provided an opportunity for arbitrage and subsequently a more efficient pricing (due to free money laying on the table quickly eliminated price discrepancies). These index derivatives was very popular with the implication of stock price levels often being determined not so much in New York as in Chicago just a few years after its introduction, by the mid 1980s.

Ten years after its introduction, the Chicago market accounted for 80 percent of the world's futures trading and 70 percent of the world's options trading. New Yorker market makers desperately tried to imitate Chicago's futures markets, but Chicago had seized to big of a head start to catch up. Outside of the US, Montreal and Toronto Exchanges started trading standardized options in 1975. In 1978, option markets in London and Amsterdam opened.⁴⁸

Stockholm stock exchange

The Stockholm Stock Exchange had in its first auction in 1863. Twenty-two transactions took place. The auctions were done once a month. It was not until 1901 that the order of the exchange was changed with a clearer organization and with more frequent auctions. The trading volume that followed up to 1979 could be seen in the figure below.



Source: Statistiska centralbyrån

In terms of trading volume, the exchange reached a peak in 1918 with 1.6 billion SEK. One of the reasons for the increase was that the banks significantly increased the amount of money they lent out for stock purchases. The banks were tempted by the revenue from the credits, with high interest, and the commissions that came from the purchase of the shares. Other reasons included a bull market, speculations and the availability having increased through more phones. With other restrictions and a poorer market, the trading volume stabilized around low volumes.

At this time the proof of your ownership was the share certificate. This certificate had two parts: the first page consisted of a picture of the company and information of how many shares the certificate entitled too. The second consisted of a number of tear-off coupons that should be handed in at dividends and issue. The one who lost the share certificate basically lost his shares even though all companies kept a record of its owners. In 1972 the government imposed regulations that required the securites central VPC (today NCSD) owned by the Swedish banks to keep registers of all the ownerships. VPC task was to assist all registered

⁴⁸ Blomé (1990)

companies with all handling of the share owners. The old share certificate was replaced with a similar certificate from VPC.⁴⁹

Then something happened; Digitalization started to take place. In just 20 years, the trading volume increased over 1000 times. This dramatic increase is illustrated in the graph below. The technology development at SSE is described in more detail in the subsection below.

Source: Statistiska centralbyrån

Up until 1993 there was just one market place in Sweden for securities, and during the period 1979-1993 the exchange was a regulated monopoly. With the abolishment of the monopoly in 1993 the exchange was converted to a limited company with the owners being the listed firms. The SSE became the world first profit driven stock exchange.⁵⁰ Since the abolishment, competitor exchanges were established. Examples include NGM stock exchange, Aktietorget, First-North list and Göteborgslistan, but they didn't gain a large market share.⁵¹ In 1998, SSE was acquired by OM.

Technological development at the stock exchange

The two most important innovations for the stock's exchange in the earlier days were the telephone and the electric marking system. Inspired by the United States SSE opened up for telephones in early 1880s but only had three by 1890 and seven by 1912. The number of phones then exploded and reached 216 subscribers by the end of 1917. This was mainly due to the introduction of the power current telephone. With the number of telephones increasing, information and quotes could be spread quicker and it became easier to lay orders.

In order to cope with the increasing trading volume around the peak in 1918 and not let the one who screamed the loudest get advantages, electric marking system was developed⁵². Stockholm stock exchange got called the world's quietest stock exchange.

In 1974 the computerization of SSE started with communication hubs and services between actors. SSE went on to introduce its own market system SIX, Stockholm Information Exchange, in 1987 and then SAX , Stockholm automated exchange, in 1989 which automatically matched buy and sell orders. Prior to that all trading had been done on the floor of the Stockholm Stock Exchange building and the stock members no longer needed any representatives in the stock exchange building. The brokers could receive order from their clients and send the order through to SAX. This meant that the traders could sit anywhere in the world and trade.⁵³ After its takeover by OM in 1998, SAX was replaced with the improved and OM inspired SAXESS system in 1999. The stock terminal that brokers used called SAXESS Trade. With the

⁴⁹ <http://www.aktiespararna.se/>

⁵⁰ <http://www.karlshamn.se/vux/netvux/FE-1202-3/M04-borsen/M04-s01-stockholmsborsen.htm>
retrieved 2010-12-09

⁵¹ <http://www.aktiespararna.se/> retrieved 2011-01-02

⁵² Ibid

⁵³ <http://www.karlshamn.se/vux/netvux/FE-1202-3/M04-borsen/M04-s01-stockholmsborsen.htm>
retrieved 2010-12-09

introduction of electronic trading, the VPC share certificates was replaced by a VP-account in which all shares a single investor owned were/are declared.⁵⁴

⁵⁴ <http://www.aktiespararna.se/> retrieved 2011-01-02

Case Study – OM

OM – the idea takes form

The story of OM starts with the story of its entrepreneur, Olof Stenhammar. After finishing his studies he got an offer to come to the States and become a stock broker in 1973. The same year as Chicago Board Option Exchange started the first market for options in the US by introducing stock options. Stenhammar got his broker licence at New York Institute of Finance finishing as number one in his class and started his career. In 1975 he returned to Sweden and started to work within the Bonnier group. His interest in the securities market persisted and after a couple of years he started his own company for private stock and bond trading. Later, he created a company that traded premium bonds together with a couple of colleagues at Bonnier. Their business model made use of own-created software to make money. In 1983 Stenhammar believed that the market for computer games would be huge. He started importing the game Atari. However, the project was a failure due to large estimation errors in sales. At the same time he started discussing with a couple of old friends, now highly regarded in the business elite, about starting an option market in Sweden.

Before creating a market for options he approached the Swedish Bank Inspection Board and asked them what rules there were for options. The Bank Inspection Board claimed that an option market would infringe on the regulated stock market monopoly: "options are futures on stocks and are thus prohibited". Stenhammar was not satisfied and proceeded to find out that the concept of options did not exist in Swedish law. In order to stop his plans of setting up an option market the government had to change the law.⁵⁵

At this stage, Stenhammar recognised that he needed the support and acceptance of some important players. Through personal networks he got in contact with the largest bank in Sweden, SEB, the largest securities brokers company, Carnegie, and the powerful and influential investment company Investor (also part owner of SEB). In March 1984, together with Providentia, they created the limited company Optionsmäklarna, OM.

The first ambition was to establish a market for call options. Stenhammar believed that the market for options was much bigger than the existing market for rights of options since this was the case in the US.⁵⁶ OM could not technically become an exchange since that would have infringed on the Stockholm Stock Exchange's monopoly. Instead OM would provide a market place and be a market maker. As such, OM chose to be the technical and legal counterpart in all transactions.⁵⁷ But in order to limit the risk, OM was going to be required to keep a zero net balance in the open interest (with a market maker function this would of course be difficult).

One of the discussions was whether OM should become a stock broker or not. When the option expired, ownership of the stocks should be settled and it would thus be easier if OM could handle these transactions. However, the Bank Inspection Board did not approve of SEB and Carnegie being owners in such a company (since they already were securities brokerage companies). After a lot of discussion these issues were solved through mediation. OM could

⁵⁵ Blomé (1990)

⁵⁶ Dagens Industri (1984-10-24)

⁵⁷ Blomé (1990)

become a securities brokerage companies but were only allowed to broker trades related to the expiry of the options.

OM gets started

OM became the first privately owned “exchange” in the world and this was very controversial⁵⁸. The Board of the Stockholm Stock Exchange wanted the option trading incorporated into its membership organization. But after a lot of struggle and discussions with the Bank Inspection Board and the government the trading could start in June 1985. In the initial trading only options on six stocks were traded. The owners of OM were Investor and Proventia who had 24.6% each, Carnegie 29.2% and Olof Stenhammar, with his firms, 21.6%.⁵⁹

The legal framework and rules was a lot a result of copy pasting the Chicago Board of Option Exchange framework.⁶⁰ The trading was supervised by The Bank Inspection Board, which gave OM a higher credibility. In the beginning a lot of effort was put into educating the Swedish investors, banks etc about options. This was of utter importance since this was directly proportional to the sales.⁶¹

OM was at this time highly afraid of what they called “socialisering”, with what they mean getting taken over by the government (socialist party) or the SSE. This illustrated the tension that existed in OM’s initial phase (and also for several years to come). The only way to avoid being taken over or shut down was to be excellent and accepted enough by the market that they couldn’t.⁶²

At this time the option did, as previously stated, not exist in legal terms, and neither did any clear tax rules. The option trading had to proceed without any clear rules for the first years. OM became one of the drivers in trying to obtain clear rules, and also created creative solutions so that profits and losses could be offset by each other.⁶³

OM provided the market place and took care of the clearing. But they also needed retailers who kept accounts for the customers at OM. Stenhammar first strived at being the only market maker, but then realized being the only one wouldn’t work. He decided to let others act as market makers and in September OM took the next step by deciding not be a market maker anymore.⁶⁴

Compared to European Options Exchange (EOE) in Amsterdam, OM had a better and unique solution with matching and clearing integrated on the end customer. However, the Swedish market had some disadvantages such as no short selling and that you were required to own the underlying security in order to sell the call.⁶⁵

After a couple of months the OM board decides that:

⁵⁸ Veckans Affärer (1986-04-04)

⁵⁹ Blomé (1990)

⁶⁰ Stenhammar, O: Tal 2001-06-28

⁶¹ Veckans Affärer (1985-05-31)

⁶² Blomé (1990)

⁶³ Ibid

⁶⁴ Ibid

⁶⁵ Ibid

- By September all market makers should have access to a terminal system so that they can make electronic transactions directly.
- The clearing fee should be decreased from 30 to 20 SEK. Minimum commission decreased from 200 to 50 SEK. OM own fee left at its current price.
- Invest significantly in new computers and new software to handle the increased volumes

After three months of trading the turnover was ten times as high as expected and the profit margins at OM were nothing less than magnificent. This gave rise to a lot of political discussions and something OM tried to keep a low profile of. OM had to constantly lobby and take measures for its continuous existence. With the increased volumes, the commission was decreased in several steps. OM had estimated the number of contracts to 400 a day, but after a year the average was 8 000.⁶⁶ Not in any other country had the acceptance of options been so quick. Stenhammar's early estimation was that OM could earn 8 million SEK after 3 years. In 1986, the company made a profit of 150 million SEK.

However, the public trust in OM was limited due to the 50% of the trading volume being done by the owners of OM. The public was afraid of fraud and getting the worse end of prices. This was one of the reasons why OM's predecessors in Chicago and Amsterdam were owned by its members. In order to increase the trust, and ultimately to increase sales, the company wanted a broader ownership base. Thus they took the company public and listed it on the Stockholm Stock Exchange in 1987.

Meanwhile, the initial success gave OM the momentum to develop new financial products. The trade in interest rate options had grown a lot in the States so in March 1986 they introduced interest rate options, with governmental bonds as the underlying security.⁶⁷ This gave investors the opportunity to hedge against interest rate increases and decreases. By the end of the year OM, in a race against its competition, were the first to introduce call and put index options.⁶⁸ By the end of 1986, OM had a turnover of 16 000 contracts a day for stock options, 4100 for interest rate options and 10 000 for index options.⁶⁹

The competition consisted of an initiative from several money-market brokers who called themselves Sofe (Sweden Options and Futures Exchange)⁷⁰ Sofe claimed that its ambitions were not to profit from its operations and that this was the best way of running the market.⁷¹ Sofe had unofficial support from the Stockholm Stock Exchange and all banks and brokers got the opportunity to buy parts of Sofe, to avoid the "trust-situation" at OM.

The next new product was put options on shares, introduced by OM in the spring 1987. However, the trade in this instrument didn't really take off due a rule at the time that the one who bought a put option also had to own the share itself. Sweden was the only country with such a rule.⁷² In 1990 this rule was removed⁷³ and the number of put option contracts more than five doubled on average each day.⁷⁴

⁶⁶ Blomé (1990)

⁶⁷ Dagens Industri (1986-03-18)

⁶⁸ Dagens Industri (1986-12-04)

⁶⁹ Blomé (1990)

⁷⁰ Dagens Industri (1986-11-03)

⁷¹ Blomé (1990)

⁷² Dagens Industri (1989-04-10)

The markets for derivatives quickly expanded up until September 1987 when the government together with the Swedish Trade Union Confederation agreed on imposing a sales duty on money market instruments and double it on shares. Furthermore, trades by brokers, who traded in the own stock and with other brokers, should also be tax liable, which they were exempted from before.⁷⁵ The official reason for the tax was to smoothen interest rate fluctuations and cold down the development of the money market.⁷⁶ Others claim that it was a political tax against the stockjobbers that had earned a lot of money during the 80s. The tax earned the government an estimated 100 Mkr.⁷⁷

With these taxes the effect on the market was drastic and the trading on the money market decreased significantly.⁷⁸ To get around the tax, OM moved the trading abroad to London. This resulted in lower tax incomes and interest rates rising due to the lower liquidity. In 1991 the tax was thus removed, with a tremendous increase in trading in the money and bond market as a result.

On the 19th of October 1987 there was a large international stock fall and the greatest fall in 30 years on the Stockholm Stock Exchange.⁷⁹ At OM, the investors wanted to get rid of their risky positions and instead protect themselves against losses.⁸⁰ Consequently OM broke their record in the number of contract traded in a day. The trading value of some of the put options rose by a factor of twenty. However, most investors lost a lot of money during this fall and the following decline that lasted for a couple of weeks.⁸¹ What started with a record day ended up with much smaller average sales since a lot of investors lost their risk appetite. As an example, two of the large actors on the option market, Götabanken and Handelsbanken, almost left the market entirely after great losses.⁸² Some investors considered legal actions against OM, but the rules set up by OM held up. Furthermore, there was a deeper mistrust against OM from the existing regime.

Meanwhile, OM's competitor Sofe struggled to obtain profitability. The new tax hurt the trading for money market instruments, which Sofe was more weighted against compared to OM. All these factors combined forced Sofe, in February 1987, to shut down their operations.

One important day for OM is when the option investigation initiated by the government was published. An associate professor was hired to make a study of the nation's economical impact of futures and options. This presented good news for OM with conclusions such as options/futures complementing the market and enabling the trading of risk. It also had positive effect on liquidity and the effectiveness of the stock and bond market. Another study around this time looked at how the option market affected the stock market with the

⁷³ Dagens Industri (1990-05-21)

⁷⁴ Annual report OM Group 1990

⁷⁵ Dagens Industri (1988-03-03)

⁷⁶ Dagens Industri (1987-10-05)

⁷⁷ Ibid

⁷⁸ Veckans Affärer (1987-09-24)

⁷⁹ Dagens Industri (1987-10-20)

⁸⁰ Dagens Industri (1987-10-21)

⁸¹ Dagens Industri (1987-11-11)

⁸² Dagens Industri (1988-01-13)

conclusion that stock prices fluctuations decreased, stock turnover increased and the stock market efficiency increased.⁸³

OM after 1990

In 1989 OM bought and sold about eight million option contracts. This was a high figure compared to other countries based on contracts per inhabitant. One of the reasons was that the option market had taken many customers from the stock trading due to the trading tax that made the cost of speculating in options lower compared to that of stocks.⁸⁴

The following depression slowed the growth of OM, but in 1992 the decision of letting the Swedish Crona float gave the stock market and the option market new energy and the profits doubled in 1993 compared to 1992.

In 1993 the stock monopoly was abolished and the following year OM bought 11.25% of the Stockholm Stock Exchange. With this positioning the likelihood of OM starting a competing exchange decreased and the likelihood of a fusion between the two increased.⁸⁵ The merger became reality in November 1997 when the Swedish financial sector had started to experience tougher competitive pressure. Sweden was the last Nordic country that let its derivative market and stock exchange merge.

At the time of the merger OM owned 20.7% of the shares. The value of the bid was 1.5 billion SEK, even though Stockholm's Stock Exchange first was valued at 1 billion SEK.⁸⁶ OM also bid on the London Stock Exchange in 2000, without success. The expansion plans continued in May 2003 when OM bought HEX for approximately 1.5-2 billion SEK.⁸⁷ HEX handled the exchanges in Finland, Estonia and Latvia. The company took the name OM HEX, which was later changed to OMX. This expansion led to a OM stock increase of 50% in just a few months. of 50%.⁸⁸ By the end of 2003 OMX had operations in 12 countries.⁸⁹

The next prospect was Copenhagen Stock Exchange that was acquired in November 2004 for 1.5 billion SEK. In October 2006 OMX launched the Nordic Stock Exchange, consisting of the exchanges in Stockholm, Helsinki, Copenhagen, Tallinn, Riga and Vilnius. This was done as an initiative to promote liquidity, increase trading, and enable an expansion into the eastern European markets. Following this ambition, the next step was the acquisition of the Armenian exchange in 2007.⁹⁰

In 2007, before its merger with NASDAQ in 2008, OM had a turnover of 1.8bSEK, made a profit of 213mSEK and had about 1000 employees.

OM and international expansion

OM expansion plans started very early. One of the drivers was the new imposed trading tax. This decreased the turnover for OM in Sweden with a third between 1987 and 1988. In its sales proposition OM claimed to sell a solution rather than a product. This included education,

⁸³ Blomé (1990)

⁸⁴ Veckans Affärer (1990-03-28)

⁸⁵ Dagens Industri (1994-02-03)

⁸⁶ Dagens Industri (1997-11-28)

⁸⁷ Nyhetsbanken Direkt (2003-05-20)

⁸⁸ Affärsvärlden (2003-08-20)

⁸⁹ OMX Annual report 2003

⁹⁰ OMX Annual report 2007

marketing, a legal framework and the electronic system. OM could then earn money through royalties per contract and through consultancy fees. At the same time OM got ownership and with that entitled to profits.⁹¹

In this manner OM had established in France (OM France), Finland (Soumen Optiomeklarit) and Spain (OM Ibercia). These operations were under a lot of political pressure, since foreign ownership of exchanges was hard to accept. For that very reason OM was forced to sell their parts of OM France and OM Ibercia.⁹² OM also tried to enter Norway, but the political power was hard to bridge, and ended up in OM just being able to set up a clearing central. Oslo Exchange was left to do the option trading.⁹³

In 1989 OM became the first foreign exchange that was granted permission to start exchange operations in London. The company was called OM London (OML) and was fully owned by OM, a special case in OM history as all other foreign operation was just part owned by OM. OML was the first exchange that was electronically linked to the OM exchange in Stockholm.⁹⁴ However, the OML was not the success OM was used to. Two years after its start the losses were still big. When the trading tax on stocks in Sweden was removed in 1991, this further reduced the trading in London, since those investors that traded Swedish instruments in London now instead traded them in Sweden.⁹⁵ However in 1993 OM finally succeeded in turning around the figures in London and managed to make a profit. The reason for this success was an increased trading in Swedish stock options and stock futures and an increase in the number of products.

Around 2000 OM bid on the London Stock Exchange of 11 billion SEK (later raised to 16 billion SEK) even though LSE at the time had a turnover of about seven times that of OM.⁹⁶ The reason for this bid was according to some that Olof Stenhammar wanted to delay the rumoured merger between LSE and Frankfurt Stock Exchange. This merger would have left these actors more or less in monopoly over a great part of the European stock and financial market.⁹⁷ The bid was actually referred to as a mockery by the chairman of LSE and thus indicates that the bid was never actually meant to be accepted. The bidding process cost OM 95 million SEK, but gave a lot of publicity. However, LSE and OM continued their worked together in the mutual owned derivate exchange EDX.⁹⁸

Furthermore OM played a central part in cooperating between the Nordic countries. Norex was a joint initiative between SSE, HEX, CSE, OSE and Iceland's Stock Exchange. This was a Nordic infrastructure for trading that among many things simplified the trading between the countries.⁹⁹

⁹¹ Veckans Affärer (1988-10-13)

⁹² Affärsvärlden (1992-02-19)

⁹³ Veckans Affärer (1990-03-28)

⁹⁴ Veckans Affärer (1989-12-21)

⁹⁵ Affärsvärlden (1992-02-19)

⁹⁶ Dagens Industri (2000-09-12)

⁹⁷ Dagens Industri (2000-08-28)

⁹⁸ OMX annual report 2003

⁹⁹ OMX annual report 2003

OM and technology

The initial system

Stenhammar choose the company Accept Data as the provider of the computer system, which could put together a functional system within four months compared to SEB computer unit's 1.5 years (and cheaper as well). This system turned out to be very advanced compared to international equivalents.¹⁰⁰

Accept Data had a background in developing financial systems and back office system for securities brokers such as Carnegie. Their newly built system for OM consisted of two integrated systems: a market place system and a clearing and settlement system. The market place was a way of connecting buyers and sellers, where options series, prices, order depths and last trades were quoted and trades could be executed. Customers laid their orders through telephone/fax and the matching of buyers and sellers could then be done both by the system and manually. The system ranked the orders based on price and time. If the matching was done manually this was directly reported to the system by the broker at OM who had done the trade. In its initial phase electronic matching was usually done for the smaller orders whereas the larger orders were written down on pieces of paper (later white board) until a matching order could be found.¹⁰¹

The information about the options, the prices and last trade was not available in real time for the securities brokers. This was because OM was not registered as an exchange and was not allowed to have a direct line to Reuters, the main quotation system in the market. So executed orders had to be entered manually, with the consequence of the system not showing correct prices. That implied that if the broker wanted the exact current price they had to call OM. The process of quoting prices in Reuters was solved when OM got the official status as an exchange.

The market place system was unique by international standards because it was electronic and did not require a physical place compared to all the other "exchanges". The implications, of course, were that you basically could sit anywhere in the world and trade. Another thing that was really unique with Accept's system, and of great significance, was that the clearing and settlement were integrated with the market place. When a trade was executed in the market place system this was sent to the clearing and settlement system. This initiated a series of processes: Money changed accounts, the positions were noted, commissions and fees were taken.

Furthermore, capital coverage was calculated individually on the positions in each account (all investors had a separate account) and not on the total positions of the securities brokers. This was of great importance and implied that OM required significantly less capital coverage from the securities brokers. Moreover, OM could help the securities brokers with information how much capital requirements the individual investors had to provide. This was unique compared to other countries and a competitive advantage. Sören Olausson claimed that "OM has never malfunctioned when it comes to capital coverage" which further eased the requirement of capital. Less capital had the advantage of the investors being able to use more capital to trade

¹⁰⁰ Dagens Industri (1985-09-17)

¹⁰¹ Blomé (1990)

with and thus OM could earn more commissions and fees. It had another advantage too, since less capital coverage were required a lot of smaller securities brokers firms were able to trade as well.¹⁰²

The clearing and settlement system also automatically printed contract notes, cancel orders, expiry notes and account- and risk lists. At the end of the day the prints were faxed to the securities brokers for their records. Thanks to the computer systems, only one person was responsible for clearing, which at this time was really unique.¹⁰³

The integrated system also included a way of communication the other way around. At the end of each day the clearing and settlement system “told” the market place system to create (if necessary) new options series so that there were at least one option in-the-money, one at-the-money and one out-of-the-money. Furthermore, all phone calls were being recorded, which is necessary in order to confirm what someone said or did not say. “Without them, it would have been anarchy.”¹⁰⁴

Capacity problems and technological advances

OM was using its computers at full capacity right from the start, to the very extent that some trades had to be cleared manually. The system was not allowed to fail or you could end up with unsecured positions and lose track of all the trades, with substantial risk involved. The much higher turnover than expected could not be handled by the system and as such OM had to delay the introduction of new call options. To handle the incredible increase in trading volume new computers were ordered before the last one had arrived. With the new computers, there was finally room for the introduction of new products. These had to be incorporated into the software.¹⁰⁵

The development at the computer section continued and in the summer 1986 OM placed trading terminals for brokers. The intention was to have a real time system where brokers could enter orders as well as taking care of administrative tasks. In 1990, Stockholm Stock Exchange and OM had made peace and they agreed upon being able to enter orders on the SSE OM system and vice versa on SSE’s SAX system.¹⁰⁶

Much of OM’s expansion abroad could be explained by OM’s advanced technology. In 1991 OM developed the CLICK Exchange System, where the Austrian derivative exchange stood as its first customer. This system was fully electronic, including all matching. Later, in 1993 Oslo Exchange became the second to choose the CLICK Exchange System in competition with 16 other suppliers. The price of the system was about 50 million SEK.¹⁰⁷ The next year OM succeeded in entering the prestigious American finance market, when they got an order from AMEX worth 50 million SEK. The system was supposed to be able to handle specialists, where the specialist could make transactions with just a click in an electronic order book. The

¹⁰² Blomé (1990)

¹⁰³ Ibid

¹⁰⁴ Ibid

¹⁰⁵ Ibid

¹⁰⁶ Ibid

¹⁰⁷ Dagens Industri (1993-10-15)

difference in this order was that it was developed specifically for a customer. The order was seen as a breakthrough on the international system sales due to AMEX's high status.¹⁰⁸

With this, a series of sales of the CLICK Exchange System followed. Milano Stock Exchange and Hong Kong Futures Exchange bought the system in 1996¹⁰⁹ and Athens Stock Exchange the year after.¹¹⁰ The sales of system became such a big part of OM's sales so in 1996 OM created a subdivision called OM Technology that only focused on the technology and sales of systems.¹¹¹

To further increase sales and remain competitive, OM in 1995 OM connected their trading system of options and stocks on Stockholm Stock Exchange, London Stock Exchange and Oslo Stock Exchange. This was done through the Linked Exchange and Clearing (LEC), a distribution network based on CLICK. LEC enabled trading in the different countries stocks and derivatives through local clearing.¹¹² In 1997 this was further enhanced with the participation of Copenhagen Stock Exchange.

In February 2000 OM presented their new system Jiway¹¹³, which was the world's first integrated exchange for cross border trading and clearing. However, even though the optimism of the idea was big the losses were even bigger and in 2002 the project was terminated.¹¹⁴ In 2003 OM Technology stood for almost two thirds of OM's revenues.

OM gives rise to financial cluster

Alongside OM's fantastic success a lot of companies within the financial software sector rose. Some were started directly by people from OM, others from companies that worked with OM. The result was a financial software cluster in Stockholm with eight successful software companies that all had close roots to OM.¹¹⁵ Six of them are still sitting around Kungsgatan in Stockholm, one in Switzerland and one is the NASDAQ-OMX technology part which is based in Värtahamnen. The companies could roughly be divided into companies that developed systems and the ones who acted as market makers.

One of the reasons that the cluster arose was the potential to reap large profits. Around the time following the black Monday in 1987 a lot of investors lost a lot of money on options because they didn't understand the pricing. "We earned huge amounts of money. We knew where our positions were at, the once without the right system didn't. They bought option series that they had written, instead of the once that were cheap. With the result that we could do safe profits in close option series"¹¹⁶

One of the companies, Servisen, started when a few enthusiasts in a basement figured out a way to value options and as such wanted to become market makers. With the support of Carnegie and SEB, Servisen soon became the largest actor at OM and whose system most that

¹⁰⁸ Dagens Industri (1994-02-11)

¹⁰⁹ OM Group annual report 1995

¹¹⁰ Computer Sweden (1997-12-16)

¹¹¹ Direkt (1996-01-26)

¹¹² Dagens Industri (1995-12-13)

¹¹³ Svenska Dagbladet (2002-10-15)

¹¹⁴ Ibid

¹¹⁵ Affärsvärlden (2008-06-04)

¹¹⁶ Affärsvärlden (2008-06-04), quote by Anders Lönnqvist, portfolio investor Anders Walls Beijer Capital (owner of Services)

traded on OM used. Another company that started out around this time, in 1987, as a market maker based on a software for pricing, trading and risk evaluation of options was Orc Software. Today they provide a tool for electronic trading for most securities (mostly derivatives) and a system with market connections to over one hundred exchanges over the world.¹¹⁷

And from the companies OM, Servisen, Front (Servisen's technology part) and Orc Software new firms had their roots. Cinnober, founded in 1998, was such a company and took one of the most prestigious orders of the last decay on trading systems, when the alternative market place Turquoise put an order on their system.¹¹⁸ Neonet is another, founded in 1996, and is as an electronic discount broker for professional investors. Actant provides real-time system for automated derivative trading with their headquarters in Switzerland. Trioptima clears up and minimizes the after-effects of derivate trading between banks.

The great success of these firms could also be discussed in light of the way trading is done today. Around 30 to 60 percent of the trading on the markets today is trading done on the market by machines based on algorithms, so called black box trading.¹¹⁹ There is a war going on, where milliseconds are now microseconds and even location becomes a factor so that the orders have a shorter time to travel in the electronic universe.¹²⁰ One of the companies that grew from Orc Software, Tbricks, provides systems for black box trading. They were founded in 2006.

The rise of a financial-IT cluster is of course not only due to OM and Olof Stenhammar. Sweden has for long been at the forefront in terms of automation within bank and money handling. The academic has also been at the forefront and the companies have been able to hire experienced and talented people. In the end it comes down to competent and knowledgeable people switching companies, spreading knowledge in a hugely growing market.

¹¹⁷ Affärsvärlden (2008-06-04)

¹¹⁸ Ibid

¹¹⁹ Ibid

¹²⁰ http://www.e24.se/business/bank-och-finans/snabbast-vinner-pa-den-hemliga-handeln_1964179.e24

Analysis

This section analyses the previous sections by splitting up the discussion into three questions: Why the huge increase in securities trading throughout the world, what explains the natural monopoly tendencies in securities trading and why did OM succeed?

Why the huge increase in securities trading throughout the world?

The trading volume on the Stockholm Stock Exchange was about the same in 1918 as in 1972: about 2bSEK. Thereafter the trading increased to reach new record levels of 4500bSEK in 2000 and 6500bSEK in 2007. What explained this huge increase? To some extent it could of course be explained by economic factors such as a growth in GDP and inflation, but above all it is a consequence of rapidly decreasing transactions costs.

Before discussing in even more detail why the trading has increased it is important to understand that a well developed economy requires a fully functional securities market. The most fundamental reason for existence of securities markets is to ease firm's ability to raise capital and debt. A secondary market exists in order to get a better price and create liquid positions and enable distribution of ownership. Derivates exist in order to distribute risk, between those who want to speculate and the ones who want to decrease their risk.

Transactions costs for the securities sector needs to be defined. They include both directly measurable costs as well as indirect costs:

- The difference between the bid-ask spread
- The commissions
- Ownership of the stock
- Information and time.
- Uncertainties of not making the trade at a fair price as well as political and regulatory uncertainties.

The bid-ask spread has constantly decreased throughout time and is often a consequence of the liquidity in the market. To some extent there is an interrelation between more trading and a smaller bid-ask spread, since more trading will lead to higher liquidity and higher liquidity will lead to a lower bid-ask spread and as such more trading. The relationship between the big-ask spread and liquidity could easily be seen in less liquid stocks on smaller exchanges. A significant step in lowering the bid-ask spread was the introduction of NASDAQ and automatic quotation in 1971.

Commissions have decreased significantly over time. As an example, in December 1968 the commission on an order of any size to buy or sell a \$40 stock was 39 cents per share, which is equivalent to \$1.45 per share in 1990. By 1990 such a trade would cost between three and six cents per share.¹²¹ SEC's removal of the fixed commission at NYSE in 1975 has a part in this decrease as well as the entering of discount brokers, such as Schwab, that cut the prices instantly by 80% the day of the removal. These organizations were built upon handling high volumes with low costs and the traditional player found it hard to compete. These brokers as well as the later online brokerage firms could be described as a disruptive innovation since they targeted a different market, at the time being pretty small but what turned out to

¹²¹ Blume (1993)

outcompete some of the full time brokerage firms. Schwab for example targeted middle income common American, who before did not really trade. Furthermore, the commission and costs involved with trading could be cut when a physical market place no longer was needed. In the context of OM, it should be noted that lower commissions were critical to the success of a lot of the derivative assets, especially shorter trading transactions that involved very small profits per transaction.¹²²

For a very long time, up until the 80s, the proof of ownership of shares was a physical paper. Every time someone bought or sold something these papers had to be transferred. When transferred, it would take time to get it and there were costs involved in transferring the stock safely. In Sweden there is a unit responsible for the record of stock ownership, NCSD. Let's say Carnegie made a trade with SEB and bought 100 000 shares of Volvo. Both Carnegie and SEB then had to send copies of that order to the NCSD. All matching had to be correct and the physical shares sent out. The process was troublesome and errors were done. When these became electronic this removed this "bottleneck" and enabled increased trading.

With information and time I refer to the costs involved in gathering the necessary information and time about the stock and trade it. Technological advances have enabled what is referred to as a network economy with tremendous increase in information and the ease of which you can gather information. Brokers have experienced increased transparency and competition. The technological advances made trading easy with just a click online compared to when you had to go to the bank, get a price (uncertain if you got it at fair value), order and get a physical delivery of the stock.

It is important to note that all of these transaction cost decreases actually come from technological advances and the subsequent increase in competition. The bid ask spread was lowered by better quotation, the commission through being able to handle larger volumes at a cheaper price, the removal of the physical ownership to electronic and the ease of which information can be spread with a subsequent decrease in uncertainties. The advance process, and the increase in trading, was continuous and followed under the order of Moore's law. The financial sector was at the forefront all the time when it came to technological development. Pushing the capacity of computers as well as bringing forward aggressive software companies that found ways of making money through program trading, through valuation, through back-office systems etc. Phone-trading and internet made it available to day traders, but these could never have existed if the commissions and transactions costs hadn't decreased. Massive profits were available to the one who used technology better.

The financial sector's increase in trading could also be seen in the light of the disruptive technologies that have affected the industry. Discount brokers competing with full-service stock brokerage firms and electronic communication networks competing with online stock brokerages are actually two disruptive technologies according by the very man who founded the concept. The very NASDAQ, compared to NYSE, could also be seen as a disruptive technology.

¹²² Blume (1993)

Overall, stocks have become a very liquid market and more and more a way of trading with money with great consequences on the real economy, including the currencies. The financial sector has become a larger part of the economy and created clusters in for example Sweden.

Another reason for the huge increase is the ease of which new financial products were created and the apparent demand for them. However, because of its novelty these instruments were difficult to value. The difficulty in valuing these instruments could be seen in some of the crisis that has arisen in the last decades. For example in valuing mortgages instruments in the financial crisis.

What explains the natural monopoly tendencies in securities trading

In theory any two private individuals will be free to trade stocks with each other at any price they desire. But to find a buyer or seller at any time could be troublesome and exchanges became the place where buyers and sellers could, through auction, negotiate a price. In the US in the 19th century, local areas had several exchanges. As time passed only one exchange per area could survive and later New York Stock Exchange proceeded to have a very dominant position with many of the exchanges closing or merging. In Sweden, Stockholm Stock Exchange is now part of OMX Nordic that in 2008 merged with NASDAQ, even though there still exist smaller lists. So why have the number of exchanges decreased? The answer could be found in the differences in the nature of securities trading compared to regular products. But if there are natural monopolies tendencies, why are there more than one exchange in the world?

The answer to the questions could once again be found in the reasoning of transaction costs. Coase claimed that the size of the firm will be a function of the costs of using the market. When the external transactions costs are larger than the internal the firm will grow. What will this imply if we apply this reasoning to the securities industry where we see the exchange as the firm? In the 19th century the external transactions costs, (such as transport to the exchange to buy/sell the stock, communication including when the phone were invented and information in general) were incredibly high and it was pretty much practically impossible to trade in New York if you lived in San Francisco. Since then, both the internal and external transactions costs have decreased significantly but the external at a slower pace. There are still external costs of using the market in a different country because of regulations, time zones, currencies, uncertainties etc. In a country though the external transactions costs are low and consequently one player has been dominant.

The other, more important reason, why there are natural monopoly tendencies when free-market forces should have eliminated the monopoly is that securities trading differ from other forms of commerce on a couple of factors.

- The “product” offered in a stock market is not the stock alone, but also an efficient process for transferring ownership. This process will become more efficient as more information becomes available about the security being sold. When all trading occur in a common location, a sharing of information takes place, which is a process that enhances the accuracy of prices and thus improves the quality of the product.
- Securities trading differ from other trading. There is no longer any transport or logistics as compared to other markets.
- There is a second hand market. With other products this is rarely the case.

The factors combined add up to one important difference and conclusion. Concentration will create liquidity and efficient pricing. Most importantly, it should be noted the natural monopoly tendencies is more for individual stocks than for exchanges themselves.

This result was strengthened in a Swedish survey with foreign brokers. The brokers were supposed to rank the most important factors when choosing a stock exchange. They picked efficient pricing, liquidity and low counterpart- and closing down cost. Interestingly enough, it was not as important with low costs.¹²³

However, there was/is one way of fighting against the monopoly: innovation. Back in the 19th century, during the civil war, the Open Board of Stock Brokers offered continuous auctions compared to NYSE and was later bought by NYSE. AMEX and NASDAQ listed different stocks compared to NYSE. In addition, NASDAQ provided a quotation system that improved the overall quality of the pricing as well as lowering the bid-ask spread. Chicago Board of Options Exchange provided the market with derivatives and could create a market of their own. In the same manner, OM entered a perceived small derivative market, grew and ended up buying the Stockholm Stock Exchange.

One of the reasons why an organization like NYSE never has been first in innovating for its investors is because many would have been affected and suffered if the system changed. That is both because the big exchanges were usually run as membership organizations instead of profit organizations as well as successful organization having reluctance towards change. Change could really only happen if you had the knife to your throat. Interestingly enough, it is actually kind of ironic that one of the strongest symbols of capitalism, NYSE, has been run as membership organization with clear parallels to a socialist collective.¹²⁴

One thing that further contributed to the monopolies was of course the regulations and sometimes the regulated monopolies that existed. With globalization, the regulated monopoly like the one SSE had until 1993 and NYSE's rule 394 abolished in 2000 was doomed to fall. "Thanks to the empowering qualities of technology, government regulators have become the tail desperately trying to wag the dog. Competition has already replaced regulation as the primary determinant of the marketplace, and will probably continue to do so in the future, for good reason: It serves the investor's need better."¹²⁵ With hindsight, this perspective has changed quite drastically with the turbulence on the financial markets and with the understanding of the consequences on the real economy if the financial system is put out of balance.

¹²³ SOU:2000:11 (2000)

¹²⁴ Blume (1993)

¹²⁵ Ibid

Why did OM succeed?

OM opened up for option trading in June 1985. The growth was phenomenal. The following year (1986) OM made a profit of 150 million SEK and sustained huge profit margins for many years. OM was so successful that in 1998 they bought their big brother, the Stockholm Stock Exchange, and as such could trade with both options and stocks. How did they reach such quick results? How could they handle the increased volumes?

To answer the question the answer has been divided into two parts: The first one addressing a wide variety of reasons why OM enjoyed such great success, the other focusing on the technology's part as the driver of and foundation for success.

Reasons for OM's success

In every successful start-up there is an enthusiastic entrepreneur. As a former stock broker around the time of the introduction of the option trading in Chicago, Olof Stenhammar was one of the most knowledgeable persons regarding options in a market where there were almost no knowledge. OM spent a lot of time informing and educating the market about options and their properties. Stenhammar's previous experiences of overestimating sales of Atari computer games probably made him underestimate the interest in options.

Stenhammar's timing was perfect. He entered in a bull market brokering call options, where the owners of call options could see huge returns and the writers enjoyed the premium even if they didn't enjoy the full potential upswing. Buyer adaption was really quick and demand was way higher than expected. There was money to be made. Everyone was happy. The timing was also perfect in a technical perspective with hardware being able to cope with the growth in number of contracts. This will be further discussed in the next section.

The company had broad support from many important players in the society; the support included the largest bank, the powerful Wallenberg Group/Empire and the largest securities brokerage company. Furthermore, Stenhammar chose to spread the ownership between influential players and even further in an IPO in 1987. This gave increased credibility from investors and speculators. The support was of utmost importance because of the sensitive nature of trading and the stock exchange monopoly. As part of this support also lies OM's continuous lobbying with the government, investors, society and the Stockholm Stock Exchange in the form of lowering of commissions, letters, interaction with government and SSE, education etc.

Another reason for the success was OM being able to circumvent the legislation and to be set up as a profit organization, one of the first of its kind in the world. This allowed OM to be more sensitive to customer preferences as well as keeping the organization effective and having strong growth objectives.

Moreover, the advantage of being the first player in a market with natural monopoly tendencies and consequently strong first mover advantages should not be underestimated. The nature of the securities market includes network effects with significant economies of scale due to the technology making the marginal transactions costs very low. With the introduction of options also came the possibility to profit from arbitrage situation through the put-call parity. This increased the trading volume of both stocks and options.

Furthermore, transactions costs could also be decreased due to OM taking the counterpart risk. If they would not have, investors would not have been willing to trade because of the uncertainty of the contract not being carried out.

Technology's part in OM's success

The growth of trading in general would not have been possible without Moore's law governing. The manual handling of all transaction today, if it would have been done 40 years ago would have consumed an absurd amount of manpower. In manual transaction there really aren't any big scale effects in the next transaction; one admin employee could only handle a certain amount of transactions. In comparison, with technology the marginal cost of an additional transaction is very low. An illustration of this is OM only having one employee in the clearing and settlement unit. However, in its initial phase the system was working at full capacity to the extent that a lot of manual work was required. Stenhammar stated that he didn't consider setting up OM without being based on technology.

Furthermore, the system that OM and Accept Data developed was very advanced compared to international equivalents. Of the sales abroad this was the central part of the package deal and the main reasons why OM enjoyed international success.¹²⁶ The systems were not only advanced, but also user friendly.¹²⁷

The uniqueness of the system also lay in the market place and clearing and settlement system being connected to each other. This had huge advantages, with OM only having one person doing clearing and being able to cope with drastic increases in volumes. Moreover, the capital coverage was so much easier to calculate and as such, significantly less capital was required from the brokers that instead could be used for trading. Thanks to the system, OM also did fewer errors than the other players which gave OM credibility, something very important when so much money was at stake. In addition, the system was flexible and more and more products could be added with more money being made.

The systems and the overall OM solution could be thought of as a disruptive technology, where OM enters a market the current players are uninterested of. The SSE lacked incentives to grow and expand its product range. They also had no real technological solution that would be compatible with established resources and capabilities.

Technology enabled OM to be set up as an electronic market place instead of a physical market place like its follower and competitor Sofe. Except for the obvious first mover advantage and natural monopoly tendencies, this was most likely one of the reasons why Sofe was not able to survive once the industry had a downturn, even though they had a broader support from the market and managed to get initial high volumes. Old exchanges were reluctant of losing their physical market place. "If you worked at the stock exchange building that was something you could be very proud of."¹²⁸ The not physical market place reduced transaction costs significantly and made it much easier to trade. In addition, being the first in the world with electronic option trading obviously was an important success factor in its international expansion.

¹²⁶ Sören Olausson

¹²⁷ Affärsvärlden (1992-02-19)

¹²⁸ Sören Olausson

Conclusions

Since the 70s trading has increased thousandfold. The reasons for this are many and includes easier access to information, decrease in uncertainties, securities trading being available to more or less everyone as well as the obvious reasons such as a GDP growth. But above all, the increase was a result of technology development and Moore's law governing. With Moore's law and innovations, such as the internet, transaction costs have falling tremendously enabling the increase in trading.

The report also described that the natural monopoly tendencies within securities markets is rather for each security than for an exchange. However, there are still significant synergy effects and easy to access benefits in trading everything at the same exchange, especially when transactions costs have fallen. As such, exchanges have historically merged. With the recent technological development the number of exchanges does not really matter though, since computer algorithms will find the exchange/market that offers the best price.

In addition, the report detailed the incredible success story of OM and its role in the financial-IT cluster that arose in Sweden. OM managed to grow despite being up against stronger-lobbied competitors and a tough political pressure. What separated them was the efficient way of coping with volume, using technology and cutting edge software to its advantage. The linkages to NASDAQ are obvious, where both were relatively small new players satisfying a then small market, which the big players overlooked. Instead of cutting edge software, NASDAQ provided the market with automation.

The market is still transforming rapidly and ECNs and other innovative exchanges are growing that may outcompete the regular exchanges in the future. Black box trading being a large part of the trading illustrates how important technology is for the increase in volume in securities industry. Looking at the trend though it looks as if there is some saturation in trading volumes. The question is if the transactions costs have fallen so low, that the underlying factors in trading is now rather a function of the cycles of the market and a growing economy with increased liquidity?

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Sören Olausson, Previous CEO of Accept Data. 2010-03-12

Appendix: OM timeline

1984: OM was created

1985: In June OM opened up for trading

1986: Sofe (Sweden Options and Futures Exchange) was created

1986: Interest rate options followed by index options are introduced

1986: OM makes a profit of 150m SEK after 1.5 years of operations.

1987: A new tax is imposed, decreasing the market and forcing Sofe to shut down their operations

1987: Put options are introduced

1987: OM was taken public and listed on the Stockholm Stock Exchange

1989: OM becomes the first foreign exchange in London, starting OML.

1990: Put options starts thriving when you no longer have to own the share to buy put options

1991: The tax is removed

1993: OM buys 11% of Stockholm Stock Exchange

1997: OM and SSE merge

2000: OM bid on London Stock Exchange without closure

2003: OM successfully acquired HEX and changed name to OMX

2004: Copenhagen Stock Exchange is acquired

2006: OMX creates the Nordic Stock Exchange, connecting the exchanges in Stockholm, Helsinki, Copenhagen, Tallinn, Riga and Villnius

2007: The Armenian Stock Exchange is acquired

2008: OMX merge with NASDAQ to form NASDAQ-OMX