



Innovation und Entrepreneurship

Hrsg.: Nikolaus Franke und Dietmar Harhoff

Felix Treptow

# **The Economics of Demutualization**

An Empirical Analysis of the  
Securities Exchange Industry



GABLER EDITION WISSENSCHAFT

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## **Innovation und Entrepreneurship**

Herausgegeben von  
Professor Dr. Nikolaus Franke,  
Wirtschaftsuniversität Wien, und  
Professor Dietmar Harhoff, Ph.D.,  
Universität München

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Felix Treptow

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An Empirical Analysis of the  
Securities Exchange Industry

With a foreword by Prof. Dietmar Harhoff, Ph. D.

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# Foreword

Whenever an economic institution is being transformed, researchers have an unusual opportunity to study causes and effects of the transformation and to test the economic theory related to the institution itself. Over the course of the last decade the global securities exchange industry has undergone such a tremendous change. Stock exchanges have demutualized and have turned into for-profit entities.

Securities exchanges play a crucial role in modern market economies. They provide market participants with financial instruments of all sorts, serve as mechanism for price discovery and are an important source for external financing. Despite their important role, research covering the demutualization of stock exchanges has been sparse. Felix Treptow seeks to fill this gap in the literature and presents in this book an in depth analysis of the demutualization phenomenon.

In his thesis, he applies advanced econometric methods to data sets which were assembled specifically for the purpose of his analysis. Each of the three self-contained chapters of this volume addresses different issues which are of importance to the various stakeholders in this process. The analysis covers the micro- and macroeconomic causes of demutualization, its impact on market liquidity and the changing relationship between exchanges and issuers.

This book is the result of more than three years of intensive research which earned the author a doctoral degree at the Ludwig-Maximilian University of Munich. Felix Treptow's studies of the securities exchange industry are a remarkable contribution to the field - the book deserves the attention of practitioners and researchers alike.

Prof. Dietmar Harhoff, Ph. D.

# Acknowledgements

*'Tis completed, the everlasting work!*

...

*As in my dreams I desired it,  
as my will directed, strong and fair  
it stands on show.'*

*Wotan, Rheingold, 2nd scene*

Though Wotan's exclamation refers to something completely unacademic, I fully share his joy and delight about an achievement that seemed unattainable for so long. Yet unlike Wotan, I pledge that my dissertation has been accomplished in a righteous and lawful way. This raises my hopes, that my work will not perish in three operas time.

Writing this dissertation, I have made the experience that time, toil and tenacity alone do not ensure success. I am extremely grateful for the opportunity to have Dietmar Harhoff as my doctoral advisor during the last years. He has been granting me a remarkable degree of freedom to pursue my projects and has been a constant and reliable source of advice, encouragement and guidance. His passionate enthusiasm for empirical research and his imperturbable confidence in my endeavors are without parallel and have been invaluable. I also wish to thank him for making it possible for me to stay at the London School of Economics and Political Science during my dissertation project.

I would also like to thank Bernd Rudolph, who initially sparked my interest in financial markets during graduate studies. I am very glad that he kindly agreed to become my thesis referee and scientific advisor. His support has been outstanding.

I am grateful to Wolfgang Ballwieser and Hermann Meyer zu Selhausen who have been my advisors during MBR studies.

I also wish to thank David Webb for inviting me to London and for his advice during my stay at the Financial Markets Group of the LSE. Research and financial support from the German Academic Exchange Service DAAD for this stay is gratefully acknowledged.

I cannot but express my deepest gratitude to my family who helped me to maintain a sense of humor during this time. Without their warm and understanding support, their continuous encouragement and affection I would not be where I am today. I owe you.

I would like to thank three friends with whom I have had the privilege to share this experience: Philipp Jostarndt, Jonathan Landgrebe and Stefan Wagner. Our endless discussions and joint forays into every aspect of academia and beyond have not only been highly appreciated advice for this thesis or most welcome distractions during this time, but have also impacted my views of the world considerably.

I am grateful to all my past and current fellow doctoral students at INNO-tec for maintaining an atmosphere of high spirits and joint support. Especially, I wish to thank those fellow researchers who have become friends and who have been there when it mattered - Karin Hoisl and Christian Tausend.

Finally, I salute my friends in Aachen, Berlin, Freiburg, Hamburg and Munich who have have been or are still going through the same experience. Cheers to us!

Felix Treptow

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# Chapter 1

## Introduction

The traditional appearance of securities exchanges resembled that of a Janus face. Though performing an integral and indispensable role at the core of market economies, they refused playing by the rules of the system they were supporting. Unlike their capital-seeking customers, they were organized as mutual institutions run by a limited number of trader-owners to protect the franchise. And contrary to investors buying into risky securities, they faced little or no competition and enjoyed the safeness of more or less entrenched local monopolies. But as Janus symbolized the progression from one condition to another in Roman mythology, securities exchanges have undergone a tremendous transformation over the last two decades. Today, most have developed into market-oriented for-profit companies, that are dominated by outside investors. And like firms in other competitive industries, exchanges develop new revenue sources, expand their market share through fierce competition and pursue the consolidation of their industry actively. The process of converting an exchange's ownership and governance structure and of turning it from a mutual organization into an outsider-dominated institution is referred to as *demutualization*. This dissertation thesis aims at contributing to a better understanding of this phenomenon.

Securities exchanges are firms that create markets in financial instruments. It is generally acknowledged, that the functions performed by exchanges are of paramount importance for capitalist economies (Rajan and Zingales, 2003). Considered individually, they seem rather unimposing: provision of pre- and post-trade information, routing of orders from investors to trading facilities, provision of liquidity, trade execution, and clearing and settlement services (Lee, 1998). But through the coverage of hundreds of securities, the interaction of thousands of participants and infinite iterations at ultra-high frequency these functions unfold their beneficial effects. First, exchanges reduce transaction costs and facilitate the allocation of risk and capital. They coordinate and support the coopera-

tion between investors by creating standard transaction procedures, reducing information asymmetries, providing a centralized trading venue and securing the enforcement of contracts (Pirrong, 2000). Second, exchanges produce accurate information on the value of securities as reflected in the prices at which they trade. This is achieved by collecting and processing the dispersed knowledge of the particular circumstances of time and place, as Hayek (1945) refers to it. For financial instruments, exchanges are the central locus of price discovery and price dissemination within an economy.

Today's securities exchanges are the result of an evolutionary process that lasted several centuries. Originally, transactions took place in public with traders meeting on the streets or in coffee houses. Formal governance structures emerged in the 18<sup>th</sup> century, after traders decided to move trading activities into closed premises and to enact rules for accession (Michie, 1986; Merkt, 1997). To operate trading venues, traders formed mutually-owned entities and limited the number of members. On a corporate level, exchanges were not operated for profit. Instead, trader-owners derived their benefit from offering their services to outsiders. Thus, exchanges resembled clubs that were operated by the same individuals who exclusively consumed their services. Decisions were taken on a democratic basis so that every member was assigned one vote. Hart and Moore (1996) have demonstrated that this form of ownership is prone to inefficiencies. Trader-owners tend to enforce their individual interests instead of considering the overall profitability and efficiency of the exchange. Prominent examples include the late adoption of electronic trading systems and delayed efforts to commercialize the dissemination of price information. Inefficiencies also extend to internal monitoring provisions and governance regulations. A recent example is given by the former head of the New York Stock Exchange (NYSE), Dick Grasso, who understood to take advantage of the NYSE's outdated governance structures in order to secure a payment and pension package of relatively high extent.<sup>1</sup>

Historically, stock exchanges were local monopolies in most countries. The most notable exception to this were the United States. During the late 19<sup>th</sup> and early 20<sup>th</sup> century the NYSE had to compete against literally dozens of rival exchanges, that mostly specialized in trading securities of a single industry (e.g. American Mining Stock Exchange) or new types of securities (Garvy, 1944). Eventually, this variety was reduced to two major exchanges: NYSE for blue chip companies and the NASDAQ (originally an acronym for National Association of Securities Dealers Automated Quotations) for high growth companies (Angel, 1998). Boundaries between local monopolies were mostly de-

---

<sup>1</sup> According to *The Economist*, who stated that Mr. Grasso's pay package exhausted even Wall Street's tolerance for greed, his pay has been determined by the managers of trading firms he was actively regulating as head of the NYSE (Sep 10th 2003).

terminated by national borders and could not be displaced through competitive behavior. This contributed considerably to the emergence of inefficiencies and brought about a lack to modernize technology. Customers on the other hand, either companies seeking a listing or investors intending to trade, were bound to the domestic exchange as the sole provider of listing and trading services.

Today, the world of trader-owners and parallel monopolies is all but gone, as securities exchanges have developed into for-profit and market-oriented companies that compete with one another. This remarkably dynamic transformation has occurred in less than two decades time. Essentially, political reform and technological advances have been the key drivers of this development (Elliott, 2002). On a national and international level, the deregulation and liberalization of capital markets and their institutions was initiated. Concurrently, the entire financial services industry was modernized by the globalization of financial markets. For instance, the British capital markets reforms of 1986 (dubbed "Big Bang") enabled the conversion of the London Stock Exchange into a private limited company. Similar reform projects were launched in other countries, such as the financial markets promotion acts in Germany.<sup>2</sup> For the transformation of the European financial system, political reform was the *conditio sine qua non* for viable competition to unfold. Legal barriers were removed by harmonizing securities laws and regulation of financial institutions, which included the lowering of regulatory barriers. For instance, the introduction of the Investment Service Directive in 1993 enabled securities exchanges officially recognized in one EU country to offer remote access to their trading platform to institutions in other EU member states without any further regulatory obligations (Cybo-Ottone et al., 2000). This provision became a prerequisite to take competition across national borders. Economic fragmentation was overcome by the creation of the European Monetary Union and the introduction of the single currency, which was of paramount importance for competition by simplifying cross-border transactions, easing capital flows and improving the overall comparability of prices.

Advances in information and communication technology were the second driver in the modernization of the securities exchange industry. Over the last twenty years, every stage of the securities trading value chain has been automated and computerized, establishing seamlessly integrated electronic trading systems (Rudolph and Röhl, 1997; Picot

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<sup>2</sup> German financial markets have been modernized by series of four Finanzmarktförderungsgesetze (FMFG) between 1990 and 2002. The first FMFG (1990) eliminated the taxation of securities transactions. The second FMFG (1994) implemented the European Investment Service Directive, banished insider trading and created a state-level financial services watchdog (Bundesaufsichtsamt für Wertpapierhandel, which was merged into Bundesanstalt für Finanzdienstleistungsaufsicht in 2002). The third FMFG (1998) improved the appeal of Germany as a business center for investment funds and reformed disclosure rules. The fourth FMFG (2002) further enhanced rules for more efficient supervision and improved market integrity and investor protection.

et al., 1996). This development has not only streamlined the provision of trading services considerably and accelerated order execution to split seconds, but has also led to the creation and acquisition of expensive proprietary trading platforms, whose profitability depends on the scale of operations to a large extent. This fact is commonly accepted as the main driver behind increasing competitive behavior and consolidation activities in the industry (Cybo-Ottone et al., 2000). The creation of alternative trading systems and electronic communications networks that do without physical trading venues marks a second technological change enhancing competition among exchanges. Electronic communication networks allow investors to execute transactions by trading directly with each other without having to place orders with a specialist. These systems have been particularly successful in America, where exchanges were slow to adopt electronic trading, and have secured market shares of up to 30% (Degryse and Van Achter, 2002). Furthermore, the introduction of order routing technology and remote access has empowered especially institutional investors to choose among various trading venues as it has uncoupled the physical location of the investor from the location of execution.

Due to the political and technological changes described above, exchanges around the world have abandoned their traditional ownership and governance structure and have evolved into for-profit companies. This transformation is referred to as demutualization. The process of demutualization is a gradual transformation from a mutually owned not-for-profit organization into a for-profit corporation owned by outside investors. The usual stages of this process cover the conversion of the exchange into a private limited company, the placement of a portion of the capital with outside investors and, finally, the public listing of the shares. Upon completion of the final stage an exchange is considered to be fully demutualized. Over the course of this process the fungibility of ownership is increases gradually, while the potential for conflicts of interest among owners decreases constantly. An essential aspect of the concept of demutualization is the termination of the mandatory identity of owners and traders and the transfer of ownership to outside-investors (Steil, 2002). These changes ensure that all owners act according to shareholder-value considerations instead of their individual interests.

Demutualization has been pioneered in Europe with the Stockholm Stock Exchange becoming the first for-profit exchange in 1993. The Australian Stock Exchange was the first exchange to complete the process. It was listed in 1998 and is currently owned by more than 16.000 shareholders. Since then, exchanges around the globe have followed suit. As of today, there are eleven fully demutualized exchanges and dozens of exchanges that are in the process of demutualizing. According to the World Federation of Exchanges (WFE), the industry's global trade association, fully demutualized exchanges provide

more than 75% of the European market for equity transactions. Annual cost and revenue surveys by the WFE reveal that demutualized exchanges are constantly outpacing their undemutualized rivals in terms of profitability. The current wave of demutualizations among securities exchanges has not yet come to its end. Lately, the world's largest exchange, the NYSE, announced that it was considering a transformation, indicating that the transformation will ultimately affect the entire industry.

With this thesis, I seek to contribute to our understanding of the transformation of the securities exchange industry in general and specifically to our comprehension of the demutualization of securities exchanges. Given the overwhelming abundance of financial literature, it is astounding how little attention has been granted to this topic in academic work. And this applies even more so when considering the minuscule number of empirical studies on the subject. With this thesis, I also attempt to partially fill this void. In three subsequent parts of this book, I present three self-contained views on the subject. Together, they encompass the organizational changes within exchanges and their consequences for both sides of the two-sided markets exchanges maintain. The first chapter scrutinizes the changing relationship between exchanges and issuers in light of the recent transformations of financial markets. In the second chapter, I analyze the determinants of demutualization from both a micro- and a macroeconomic perspective. Finally, the third chapter examines the impact of a demutualization on the liquidity of its market. In the following, I briefly review each of the three chapters and highlight the main findings.

The first part of this dissertation thesis, Chapter 2, examines the transformation of the functional role of stock exchanges. It focusses on the relationship between stock exchanges and issuers. The nature of this relation has changed considerably over the past decades. Historically, stock exchanges provided various services to their listing clients such as the provision of standardized corporate governance rules, assistance in transmitting a reputational signal to investors, the provision of clearing and settlement services and the provision of liquidity. Nowadays, many of these functions have been seized by other institutions such as legislators, rating agencies and equity analysts. Thus, the exchange-issuer relationship has lost most of its complexity and has almost been reduced to a standardized contract in the sense that there are few contractual properties distinguishing listing on different exchanges apart from granting access to a specific liquidity pool.

In a detailed empirical examination of listing requirements and follow-up obligations of five major equity markets I find that the contractual features have in fact been converging towards a standardized agreement. Apparently, listing requirements are of minor importance as a means for differentiation for exchanges. This development is also re-

flected in constantly decreasing revenues generated from listing activity. In Europe, these changes have been accompanied by massive structural changes of the financial landscape. A closer look at the current political activities reveals that the major implications of the changing nature of the listing agreement have been considered. However, the proposals made still have to be implemented at their full scale and without significant differences so that both issuers and exchanges can safely disregard jurisdictional and national borders when dealing with each other.

The second part of this thesis, Chapter 3, presents an empirical analysis of the determinants of demutualization. It is conducted from a micro- and a macroeconomic point of view. In the introductory part, I survey the different forms of ownership and governance structures of stock exchanges. I also present a detailed overview over the stages of the process of demutualization and review the main drivers behind the fundamental transformation of the securities exchange industry. Building on related theory, I identify several exchange-related and economy-related factors that can accelerate or delay the decision to demutualize. For instance, I argue that political quarrels will delay the demutualization of exchanges that are of high economic importance to their home economies. In contrast, I assume that exchanges that face strong competitive pressure will be among the first to demutualize.

The empirical analysis of this chapter is based on a sample of 49 exchanges from 40 countries that contains cross-sectional data for the first quarter 1995 plus the ownership structure of the sampled exchanges as of January 1<sup>st</sup> 2003. I estimate multivariate binary response and ordered response models to derive the influence of various exchange- and economy-related variables on the decision to demutualize. Specifications differ in the design of the response variable, which allows to account for difficulties in clearly determining at what stage of the process an exchange can be considered to be fully demutualized. Analyzing economy-related factors I find that exchanges operating in small and open economies demutualize early. This effect increases with diminishing economic importance of an exchange for its home economy. Exploring exchange-related factors reveals that large exchanges with many equity issuers display a higher propensity to demutualize. However, the analysis does not provide distinct evidence on the effect of competition on the decision to demutualize.

In the final part of this thesis, Chapter 4, I investigate the effects of a demutualization on an individual exchange's competitive position. Economic theory suggests that a demutualization improves an exchange's efficiency, as a for-profit conversion contributes

to overcoming the institutional inefficiencies inherent in mutually owned organizations. Prior empirical research on this subject has been both ambiguous in results and questionable in methodology. In this study, I present a new approach to addressing this problem. I argue that liquidity is the key variable for assessing an exchange's efficiency. Though not under an exchange's direct control, it ultimately reflects the efficiency of an exchange's operations, as it represents the core competitive variable among securities exchanges.

To capture the impact of a demutualization on liquidity, I study securities that are listed on two markets simultaneously. The empirical setting is quasi-experimental, as all securities are listed on a primary markets that demutualizes during the observation period. All securities share the NYSE, which does not undergo organizational reform, as a common second trading venue. My data set consists of a panel of paired low-frequency observations for various liquidity measures for 156 dually listed equity issues and spans across a ten year period. Using difference-in-differences estimation and other standard panel regression methods, I find that a demutualization yields significant beneficial effects on a demutualizing exchange's liquidity. Compared to pre-demutualization levels, turnover and resiliency increase, while spreads tighten. Also, I present strong evidence that the liquidity gap between a demutualized and a undemutualized exchange increases due to the transformation.

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# Chapter 2

## Stock Exchanges and Issuers: A Changing Relationship\*

### 2.1 Introduction

The global securities exchange industry is currently undergoing a fundamental transformation. Driven by both political reform and competitive pressure it has turned into a dynamic industry that is in a state of flux and develops at a remarkable pace. On the political side, the drivers behind these changes include the liberalization and deregulation of national exchanges during the Eighties and Nineties of the 20<sup>th</sup> century. In Europe, the current efforts to fully integrate European capital markets and to open up cross-border competition have provided additional stimuli to change. Fueled by political reform and technological advances, competition among stock exchanges has unfolded in several ways. Exchanges have demutualized and were turned into for-profit entities. Moreover, merger and acquisition activity has caused the formation of large multi-national exchanges. Simultaneously, investors have been enabled to access even the remotest markets without difficulties. Facing increasing competitive pressure, exchanges have developed different approaches to covering the value chain of securities trading while competing for liquidity.

It is a peculiarity of stock exchanges that the markets they supply for their customers are two-sided. A market is considered to be two-sided if the goods or services it provides are directed to two distinct groups of end-users with network effects existing between the

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\* This chapter is based on joint work with Stefan Wagner, that is going to be published in the Quarterly Journal of Economic Research. For the purpose of this dissertation, the earlier article was extended by this author. I would like to thank Bernd Rudolph and Philipp Jostarndt for helpful discussions on the topic and valuable advice for the paper and the World Federation of Exchanges for providing data. I also acknowledge very helpful comments from an anonymous referee.

two groups. In order for a market to succeed it has to attempt to design a price structure for both groups of end-users that “brings both sides on board” because the consumption by one group of end-user yields positive externalities on the benefit of the other group of end-user and *vice versa* (Rochet and Tirole, 2003; Armstrong, 2005). In the case of exchanges the two sides are constituted by securities’ issuers and trading customers (that is brokers, dealers and investors). By listing their securities on a market issuers provide the market with the relevant objects of trade. Traders on the other hand equip the market with the liquidity necessary to both handle regular demand and supply and to absorb new issues, thus making listing additional securities more attractive.

In this paper, I solely focus upon the issuer side of exchanges’ business and assess to what extent the contractual relationship between an exchange and its issuers has changed during the recent transformation of the industry. In line with Macey and O’Hara (2002), I conclude that this relationship has lost most of its historic complexity and has almost been reduced to a standardized contract in the sense that there are few contractual properties distinguishing listing on one exchange from on another.<sup>1</sup> Nowadays, both parties, the company seeking a listing and the exchange, enter a comparatively unspecific relationship that has lost formerly important attributes. For example, historically exchanges provided standardized corporate governance rules with which listed companies had to comply. Acceptance of these rules helped issuers to transmit a quality signal to investors. Yet over the years, the provision of standardized corporate governance rules has been seized by legislators. Also, for years exchanges were essential to secure post-trade services such as clearing and settlement. Today, the traditional securities trading value chain is being unbundled.<sup>2</sup> On the one hand, the transformation of the exchange issuer relationship is caused by political advances, such as the creation of the single market in Europe and the introduction of the Euro. On the other hand, it is also sparked by technological advances within the industry and by the emergence of new institutions which provide functions formerly delivered by exchanges.

The analysis of the changing exchange issuer relationship is supplemented by an empirical examination of the convergence of listing requirements across the industry. Examining the current specifications of listing agreements I find that exchanges do hardly differ along these lines, but can only differentiate themselves through the liquidity pools they provide

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<sup>1</sup> Since I intend to analyze these changes from a purely economic point of view, I abstract from the underlying legal arrangements to a certain degree. However, I am fully aware of the legal diversity to be found in admission and listing procedures and agreements. Hopt et al. (1997) provide a comprehensive overview over these differences for all markets considered in this paper.

<sup>2</sup> Lately, this development has gained momentum as the traditional vertical silo approach to delivering securities trading services is suspected to drive up transaction costs (Cruickshank, 2001; Cayseele and Wuyts, 2005).

for potential issuers. Also, I find that listing fees and exchanges' revenues from listing activities are decreasing, which reflects the reduced scope and complexity of the contractual exchange issuer relationship. As the paper proceeds, I identify the public and private institutions that now provide the functions formerly contained in the listing agreement. Overall, the analyses in this paper suggest that the two-sidedness property of exchanges' markets is losing some of its complexity, as the issuer side of their business is moving towards standardization. Finally, I analyze whether the current political activities in Europe reflect the changing nature of the exchange issuer relationship. In this discussion, I focus upon the efforts of policy makers to create integrated European capital markets and on the current regime of regulation and supervision of cross-border activities.

The rest of the paper is organized as follows. Section 2.2 examines the various elements of the listing relationship as it presented itself in the past and discusses whether and in which form the different contractual properties endure to the present date. Section 2.3 goes on to examine the convergence of initial listing requirements and follow-up obligations and briefly discusses the development of listing fees and revenues generated from listing activities. To reduce complexity, the analysis is limited to the five major stock market in the United States and Europe (NYSE, NASDAQ, LSE, Euronext and Deutsche Boerse), which share among themselves 70% of global share trading turnover and 60% of global market capitalization. Section 2.4 analyzes how current policy debates in Europe reflect the changing exchange issuer relationship. Finally, section 2.5 briefly summarizes the main findings and concludes the paper.

## 2.2 The Changing Nature of the Exchange Issuer Relationship

### 2.2.1 Overview

Efficient markets need strict rules and external enforcement of these rules in order to mitigate prevailing incentives of the market participants to cheat. Only the existence of a set of coherent and strict rules enables welfare-enhancing trades which would otherwise not occur (Glaeser et al., 2001). It became a common argument of policy makers that state intervention is needed to set these rules, especially with regard to financial markets. However, regarding the historical record it can be contested that, by and large, most complex rules governing financial trading in formal marketplaces developed antecedent to and independently from state intervention or regulation. In fact, the emergence of organized stock exchanges was the first and primary source of rules setting a legal framework for the trading of securities. First institutionalized stock markets developed at the end of the 18<sup>th</sup> century in the United States and at the beginning of the 19<sup>th</sup> century in Europe and introduced – for the first time in modern history – organized market places for securities trading and explicit rules on the accomplishment of these trades (Neal, 1987; Davis and Neal, 1998).<sup>3</sup>

Beyond their most obvious purpose which is providing buyers and sellers with a location to meet and to trade and ensuring the availability of sufficient liquidity levels, it was one of the most important functions of the self-policing stock exchanges at that time to provide a miniature legal system. This legal system with its own rules governed securities trading and included mechanisms for resolving trade related disputes (Banner, 1998; Stringham, 2002). In addition to these trading regulations stock exchanges have also been the major source of rules concerning the disclosure of firm information and corporate governance by requiring companies which wanted to list their securities on an exchange to comply with its listing requirements (Davis et al., 2003). The importance of the provision of comprehensive listing requirements for firms as well as of rules related to securities trading by stock exchanges was essential to the development of capital markets and beneficial for both issuers of securities and investors. This is especially true since state regulation was mostly absent at that time and self-policing stock exchanges were the only source of such rules. However, restricting their role to a mere provider of legal

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<sup>3</sup> Apparently, these dates do not mark the beginning of trading in financial securities. Markets for exchange bills and government bonds have existed ever since their invention in the Middle Ages and Renaissance, respectively. Yet these markets lacked a formal organization and the enforcement of rules for trading and accession.

standards would be too narrow. Stock exchanges also provided trading and post-trading infrastructure. Furthermore, they served as major informational intermediaries at times where information was both hard to distribute and difficult to gather.

While the purposes of exchanges were manifold the relationship between exchanges and issuers was similarly complex. Stock exchanges provided various functions to their listing customers. Among others were the provision of standardized corporate governance rules, assistance in transmitting a reputational signal to investors, the provision of clearing and settlement services and the provision of liquidity and fair and orderly markets (Macey and O'Hara, 2002). Obviously, this array of provisions was not implemented at once but emerged as the result of a continuous process. With the exception of NASDAQ<sup>4</sup> the predecessor organizations to all exchanges analyzed in this paper were created at the turn of the 19<sup>th</sup> century.<sup>5</sup> On all exchanges first formal listing requirements were imposed shortly after their incorporation. Yet these provisions can hardly be compared to today's listing requirements, but were rather enumerations of the securities and prices to be quoted. But over the next century's time, the exchanges had developed detailed listing requirements that applied to listing candidates. For instance, all exchanges demanded that their listing committees were given full excess to all legal documents required in the listing company's home country. Furthermore, all exchanges had mandatory provisions for the listing company's prospectus to be publicly advertised in the press. Yet they differed widely on all other sorts of provisions including minimum size criteria, accounting and disclosure provisions and compulsory corporate governance standards. For example, the NYSE demanded information on the size distribution of stock holdings to be published, a provision not implied by any other exchange (Davis et al., 2003).<sup>6</sup>

As listing requirements grew more complex so did the relationship between exchanges and issuers. As a consequence, the contract between both parties became more and more relational. Listing firms were dependant on exchanges as they had to ensure liquid trading in their securities. Yet this dependency was not one-sided. Macey and O'Hara (1999) argue that *"the complex bundle of services provided by exchanges to listing firms resulted in a relationship characterized by long-term mutual dependency. Each side had asset-specific relations with the other that raised the specter of exploitation through opportunistic*

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<sup>4</sup> The name NASDAQ derives from an acronym for National Association of Securities Dealers Automated Quotations, which labeled the world's first electronic stock market. It was founded in 1971 to facilitate OTC trading.

<sup>5</sup> Precisely, the NYSE was created in 1792 by the Buttonwood-Agreement, the London Stock Exchange was founded in 1801, the Berlin Exchange in 1804 and the Paris Exchange in 1808 (Davis and Neal, 1998). While the former two were created by private agreements, the latter two exchanges were called into existence by the ruling monarchs.

<sup>6</sup> Chapter 2.3 gives an overview of the current listing requirements of the same exchanges. It becomes apparent, the over the course of the last century regulations have been harmonized for the most part.

*behavior.*” Exchanges depended on listing firms as they provided the necessary objects of trade to enable secondary trading. This dependency increased the more exchanges relied on listing fees as a source of income.<sup>7</sup> Yet due to the fact that dependency was reciprocal incentives for opportunistic behavior were manageably small for either party.

In the following, the historically most important functions of stock exchanges and the main contractual elements between exchanges and issuers are presented. At the same time, I provide an economic perspective on the rules and mechanisms which were developed by self-regulated stock exchanges in absence of state intervention. Further on, I argue that stock exchanges facilitated securities trading by providing the necessary infrastructure as well as by serving as informational intermediaries for investors. Additionally, I comment on the current role of stock markets in the provision of these features especially in the light of recent developments in state interventions and major changes in the economic environment in which stock exchanges operate. I argue that the role of stock exchanges in providing and enforcing most of these features decreased over the last decades and that other institutions took their place.

## **2.2.2 Provision of Standardized Corporate Governance Rules**

Strict corporate governance rules protect stockholders and potential investors from fraud, manipulation and possible misconduct of a firm’s management and hence lower the cost of capital for firms (La Porta et al., 1997; Shleifer and Vishny, 1997). Historically, many stock exchanges provided codified rules of corporate governance long before legislators explicitly turned to this problem by creating superordinate public regulatory bodies (Davis et al., 2003; Macey and O’Hara, 2002). The rules set by exchanges included detailed accounting and disclosure requirements as well as rules regarding capital structure or voting rights. When seeking a listing of their shares on a certain exchange firms had to commit to obeying the rules set by the stock exchange. It is beyond the scope of this paper to provide a detailed discussion of all these rules and their historic evolution. Davis et al. (2003) give a comprehensive analysis of the provision of corporate governance and disclosure rules set by the four leading stock markets in the 19<sup>th</sup> century. Stigler (1964) and Benston (1973) present a detailed discussion on the role of the New York Stock Exchange (NYSE) as a standard setter before the emergence of the Securities and Exchange Commission (SEC) in the U.S. Stringham (2002) briefly discusses the situation in the United Kingdom.

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<sup>7</sup> For instance, during the Eighties and Nineties of the 20<sup>th</sup> century the NYSE’s revenue share from listing fees totalled more than a third.

It should be noted that the predominant role of stock exchanges as a primary source of legal rules for listed companies largely eroded when policy makers turned to the problem in the last century.<sup>8</sup> In particular, state legislation as well as common and business law advanced within the last century and both now contain comprehensive regulation concerning the governance of public corporations. Moreover, when policy makers realized the importance of efficient capital markets for national economies during the 20<sup>th</sup> century, they started establishing independent legal authorities overseeing trading on stock exchanges and prescribing additional listing requirements to issuers of securities. More and more, these institutions replaced stock exchanges as major source of legal rules. For instance, in the United States the Securities and Exchange Commission (SEC) was established as early as 1934 as a consequence of the 1929 stock market crash (Benston, 1973). In Western Europe comparable single regulator institutions have been founded only towards the end of the 20<sup>th</sup> century. In Germany, the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin) dates back to 1994, in the United Kingdom the Financial Service Authority (FSA) was established in 2000 and the French Autorité des Marchés Financiers (AMF) only in 2003.

The intention behind these developments was to create a reliable and uniform framework for corporate governance on a national level. Within the last decades, however, European policy makers have decided to extend standardization across countries. Therefore, in addition to national initiatives, the European Union is currently developing a unified framework for the whole Financial Services industry (see Lamfalussy Group (2001), EC (2005, 1999) and Section 2.4 for more details). For stock exchanges the process of standardization has brought about the end of their function as a source of standardized corporate governance rules. Furthermore, they have passed on almost all monitoring and regulatory activity to national or supranational watchdog institutions. As a consequence of the introduction of state regulation, legal structures are currently set by legislators and courts and do thus supersede stock exchanges as sources of corporate governance rules.

### 2.2.3 Signaling Function

In addition to the provision of corporate governance standards, stock exchanges can also be seen as reputational intermediaries who generate and transport signals to investors.

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<sup>8</sup> In many cases the rules devised by stock exchanges have had considerable influence on the design of state legislation. This is especially the case in the U.S. where the listing requirements designed by the NYSE have impacted the development of standardized corporate governance rules and accounting standards extensively Davis et al. (2003).

Macey and O'Hara (2002) argue that a firm's decision to list its shares on a stock exchange conveys a quality signal to investors since investors can derive information from the very fact that this particular exchange has agreed to list a firm for trading. Among others, this agreement signals that the listed firm has a significant market presence which is required to be listed in important market segments at most stock exchanges. Requirements include the number of outstanding shares, minimum market capitalization or minimum revenues realized in the past.<sup>9</sup> Second, and of at least tantamount importance to investors, when listing their shares on a certain exchange firms have to commit to obeying the rules set by the stock exchange and the according regulating authorities with regard to corporate governance and timely disclosure of information. Investors can interpret this fact as an indication that the firm follows agreed governance principles since non-obedience would result in penalties or in the most extreme case in delisting the firm from the exchange. Formal treatments model firms' decisions to list on alternative stock exchanges dependent on the quality of the firm and the required level of disclosure of firm-specific information. They find that stricter standards should result in better pricing transparency and hence are beneficial to investors (Cheung and Lee, 1995).

Clearly, the value of a signal transmitted by a stock exchange's decision to accept securities from a firm for listing depends on the willingness of the exchange to enforce the set of rules it established as well as the availability and the cost of alternative signals on the quality of firms. A closer look at these determinants suggests that the value of the 'listing signal' decreased over the last decades. Concerning the enforcement of rules there are several indications that stock exchanges have become less willing to enforce their listing requirements due to increasing competition for listings among exchanges. The NYSE provides the most cited example. During the 1980s, when several firms ignored the NYSE's rules prohibiting dual class voting stock the NYSE declined to enforce these rules by delisting the offending companies. Finally, with the approval of the SEC the rules preventing firms from listing shares with different rights were abandoned (Gilson, 1993).

Moreover, it can be argued that the relative value of the 'listing signal' has decreased due to the widespread availability and the good quality of alternative signals, in particular reports produced and published by stock market analysts. Several studies show that analyst reports convey valuable information for investors (Asquith et al., 2005; Barber et al., 2001; Irvine, 2003; Womack, 1996) and that the number of U.S. firms covered by analysts rose by more than 100% over the Nineties of the 20<sup>th</sup> century (Barth et al., 2001). This reflects that the sole fact that a company is admitted to trading is no longer sufficient information for investors' to base their decisions upon. Apparently, investors'

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<sup>9</sup> Listing requirements are discussed in more detail in the subsequent Section 2.3

demand for detailed and frequent information updates has risen considerably, making it profitable for specialists to provide such data on a permanent basis. However, on a few occasions firms do still benefit from the reputational effect associated with obtaining a listing. For instance, small companies gain visibility when listing initially and during the Nineties many European companies considered listing on the NYSE to have a favorable reputational effect.<sup>10</sup>

## 2.2.4 Provision of Clearing and Settlement Services

Firms issuing securities and investors trading in them face a counterparty risk with regard to the payment for securities sold and the delivery of securities purchased. Historically, stock exchanges minimized this risk by offering clearing and settlement services which in fact constituted a core business of exchanges. These clearing and settlement services included the necessary infrastructure as well as rules for dispute resolution. However, market developments proved that clearing and settlement services can largely be unbundled from trading services. In fact, most of the important stock exchanges transferred clearing and settlement tasks to separate firms.<sup>11</sup> This transfer of post-trading services was largely driven by economies-of-scale arguments disposing stock exchanges from another once important and profitable activity (Schmiedel et al., 2002).

However, the situation in Europe and the United States is quite different. While in the U.S., the Depository Trust Company (DTC) provides both clearing and settlement services in a centralized form for most U.S. stock exchanges including NASDAQ and NYSE, there is no integrated clearing and settlement system in Europe. In fact, there are currently two major clearing and settlement organizations which developed parallel to the emergence of the major capital market centers, or 'poles', in Europe. One of these poles is grouped around LCH.clearnet/ Euroclear (result of a merger of UK's London Clearing House and the French Clearnet) which provides clearing and settlement services to the London Stock Exchange (LSE) and the Euronext exchanges. The other center (Clearstream) is grouped around the German Deutsche Boerse / Eurex and provides these services not only for its parent company Deutsche Boerse but also for other European exchanges and financial institutions. However, in addition to these leading companies

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<sup>10</sup> Yet this effect could also be ascribed to the listing firm becoming subject to tighter regulation and enforcement policies implemented and executed by the SEC and to the firm committing itself to providing more detailed financial statements according to the U.S. generally accepted accounting principles (GAAP).

<sup>11</sup> With the notable exception of Deutsche Boerse that pursues a vertical silo approach and covers the entire securities trading value chain including clearing and settlement services.

there are still a number of smaller firms serving smaller European exchanges.<sup>12</sup> This fragmented structure hampers particularly cross-border transactions and is responsible for comparably high clearing and settlement costs in Europe (Cruickshank, 2001; Cayseele and Wuyts, 2005).

The economic problems associated with high-cost cross-border clearing and settlement in Europe and the barriers to efficient cross-border post-trading services have been put on the European agenda by the Giovannini Group in 2001 (Giovannini Group, 2001). To a large extent, these problems remain unsolved and hamper further integration of the securities services infrastructure in Europe (FESE, 2004; Schmiedel and Schoeneberger, 2005). Yet all these developments clearly demonstrate that clearing and settlement activities are no longer an integral part of the exchange issuer relationship. While it was historically favorable to bundle trading and clearing in one location and thus in one organization, technological advances have rendered this necessity obsolete. Instead, these processes have been moved to firms that specialize in the complex handling of data for exchanges, but also for brokers involved in OTC transactions.

### **2.2.5 Provision of Liquidity**

Given the decreasing importance of stock markets in providing and enforcing corporate governance rules and the detachment of clearing services from the standard contractual bundle, the provision of liquidity is probably the most important function of stock exchanges at the moment. From an issuing firm's perspective, the provision of liquidity is especially important for two reasons: First, the availability of deep liquidity pools enables companies to quickly raise equity at low cost in primary markets. Thus, a market's ability to absorb equity offerings is of paramount importance for companies seeking an initial listing or planning a capital increase. Second, high levels of liquidity allow investors to buy and to sell their shares quickly in secondary markets without causing a significant influence on market prices, which in turn reduces the cost of equity for companies (Muranaga and Shimizu, 1999).

While the provision of liquidity continues to be the most important of stock exchanges to listing firms recent developments suggest that dominant position of exchanges in this field is no longer uncontested. Considering the recent emergence of electronic communication networks (ECNs), that is electronic non-intermediated for-profit financial trading systems, one might wonder whether the predominant role of established stock exchanges

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<sup>12</sup> London Economics (2004) contains a detailed overview of the current state of the European clearing and settlement industry.

in providing liquidity has been eroded. ECNs are alternative trading systems that are operated by large banks to match in-house trades or by independent providers attempting to put up rival markets.<sup>13</sup> The threat posed by ECNs to regular exchanges' liquidity results from their microstructure: buyers and traders are matched automatically, which eliminates the need for any intermediary such as brokers or market makers. This enables ECNs to offer trading services at lower transaction costs. Furthermore, they can be easily employed for after-hour trading.

The competitive situation between traditional stock exchanges and ECNs is quite different in the United States and in Europe. Due to different market structures ECNs have attained relatively large market shares in the United States while they are more or less irrelevant for the European capital markets. McKinsey and JP Morgan Securities (2002) and Degryse and Van Achter (2002) estimate that for secondary markets ECNs gained a market share (in terms of traded NASDAQ shares) of 37% in the U.S.<sup>14</sup> There is sound empirical evidence for the United States suggesting that despite the success of ECNs traditional exchanges still provide highest liquidity levels, which leads to lowest transaction costs (Christie and Huang, 1994; Bessembinder and Kaufman, 1997; Bessembinder, 1999; Degryse and Van Achter, 2002). Moreover, it has been shown that even the abolishment of SEC Rule 19c-3 in 2000, which made it impossible for NYSE member firms to trade NYSE listed securities outside the exchange, did not lead to any substantial gains in market shares for ECNs but to an increase in pricing quality at the NYSE (Kam et al., 2003). However, for primary markets ECNs have failed to establish themselves as alternatives to traditional stock exchanges. To date, there have been no significant initial public offering activities outside traditional stock exchanges. Given these findings, I conclude that out of the multitude of functions formerly provided by exchanges to listing firms the provision of liquidity currently remains their most important function.

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<sup>13</sup> Of the various attempts to establish profitable and liquid alternative markets only Archipelago and Instinet in the U.S. have prevailed. Virtually all in-house trading platforms by banks have been shut down.

<sup>14</sup> There are no comparable numbers for European markets, but it is a reasonable assumption that the market shares of ECNs in Europe is less than 5% (Degryse and Van Achter, 2002; McKinsey and JP Morgan Securities, 2002).

## 2.3 Current Specifications of Listing Contracts

Recent trends such as deregulation, technological advances and changing investor behavior intensified the competitive pressure on financial market institutions in general. Especially in Europe, the institutional arrangements are currently in a state of flux. The introduction of the Euro has laid the groundwork for a single capital market by eliminating intra-European currency risk. Also, in order to create a level playing field, the European Union is developing a unified framework for the entire Financial Services industry. As a consequence, national borders do no longer serve as protective barriers to companies, but competition extends across countries. This is especially true for the securities exchange industry where ongoing changes in ownership structures from member-owned towards shareholder-owned organizations have further increased competition (cf. Chapter 3 of this thesis). This has led to a number of cross-border mergers among stock exchanges.<sup>15</sup>

Securities exchanges operate two-sided markets. Analogously, the competition among stock exchanges can be described to take place in two main areas: First, competition for secondary trading, that is volume and liquidity, occurs within established securities. Second, competition for new listings takes place in primary markets.<sup>16</sup> Since I intend to focus upon the issuer side of exchanges' business the analysis is restricted to a discussion of the competition for listings between stock exchanges. In the following, I focus upon the most important aspects of a firm's decision whether to list its shares on a specific stock exchange: formal listing requirements which have to be satisfied (initial and follow-up obligations) and the cost associated with a stock market listing (initial and continued costs). These two parameters are reviewed and analyzed for five major stock markets: NYSE, NASDAQ, LSE, Euronext and Deutsche Boerse. Together, these exchanges cover over 70% of global share trading turnover and 60% of global market capitalization (FESE, 2005). I argue that both, listing requirements and pricing structures, are converging for these markets.

### 2.3.1 Listing requirements

In order to obtain an admission for listing their shares on a stock market, companies have to meet a multitude of qualifications. In the past, rules and regulations formulated

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<sup>15</sup> The rationale behind merging securities exchanges is that the automation of the securities trading value chain has turned the industry into a business driven by cost-reduction through economies of scale. Thus, forming larger exchanges provides an effective means to reduce fix costs.

<sup>16</sup> Apart from these two main strains of competition, exchanges also compete on the provision and emanation of trading information such as prices and the provision of trading technology.

by stock exchanges had a significant impact on listed companies and served as an important source of governance rules for listed companies (see Chapter 2.2). In particular, exchanges enacted strict rules regarding disclosure and other aspects of governance long before legislators attended to these issues. Nowadays, the scope of exchanges' provisions is narrowed down by binding legal rules set by regulatory authorities like the SEC (U.S.) or the FSA (UK) and by legislators. Despite a multitude of different sources, listing requirements at different stock markets can be systematized in three large groups: demands on a company's size as well as the free float of its shares, requisites for profitability or accounting history prior to the initial flotation and follow-up requirements covering financial reporting, formal disclosure and other obligations.

Table 2.1 shows the most important listing requirements raised by major stock markets in Europe and the U.S. It displays the main criteria a domestic company has to meet in order to be admitted to an initial public offering of its shares on a specific exchange's main market. With the exception of NASDAQ all exchanges require new listings to provide audited accounts for the last three fiscal years.<sup>17</sup> All stock exchanges require the fulfillment of minimum demands on a company's size and free float. The reasoning behind this is to ensure that companies are apt for market trading and that trading meets a desired minimum liquidity level. With decreasing size, equity issues become less liquid making transactions more expensive. However, since the *raison d'être* of exchanges is to reduce transaction costs by amassing liquidity, they protect their markets through minimum size barriers. For segments other than the flagship market, often less rigid rules apply in order to provide smaller companies with a trading venue for their securities. While U.S. stock markets do not require minimum free float ratios for listed firms, European exchanges almost uniformly require a free float ratio of 25%.<sup>18</sup> The situation is different with regard to requirements on minimum size. The minimum market capitalization required to obtain a listing varies between £0.7 million (LSE) and \$60 million (NYSE). This difference could be a consequence of the fact that the U.S. capital market is served by several exchanges simultaneously. This provides companies that do not meet the NYSE's listing requirements with alternative listing venues.

The second set of rules frequently found in listing requirements are minimum requisites for profitability and operating history. The object of these rules is to ensure a going concern in the company aspiring a listing. Companies with insufficient track records are extremely difficult to value from an investor's perspective, since they bear a high

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<sup>17</sup> Listing mechanics, that is the formal process of registration for obtaining a listing, as well as the mandatory content of the offering circular are neglected in this analysis since they are mostly beyond the exchanges' power of constituting rules.

<sup>18</sup> The sole exception currently is Euronext Amsterdam requiring a free float of only 10%.

Table 2.1: Listing Requirements

This table displays the main listing requirements imposed upon their respective issuers by five major stock markets in Europe and in the United States. It contains the major criteria a domestic company has to meet in order to be admitted to an initial public offering of its shares on a specific exchange's main market. Small cap markets and markets tailored to growing businesses have been excluded from the analysis. With the exception of NASDAQ, all exchanges require new listings to provide audited accounts for the last three fiscal years. *Min. Market Capitalization* refers to the minimum market value of publicly held shares. Listing mechanics, that is the formal process of registration for obtaining a listing, as well as the mandatory content of the offering circular are neglected. Additional provisions that aim at providing a minimum standard in the post-listing quality of trading, such as a minimum number of market makers in a newly listed stock, are neglected as well.

	Free Float	Min. Equity	Min. Market Cap	Min. Number of Shares	Other minimum quantitative standards
<b>Deutsche Boerse</b>					
Official Market	25%	-	€1.25 million	10,000	-
Regulated Market	-	-	-	10,000	-
<b>Euronext</b>					
Amsterdam	10%	€5 million	-	-	Profitable in 3 of the last 5 fiscal years
Brussels	25%	€15 million	€15 million	-	Either min. equity of min. market cap are required
Paris	25%	-	-	-	-
<b>LSE</b>	25%	-	£0.7 million	-	Working capital for the next 12 months
<b>NASDAQ</b>					
Standard 1	-	\$15 million	\$8 million	1.1 million	Pre-tax income of \$1 million in latest fiscal year of 2 of the last 3 fiscal years
Standard 2	-	\$30 million	\$18 million	1.1 million	-
Standard 3	-	-	\$20 million	1.1 million	Market value of listed securities of \$75 million OR total assets and total revenues of the same amount
<b>NYSE</b>	-	-	\$60 million	1.1 million	Aggregate pre-tax earnings of \$10 million over last 3 years OR aggregate operating cash flow of \$25 million of last 3 years OR revenues of \$75 million in last fiscal year

Table 2.2: Continuing obligations

This table displays the main follow-up obligations imposed by five major European and U.S. stock markets upon their respective issuers. It contains the major criteria a domestic company has to comply with continuously in order to remain admitted to a specific exchange. Small cap markets and markets tailored to growing businesses have been excluded from the analysis. *Financial Reporting* covers obligations to provide and publish financial results. *Disclosure* encompasses all obligations to inform the market of certain events.

	Financial Reporting	Disclosure	Other obligations
<b>Deutsche Boerse Amsterdam</b>	Annual financial statements and publication of an interim report	Ad-hoc disclosure in accordance with §15 and §21 WpHG	Compliance with German Takeover Act and German Corporate Governance Code, further transparency provisions for Prime Standard.
<b>Euronext Amsterdam</b>	Annual and semi-annual report, quarterly figures are recommended	Publication of any price-sensitive information and in compliance with the Listed Companies Act of 1996	Compliance with the Listing and Issuing Rules of Euronext Amsterdam and the Dutch Corporate Governance Code
<b>Brussels</b>	Annual and semi-annual reports	Any price-sensitive information and information related to the modification of rights attached to financial instruments	
<b>Paris</b>	Annual report and accounts, half-yearly reports and quarterly turnover figures	Public disclosure of any material facts likely to have a significant impact on price	Compliance with the Regulations of the Autorité des Marchés Financiers
<b>LSE</b>	Audited annual reports, unaudited half yearly figures	Public notification of any price-sensitive information	Compliance with the Listing Rules of the UK Listing Authority and the Companies Act
<b>NASDAQ</b>	Annual report independently audited and filed with SEC on Form 10-K, publication of interim earnings reports	Public disclosure of material events and notification in case of various predefined events (Para. 4120 NASDAQ Marketplace Rules)	Rules, standards and maintenance criteria applicable according to the NASDAQ Marketplace Rules and SEC regulations
<b>NYSE</b>	Annual report independently audited and filed with SEC on Form 10-K, publication of interim earnings reports	Public disclosure of material events and notification in case of various predefined events (Para. 204 NYSE Listed Company Manual)	Corporate governance standards and other business standards in compliance with the Listed Company Manual and SEC regulations

degree of uncertainty. While being similar in intention, such rules are based on a number of different financial figures such as operating cash flow, revenues or pre-tax income. Euronext Amsterdam even requires companies to be profitable for a number of years.

The third kind of provision common to all listing requirements is usually contained in the follow-up obligations. Follow-up obligations are additional rules and provisions a listed company has to comply with on an ongoing basis after its initial listing. Failure to do so is either finable or at worst results in delisting. The main follow-up obligations the exchanges in this sample call for are displayed in Table 2.2. The most common requirements are minimum disclosure and financial reporting standards, but also include commitment to voluntary codes of conduct such as corporate governance standards. By committing companies to comply with a certain standard of disclosure, reporting or conduct beyond the legally required, exchanges ensure that the investing public disposes of reliable financial information and is kept informed on the progress of a company's affairs. This safeguards that a floated company is a viable going concern and has sufficient prospects to survive in the future while being a reliable investment. As Table 2.2 demonstrates, the follow-up obligations which constitute the largest share of the costs associated with a stock market listing are very similar at the different markets and are not a means of differentiation for exchanges when competing for listings. I do not find empirical support for models treating listing requirements as major means for differentiation of stock exchanges like in Foucault and Parlour (2004), Fluck and Stomper (2003) and Huddart et al. (1999).

### 2.3.2 Listing Fees

Listing requirements and follow-up obligations are not the only parameters at hand in the competition for listings. Exchanges also compete for listings via the price of their services for issuers. Listing fees are fees that issuing companies have to pay in order to be listed by a certain stock exchange. In general, listing fees are composed of initial fees which have to be paid once at the beginning of the listing relationship and continuing fees payable on an annual basis. It is not straightforward why firms have to pay for a listing of their shares since it is vital for exchanges to list firms' shares in order to derive revenues from secondary trading in these securities. In two-sided markets it is not uncommon for firms to offer their services for free to one side of the market.<sup>19</sup> However, it can be argued that the functions carried out by exchanges for issuing firms are sufficiently valuable to companies in order to justify listing fees (cf. Chapter 2.2).

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<sup>19</sup> For instance, shopping mail operators do not charge shoppers, but retailers only. Similarly, gratis newspapers charge advertisers only.

Table 2.3: Listing fees overview

This table displays the pricing models of five major stock markets for the calculation of listing fees to be levied upon issuers. The pricing models apply to the respective main markets. Fees apply to domestic issuers only. Deutsche Boerse's *Fixed Commissions* vary over different market segments, but are independent of firm characteristics. The *Market Capitalization* during IPO is used to compute initial listing fees while yearly averages are used to determine continuing fees.

	Fixed Commis- sions	Market Capital- ization	Number of Shares	Minimum Fee	Maximum Fee
Panel A: Initial listing fees and charges for admission					
Deutsche Boerse	X			€ 7.500	€ 7.500
Euronext		X		€ 10.000	€ 3.000.000
LSE		X		£ 5.320	£ 265.988
NASDAQ			X	\$ 100.000	\$ 150.000
NYSE			X	\$ 150.000	\$ 250.000
Panel B: Fees payable on an annual basis					
Deutsche Boerse	X			€ 7.500	€ 10.000
Euronext			X	€ 3.000	€ 20.000
LSE		X		£ 3.503	£ 34.517
NASDAQ			X	\$ 24.500	\$ 75.000
NYSE			X	\$ 35.000	\$ 500.000

Source: Deutsche Boerse, Euronext, LSE, NASDAQ, NYSE

Table 2.3 presents the composition of listing fees for five major stock exchanges and shows that listing fees are a function of the characteristics of the issuing firm. Yet there is no standardized pricing model. For instance, the LSE and Euronext calculate the initial listing fee on the basis of the market capitalization of the issuing firm, while NASDAQ and NYSE rely on the number of shares issued. Deutsche Boerse employs a different approach and charges fixed commissions which depend on the market segment in which a company decides to list.<sup>20</sup> Also, there are substantial differences in the potential range of listing fees. Minimum and maximum initial listing fees vary between € 7.500 (Deutsche Boerse) and € 3.000.000 (Euronext). LSE charges the lowest minimum annual fees (£ 3.503), while the NYSE levies up to \$ 500.000. These differences in fees are surprising, since they do not reflect exchanges' market positions or pricing power properly. For years, NASDAQ has been dominating the NYSE in terms of initial public offerings in U.S. companies. Likewise, the LSE attracts consistently more new listings than Euronext. Yet differences in listing fees could reflect an individual exchange's market and for-profit orientation.

<sup>20</sup> Currently, there are different commissions for the Official Market, the Regulated Market, the Prime Standard and the Regulated Unofficial Market.

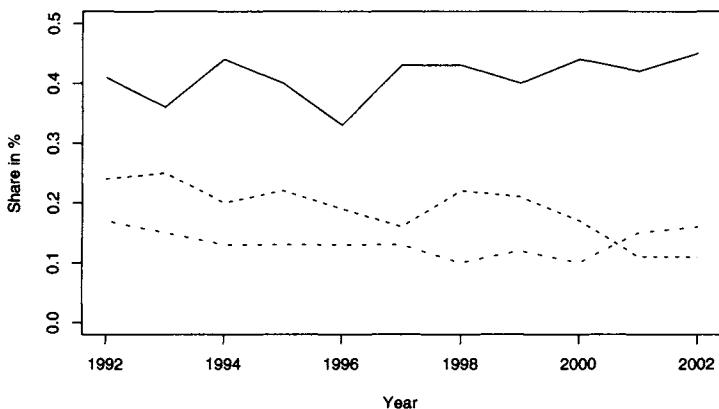


Figure 2.1: Revenue composition of exchanges world-wide between 1992 and 2002: (—) Trading Fees, (- - -) Listing Fees, (···) Services, (- · - ·) Other. Source: World Federation of Exchanges Cost & Revenue Surveys 1993-2003.

There is also considerable evidence, that stock exchanges have identified listing fees as an effective parameter to attract further listings to their market. For example, in 2004, NASDAQ announced to waive listing fees for dual listings for one year in an attempt to lure companies from the NYSE. Similarly, in 2003 the LSE slashed listing fees for its Alternative Investment Market (AIM) and thus managed to provide an active and liquid flotation venue for high growth companies. The different pricing models presented in Table 2.3 show that stock exchanges have developed different solutions to coping with the trade-off between attracting listings with lower fees and generating profits for the owners of the exchange. Existing theoretical models, however, such as Foucault and Parlour (2004) and Chemmanur and Fulghieri (2005) do not provide a convincing explanation for the observed variety of pricing models.

Figure 2.1 displays the average percentage of revenue generated by members of the World Federation of Stock Exchanges (WFE) between 1993 and 2003.<sup>21</sup> Exchanges included have participated in the annual Cost & Revenue Survey provided by the WFE. Participation varies between 44 (1993) and 50 (2003) respondents. Figures are split up in trading fees, listing fees, services (essentially price dissemination and membership fees

<sup>21</sup> The *World Federation of Exchanges* is the international trade organization for regulated securities and derivative markets.

if applicable) and other activities. In fact, the share of listing fees of the total revenues decreased from almost 25% in 1992 to slightly more than 10% in 2002. Without presenting formal evidence, I associate this decrease with the changing nature of the relationship between issuers and exchanges. As presented in Section 2.2, many of the functions initially provided by stock exchanges are no more part of the contract between issuers and exchanges since they are provided by different institutions. I argue that the decreasing importance of listing fees for stock exchanges is a direct consequence and a clear sign of the reduced set of features a listing contract comprises.

## 2.4 Do the Current Policy Debates Reflect the Changing Nature of the Exchange Issuer Relationship?

The previous chapters have outlined the fundamental changes in the contractual relationship between issuers and exchanges. They have also demonstrated that the service of listing a company is moving towards becoming a standardized contract in the sense that few contractual properties remain that distinguish one exchange from another. In Europe, these changes are accompanied by major structural reforms of the financial landscape after the introduction of a single currency. In the following, I briefly review the current state of the integration efforts and the underlying political processes. I discuss whether the changing nature of the exchange issuer relationship is reflected by the efforts undertaken by policy makers to create an integrated European capital market. Moreover, I focus upon the current regime of regulation and supervision of cross-border activities for both issuers and exchanges.

### 2.4.1 The Integration of European Financial Markets

A glance at the current degree of financial integration among securities exchanges reveals the importance of the issues described above and helps identifying considerable obstacles towards fully functioning integrated European capital markets. The European securities industry has been fragmented along national borders for centuries. Not until the end of the 20<sup>th</sup> century did any significant cross-border consolidation occur. However, the speed of integration has increased sharply lately. On the infrastructure side at least two important players operate across different jurisdictions and national borders (Euronext and Norex Alliance).<sup>22</sup> Cross-border activities include the sharing of technology, the development of new market segments and multilateral trading systems. While the infrastructure side is still gaining momentum in cross-border integration (Deutsche Boerse / Euronext takeover bid for the LSE), integration of the issuer side is already much more advanced. Blue chip issuers enjoy the benefits of integrated markets to a large extent as public offerings often extend across various European countries. Secondary trading in European blue chips is also extremely liquid. With the exception of the London based AIM market, primary and secondary trading for small and medium-sized enterprises issuers is compared to blue chip

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<sup>22</sup> Euronext is the result of a merger of the Amsterdam, Brussels and Paris stock exchanges in 2000. In 2002 Euronext expanded through the acquisition of LIFFE and a merger with the Portuguese exchange. Norex Alliance emerged from a strategic alliance between Copenhagen and Stockholm stock exchanges in 1997. Gradually, this alliance was extended to include the exchanges of Oslo (2000), Reykjavik (2000), Helsinki, Riga and Tallin (2004) and Vilnius (2005).

trading more nationally oriented and attracts mainly proximity investors (CESR, 2004), i.e. investors who focus upon a national or regional market. Yet companies are beginning to use foreign exchanges to raise equity in order to access liquidity pools unavailable to them in their home economies. Especially, the NYSE and LSE have been successful at attracting foreign companies to use their market as a primary listing venue.

Political efforts to integrate European financial markets have lagged behind the transformative push emanating from within the industry to a certain degree. Yet with the preparation of the Financial Services Action Plan (FSAP) in 1999 and its endorsement at the Lisbon summit in March 2000, the European Commission has committed itself to the goal of advancing the integration of financial markets in Europe and to fully reaping the benefits from the introduction of a single European currency (EC, 1999). At the same time, the Commission asked two groups of experts (Lamfalussy group and Giovannini group) to consider how to improve and accelerate European securities market legislation and regulation and how to enhance clearing and settlement services in Europe, respectively.

In particular, this aims at reducing the legal obstacles that prevent financial businesses from selling their services seamlessly across the EU (EC, 1999). The necessary measures have been classified in three major strategic objectives that remove existing barriers and fill legal gaps: 1) creation of a single market in the EU; 2) establishment of open and secure retail financial services markets; 3) state-of-the-art prudential rules and supervision. Especially the first and the third objective are of interest for this paper as they aim at enabling corporate issuers to raise capital on competitive terms on a EU-wide basis. As a prerequisite, it becomes necessary to provide investors, issuers and intermediaries with access to all markets and to create a climate of legal certainty.

Along with the FSAP, European institutions have endorsed a new approach for making securities markets legislation faster and more efficient, the so called Lamfalussy process (FSA, 2004). This process is a four-level approach that intends to maintain regulations flexible in reacting to innovations in the financial services sector and leaves the detailed implementation to committees and related specialists close to the affected industry. At level 1, framework principles are drafted by the Commission and passed by the Council of Ministers and the European Parliament. For the next two levels, the process arranges for the relevant regulatory and supervisory institutions in the fields of banking, insurance or securities to be involved. Following consultations with the regulatory committees (EBC, EIOPC or ESC), technical advice provided by the supervisory committees (CEBS, CEIOPS or CESR) and a favorable vote by the member states, legislation is adopted by

the Commission at level 2.<sup>23</sup> At level 3 the relevant supervisory committee ensures the consistent and coordinated implementation of level 1 and level 2 across member states. It also seeks to adopt best practice rules for consistent regulatory and supervisory approaches through the publication of non-binding standards. Finally, at level 4 the Commission jointly with the member states and the financial supervisory authorities ensures the ongoing supervision of the implementation and enforcement efforts (FSA, 2004, 2005).

As of today, 39 of the original 42 FSAP measures have been agreed on at level 1 of the Lamfalussy process. This means that the respective legal acts, namely framework directives and regulations proposed by the Commission, have been adopted by the Council of Ministers and the European Parliament.<sup>24</sup> However, most of them have yet to pass the other levels of the process, which means that they still are to be implemented into the member states' codes of laws and that they still need to be enforced. Though the overall progress has been impressive, it has also been observed that some rules differ significantly after being incorporated into member states' laws. Yet for the integration process to be considered successful it is necessary that both issuers and exchanges can safely disregard jurisdictional and national borders when dealing with each other without having to bear additional costs.

Various trade organizations have pointed to this problem. For instance, the Federation of European Securities Exchanges (FESE) has identified a number of differences in the implementation of directives.<sup>25</sup> For example, the implementation of the Market Abuse Directive displays differences that are perceived to extend beyond the acceptable and necessary flexibility in transposing EU legislation into national law (FESE, 2004). Such differences impede competition between market participants and lead to obstacles for companies seeking the best listing opportunity. Furthermore, they are costly, they stifle innovation and prevent trading costs to decrease as desired. Within this process, implementation differences between member states are not the only source of impediments towards well working integrated capital markets. Firms have been complaining that the resulting rules are too complex and should rather be drafted in closer cooperation with the private sector (Murray, 2004). As a consequence, regulation may be overly restric-

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<sup>23</sup> The European Banking Committee (EBC), the European Insurance and Occupational Pensions Committee (EIOPC) and the European Securities Committee (ESC) form the Level 2 committees of national regulatory authorities. The Committee of European Banking Supervisors (CEBS), the Committee of European Insurance and Occupational Pension Supervisors (CEIOPS) and the Committee of European Securities Regulators (CESR) form the Level 3 committees of national supervisory authorities.

<sup>24</sup> Directives require the transposition into the respective national laws within a given time frame, whereas regulations apply directly to each member state without introducing or amending national laws.

<sup>25</sup> The FESE is the European counterpart of the WFE and represents and promotes the common interests of securities exchanges in Europe.

tive and over-prescriptive. The current debate covering the extension of the Directive on Markets in Financial Instruments (MiFID) to commodities derivatives trading serves as example.<sup>26</sup> Companies active in the business have expressed their concern that during Lamfalussy level 2 consultations the CESR does not sufficiently consider the costs and benefits imposed upon them (FESE, 2004).

## 2.4.2 Implications for Policy Makers

The recent organizational reshaping of the European securities trading industry landscape poses a challenge for policy makers. In particular, the emergence of legal entities operating in more than one jurisdiction and the transformation of the issuer exchange relationship has to be considered. These phenomena mark two distinct changes that have to be taken into account in the pursuit to create unified capital markets in Europe.

Organizations which operate stock markets in more than one European country have to report to different regulatory authorities according to the respective national laws. Making things worse, each report to national authorities is slightly different from the others and does not follow a fully standardized reporting procedure. Apparently, this is of limited benefit in terms of providing an accurate picture of the regulated entity, but is instead costly and causes a substantial amount of duplicate work. The same applies to multi-listed issuers. In fact, the European regulatory supervision of stock exchanges is highly fragmented and entrusted to around 60 bodies in 25 member states (Murray, 2004). This dense net of regulatory bodies with overlapping responsibilities does not only increase the cost for existing international stock exchanges, but also delays new cross-border activities by the unclear regulatory requirements caused by this fragmentation.

The CESR has identified the emergence of multi-jurisdictional market players as a key challenge to cope with. Yet the supervisory improvements considered by policy makers address the symptoms but not the causes of the problem. For example, CESR has mostly restricted their considerations to measures that can be put into place rapidly such as joint inspections and communication channels and consultations between the involved regulators (CESR, 2004). Though beneficial in the short run, these measures fail to resolve the problem in its entirety. To fully resolve the problem, two different approaches are being discussed. The first concept maintains the current regulatory institutions, but proposes the introduction of a lead supervisor, so that the respective institutions would deal with one supervisory authority only. This supervisor should be the single point of contact for the regulated institution and have the authority to decide on all reporting and

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<sup>26</sup> MiFID provides a passport for investment firms. It allows them to conduct cross-border activities across Europe after prior authorization from their local regulator.

authorization procedures (EFR, 2004). The second concept calls for a more centralized solution in the form of a central European body to control the single market and to oversee national regulators (Murray, 2004). Though this approach seems overambitious for the moment, it would yield not only the desirable benefit of having a European counterweight to the SEC in transatlantic regulatory affairs but also solve the problem of overlapping responsibilities of national regulators.

While the lack of a unified European regulatory framework for stock exchanges needs to be solved with highest priority, changes in the relationship between stock exchanges and issuers also require attention. For instance, Chapter 2.2 has demonstrated that signaling activities formerly performed by exchanges have shifted to other institutions. In particular, investors in financial assets increasingly rely on rating agencies' and analysts' opinions on their current or prospect investments. Rating changes and analysts' upgrades or downgrades have already become widely observed signals on a security's quality and influence markets significantly. To investors, their informational support provides substantial comfort regarding the risks and potential returns which makes these institutions more and more important for capital markets.

A rating agency's assessment of the risks associated with a security largely influences the cost of capital for the issuer. Despite their important role for investment decisions, rating agencies are private companies which are neither substantially regulated in Europe nor in the United States. However, recently a debate on rating agencies emerged on different levels and focused not only the highly concentrated structure of the industry but also the codes of conduct of the agencies (Schwarcz, 2002). In September 2003, the International Organization of Securities Commissions (IOSCO) published a technical statement, which formulates basis principles regarding the activities of credit rating agencies (IOSCO, 2003). In the U.S., the 'Credit Rating Agency Duopoly Relief Act' has been released in 2005 with the goal of lowering the barriers to entry for new rating agencies.<sup>27</sup> In Europe, there have been ongoing discussions on the creation of a state-funded European credit rating agency without leading to clear results. However, as the cited literature clearly shows, these discussions largely focus upon credit rating agencies. Other institutions providing ratings or analyses of equity prospects to investors like equity analysts or investment banks have not been paid attention to. As I argued in Section 2.2, these institutions replaced stock exchanges in providing capital markets with quality signals on firms.<sup>28</sup> Several cases of concealment of price relevant information and insider trading by

<sup>27</sup> A full-text version of the 'Credit Rating Agency Duopoly Relief Act' can be found online at [http://www.americansecuritization.com/docs/109th\\_HR2990.pdf](http://www.americansecuritization.com/docs/109th_HR2990.pdf). Latest visit on May, 26th, 2005.

<sup>28</sup> In the UK more than 1,000 firms are currently covered by stock market analysts who publish at least one report a year. In Germany this figure is about 550 and slightly less than 500 in France (I/B/E/S Database as of March 2005).

analysts have demonstrated how vulnerable the financial system is to improper behavior of these institutions. It might be hard to find an internationally agreed regulatory framework or a code of conduct for institutions rating equity titles. However, legislators might consider creating a uniform level of legal protection and compensation for investors suffering losses from misconduct of these institutions.

## 2.5 Conclusion

Over the past decades, the nature of the relation between stock exchanges and firms seeking a listing of their shares has changed considerably. In this paper, I argued that listing agreements once contained complex assignments of duties to the two parties involved and that many of these features have not necessarily been specified in the formal listing contract. However, most of them are no longer provided by stock exchanges but by other institutions which led to a reduction of the previously rather specific listing contract to a more or less standardized contract. In particular, stock exchanges are no longer the dominant source of corporate governance rules for listing firms nor do they necessarily provide clearing and settlement services. In addition, a listing on a major stock exchange is no longer a quality signal to investors who nowadays rely on information provided by stock market analysts and investment banks. Analyzing the actual specifications of listing agreements for five major stock markets, I demonstrated that the contractual features are converging and that listings are becoming a commodity. Moreover, listing fees constitute a decreasing share of the total revenues generated by stock exchanges which is a further indication that the value of the services provided to the listing firm actually decreased.

In Europe, these changes are accompanied by major structural changes of the financial landscape after the introduction of the single currency. Section 2.4 presented a brief overview over major topics currently debated by policy makers on a national and a European level in order to create a single capital market within Europe. The endeavors to reform European capital markets include efforts to implement a single regulatory framework for the provision of financial services and a simplification of cross-border clearing and settlement services (Lamfalussy and Giovannini Committee). A closer look at the European consultations on these questions reveals that major implications of the changing nature of the listing agreement have been considered. However, the proposals made still have to be implemented at their full scale and without significant differences so that both issuers and exchanges can safely disregard jurisdictional and national borders when dealing with each other. Furthermore, the current debate does not sufficiently reflect the increasingly important role of institutions providing investors with information and ratings on equity investments. While the regulation of credit rating agencies is contained in the discussions, there are no considerations on how to provide a framework for the monitoring of stock market analysts or investment banks whose recommendations have a strong impact on share prices. I hope that this paper further stimulates the discussions on this issue.

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# Chapter 3

## The Determinants of Demutualization\*

### 3.1 Introduction

A central thought in modern economic theory is the assumption that firms are owned by investors seeking profits who confer the right of control upon a management. Accordingly, the design of corporate institutions is based upon the idea of separation of ownership and control (Berle and Means, 1932; Jensen and Meckling, 1976). However, in a modern capitalist society we observe a variety of ownership and governance structures that mark an alternative to this investor-oriented view. Various firms of the tertiary sector like consultancies and law firms are owned and governed by their employees. Cooperatives operate successfully in sectors like insurance, banking or housing and are owned by their customers. While the various underlying institutional designs and governance structures as well as their economic characteristics have been analyzed at length (Hansmann, 1996), our understanding of the transformation of ownership structures remains vague and incomplete. Little attention has been paid to the reasoning behind firms' abandoning their traditional ownership structure and converting to others. The same applies to our understanding of the processes of transformation.<sup>1</sup> In this paper I seek answers to these questions by studying an exemplary industry that has recently been subject to a widespread change of ownership structures. The industry in the focus of my analysis is the securities exchange industry, which has witnessed a wave of demutualizations during the last decade.

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<sup>1</sup> Notable exceptions are the privatization of public companies and the demutualization of insurance companies, which have been in public focus and have therefore received a considerable amount of academic attention.

The technological advances of the late 20<sup>th</sup> century have caused securities exchanges around the globe to abandon their traditional mutual ownership structure in favor of a more open structure, which in its most advanced form has led them to a public listing of their equity. This process of transformation is referred to as demutualization. Despite a downright wave of stock exchange demutualizations, literature covering the topic remains scarce. Next to a few overall reviews (IOSCO, 2001; Aggarwal, 2002; Steil, 2002), and case studies (Akhtar, 2002b) only a few articles focussing on the efficient regulation of demutualized exchanges can be found (Karmel, 2002; Elliott, 2002). Surveying empirical research on financial innovation Frame and White (2004) contest “*a relative dearth of empirical studies that test hypotheses.*” This is even more the case when it comes to demutualization. Apart from Mendiola and O’Hara (2004) who analyze the post IPO performance and evaluation of demutualized stock exchanges and Krishnamurti et al. (2003) who compare the market quality of a mutual and a demutualized Indian stock exchange, there are no studies devoted to empirically dealing with this phenomenon. This finding is rather surprising since the demutualization of securities exchanges represents a major innovation to global capital markets. Yet a reason for this might be the scarceness of suitable data as well as the complexity of the research object. Stock exchanges can hardly be compared to regular corporations. Due to their position at the core of an economy, they are subject to stiff national and international regulation as well as various political and economic interests. This bars them from being analyzed in a purely microeconomic way. Instead, economy- and exchange-related factors can be causal for an accelerated or decelerated transformation speed.

To the best of my knowledge, this paper is the first to empirically analyze the determinants of demutualization. Comprehending why securities exchanges transform their ownership structures, requires a thorough understanding of their governance structures. Different jurisdictions, diverse regulatory systems and varying forms of governmental influence have created a plethora of ownership and governance structures among securities exchanges worldwide. The same applies to the various legal entities and organizational structures emerging and vanishing during the process of a demutualization. Yet a closer analysis reveals that this variety can be narrowed down to four distinct categories. Classifying exchanges on their transformative paths according to these categories allows for econometric analysis to be carried out and helps to illustrate the underlying economic principles and problems.

In this paper, I analyze the determinants of demutualization using a sample of 49 stock exchanges from 40 countries. Estimating binary response and ordered response models I show that both exchange-related and economy-related factors have an effect on

the propensity to demutualize. The results obtained do not only allow to assess the causes of demutualization, but also help to identify factors delaying the process. Among other results, I find that exchanges operating in small and open economies, demutualize early on. This effect becomes even stronger as the economic importance of an exchange for its home market declines. Furthermore, the larger the number of equity issuers that use an exchange as a listing venue, the larger becomes its probability to demutualize. However, the effect of the level of competition an exchange faces remains ambiguous.

The rest of this paper is structured as follows. Building on related theoretical literature Chapter 3.2 surveys the various forms of securities exchanges' ownership structures and the process of demutualization. Computerization and automation of the trading process are identified as critical triggers for this development. Subsequently, to guide the empirical analysis, hypotheses are derived. Chapter 3.3 describes the data set at hand and provides descriptive statistics on exchange- and economy-related variables. This is followed by a brief review of the econometric methodology employed. Finally, I discuss the results of the multivariate analysis. Chapter 3.4 concludes the paper with an outlook for further research activities.

## 3.2 The Determinants of Demutualization

### 3.2.1 The Process of Transformation

Stock exchanges as they are known today are the result of an evolutionary process lasting several centuries. Two events mark the origin of stock exchanges with formal governance structures: the relocation of trading activities from outdoor meeting places into closed premises and the enactment of rules for accession (Michie, 1986). Up to now, two fundamentally different forms of ownership and governance structures have emerged.<sup>2</sup> Historically, the prevailing form was characterized by an identity of owners and traders who formed a cooperative and limited the number of cooperative members. An exchange was not run for-profit on a corporate level, but rather for the individual benefit of its members. The inside-owners controlled all of the exchange's assets and took decisions on a democratic basis, so that each member was assigned one vote. In the following this kind of ownership and governance structure will be referred to as *closed*. During the last decade of the 20<sup>th</sup> century an alternative ownership and governance structure emerged and has been adopted by many exchanges since. This new form is no longer dominated by insiders. Instead, the exchange is run according to for-profit principles. Ownership changes hands and is dominated by outside investors, who take decisions on a one-share-one-vote basis. In the following this kind of ownership and governance structure will be referred to as *open*.

Stock exchanges with closed ownership structures evolve from a mutual agreement of individuals or institutions to operate a securities market collectively and to consume its services exclusively. Thus, the identity of owners and traders is established. In terms of Buchanan (1965) and Olson (1965) the resulting institutions can be characterized as exclusive clubs that provide an impure public good (exchange infrastructure and transaction services) to their members, but refuse access to others. Costs that occur due to the provision of the impure public good are covered by the clubs' members, who in turn enjoy the benefits of economies of scale. The thread of overcrowding and congestion requires rationing the number of members, since the good exhibits partial rivalry or excludability of benefits to a certain degree (Sandler and Tschirhart, 1980).

Hart and Moore (1996) show that stock exchanges with a closed ownership structures are prone to inefficient governance structures, which in turn cause economic inefficiencies. Members are inclined towards enforcing their individual interests instead of pushing the

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<sup>2</sup> A different approach is proposed by Lee (1998), who subdivides the organizational forms into three: "The three archetypical organizational structures that have most commonly been adopted by exchanges are the non-profit, the consumer cooperative and the for-profit forms."

overall profitability and efficiency of their exchange. Inefficiencies are mainly caused by the decision making system, which attributes one vote to each member and, thus, can be considered to be democratic. According to the *Median Voter Theorem*, the key role in such a decision making system is held by a pivotal voter, who secures a simple majority. Apparently, the preferences guiding the pivotal voter's decision can be opposed to overall welfare, leading to inefficient decision making. As the heterogeneity among members increases decision making becomes even more inefficient.<sup>3</sup> In the case of securities exchanges, heterogeneity among members can result from several sources. One is size or the turnover generated by an individual member and the specific market segment this turnover is generated in. A second source of heterogeneity are functional differences of members within the trading process (market makers vs. brokers).

The unsuccessful attempt of the London Stock Exchange to introduce a new electronic trading system serves as an illustration as it depicts the inefficiencies arising from a one-member-one-vote system. Traditionally, the exchange's trading system was a pure market maker system with electronic quote dissemination. In 1996, a small number of members, mainly American and Continental big banks who produced the heap of orders channeled into to the market favored the introduction of an electronic trading system with a public order book and an automated matching mechanism. Among the advantages of this system was a steep decline in transaction costs and an increase in pre- and post-trade transparency. Yet the attempt was blocked off by a large group of local market makers, who feared disintermediation and were actually profiting from the lack of transparency within the old system (Schmerken, 1996).<sup>4</sup>

Stock exchanges with open ownership structures share the common feature of lifted ownership restrictions and for-profit operations. By abolishing the identity of owners and traders the enable outside investors to buy into the company. Thus, they resemble the classical capitalist firm as described by Alchian and Demsetz (1972). Voting rights are distributed dependent on shareholding, so that one share equals one vote. It is essential to have no systematic overlap between investors, traders and management, but that non-members are free to buy into equity (Steil, 2002). Hart and Moore (1996) show that exchanges that are set up according to these principles overcome the inefficiencies inherent to exchanges with closed ownership structures. This proposition is backed by Schmiedel (2003) who analyzes the development of input-output relation of 17 European stock exchanges between 1985 and 1999 and finds that exchanges with open ownership

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<sup>3</sup> See Black (1948) for an overview over the Median Voter Theorem and the role of the distribution of preferences among members.

<sup>4</sup> Among others, similar conflicts have been reported for the New York Stock Exchange (Blume et al., 1993) and the NASDAQ (Steil, 2002).

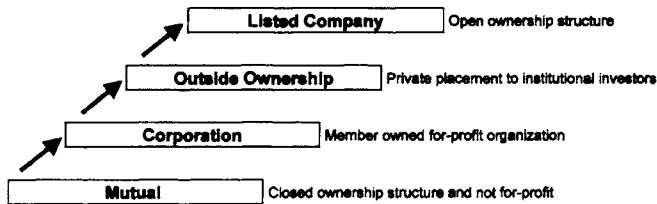


Figure 3.1: Stages of demutualization (adapted from Aggarwal (2002))

and governance structures display a positive effect on efficiency. Schmiedel assumes that improved efficiency is due to a better adjustment to technological advances and changes in the regulatory and economic surroundings. Hasan et al. (2002) come to similar results when studying the effect of for-profit orientation of an exchange and its cost efficiency. Krishnamurti et al. (2003) compare the market liquidity of two Indian stock exchanges with different ownership models and report similar results.

The process of transforming a stock exchange from a closed to an open ownership structure is called *demutualization*. In the following, I seek to comprise the different dimensions associated with this term and to analyze the stages of demutualization in more depth. Up to now, there is no consensus on a formal definition of the term. Instead, different authors put emphasis on different aspects. Akhtar (2002a) underlines the change of legal form and of the decision making system: "*Demutualization, in the strictest sense, refers to the change in legal status of the exchange from a mutual association with one vote per member (and possibly consensus-based decision making), into a company limited by shares, with one vote per share (with majority-based decision making).*" This definition underlines a central aspect of the phenomenon: A demutualization alters the institutional set-up of an exchange, yet the services provided remain unchanged. According to Steil (2002) an exchange can be considered to be demutualized if it operates for-profit instead of on behalf of its members. Yet he points out that there is more to the concept than the mere possibility of redistributing profits to members. Instead, terminating the mandatory identity of owners and traders and enabling outsiders to acquire equity is the central idea, as it ensures overcoming the economic inefficiencies and provides a clear-cut incentive scheme to the exchange's management.

Elliott (2002) and Aggarwal (2002) emphasize that demutualization is a dynamic process that takes place in stages. They describe demutualization as a gradual transformation from a mutually owned not-for-profit organization to a for-profit corporation owned by outside investors. In a first step, the exchange is turned into a joint-stock company without any change of ownership. Seats are turned into equally weighted share quotas. Next,

a number of shares may be placed with outside investors in the course of a private placement. New investors are often institutional investors or institutions that use the exchange as issuers, thus extending ownership to a different group of stakeholders. The final step ensures the implementation of free and unrestricted transferability of shares, enabling investors to engage in small and temporary investments. The most common way to do so is to list the shares of the exchange. Going public provides the best means to transfer shares in a standardized way at low transaction cost. Figure 3.1 displays the stages of demutualization.

The stages of demutualization vary in two dimensions: fungibility of shares and the potential for conflicts of interest among owners. The transfer of ownership in exchanges with closed ownership structures is object to stiff restrictions. Usually, ownership is acquired in connection with membership. Upon initial admission to the trading floor a new member takes a stake in the exchange simultaneously. This stake cannot be transferred to a third party. Instead, when terminating the membership the stake falls back to the exchange. An alternative to this system are markets for seats as often found in America.<sup>5</sup> Yet despite having in place a market mechanism for price discovery, ownership is restricted to market participants only and has to be approved by the present members. As described in the above, conflicts of interest among members or groups of members arise frequently. Overall, fungibility of shares and congruency of interest among members is low.

Turning an exchange into a joint-stock company somewhat increases the fungibility of shares, but does not eliminate conflicts of interest among members. Theoretically, a transfer of shares in a joint-stock company can be arranged at low cost, yet is often hindered by special provisions such as ownership caps and temporary prohibitions of sale.<sup>6</sup> Particularly, in the early stages of a demutualization the shareholders are identical with the former members, which interferes with running the exchange according to for-profit principles. Koendgen (1998) points out that usually during this stage of the transformation significant modifications of the governance structure cannot be observed.

The decisive step towards the effective harmonization of interest among owners is allowing outside investors to take a stake in an exchange. Institutional investors expect to earn an adequate return on their investment. Different from member owners, they take their decisions according to shareholder-value-maximization. The larger the stake of outside investors, the more individual interests are dominated by the intention to

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<sup>5</sup> For an extensive survey of the market for seats and its role for American securities exchanges see Schwert (1977) and Keim and Madhavan (1998).

<sup>6</sup> After converting into a joint-stock company, shares in the Toronto Stock Exchange Inc. were barred from sale for a two year period unless the board and the majority of shareholders approved. Additionally, ownership was limited to 5% of issued shares (Baikie, 2002).



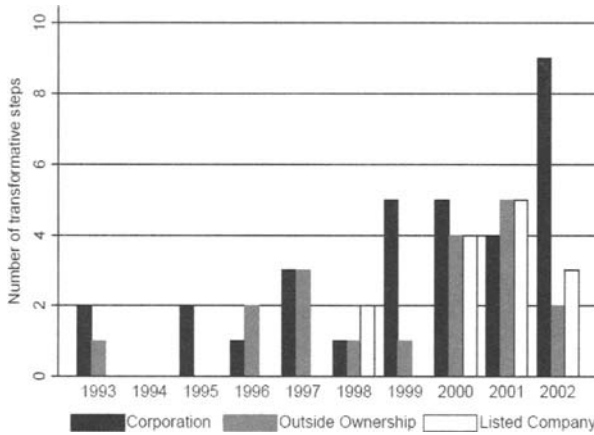


Figure 3.3: Transformative steps taken by securities exchanges worldwide between 1993 and 2002.

companies only a fraction of these are finally listed. Of the 32 stock exchanges engaged in the process of demutualization between 1993 and 2002 only 14 have sought to be listed publicly. Yet to some extent this difference is due to merger activity. Many exchanges, such as the Euronext, have initiated the demutualization process in order to be suited for a takeover or merger. As of today, this trend has not lost momentum. In 2005, the NYSE, the world's largest exchange in turnover and market capitalization, has announced to consider pursuing a demutualization.

### 3.2.2 Technological Change as Impetus

Several developments have caused securities exchanges to abandon their traditional ownership structures. Among these are increasing conflicts of interests among members and, especially in Europe, the rapid advances in the harmonization and standardization of financial markets regulation. Furthermore, increasing competitive pressure and an accelerating pace of concentration and consolidation in the industry can be stated (Elliott, 2002). However, the common root behind all of these developments are the technological advances of the past 20 years and the accelerating use of information and communication technology in the processing and execution of trading services. This has led to an almost

seamlessly automated and computerized value chain and has turned the competition for liquidity into a global one.<sup>7</sup>

Information and communication technology has altered and streamlined the provision of trading services fundamentally. In the past, data had to be fed into trading systems repeatedly and had to be adjusted to various interfaces at the cost of limited reliability. Nowadays, all relevant processes are gathered in one single system as automation and computerization virtually covers every single stage of the trading process. Among others, Domowitz and Steil (1999) demonstrate that automation enhances the transparency of markets and helps to bundle order flow.<sup>8</sup> Furthermore, it boosts the quality of execution and significantly cuts transaction costs. From an outside perspective, this can be perceived best at the core of the trading process, where price discovery takes place and supply and demand are matched. Until a few years ago, trades were executed on a busy trading floor with traders and market makers shouting and gesticulating. Today, with the exception of the NYSE all major exchanges maintain automated trading systems that cover the bulk of trades. Remaining trading floors are gradually abandoned in favor of computerized trading. This is mainly due to their higher execution reliability, instantaneous matching and reduced transaction costs. Furthermore, automation increases market efficiency. Gruenbichler et al. (1994) were the first to show that adopting an automated trading system enhances the capacity of markets to process information and the speed of pricing. Brailsford et al. (1999) support this view.

The impact of automation is not limited to internal processes but has also considerable effects for the competition among stock exchanges. Especially, the application of information and communication technologies to order routing has enabled investors to choose among various exchanges for best execution and has decoupled the location of the investor from the location of execution. Given the choice among several markets, investors typically pick the exchange that provides most liquidity, while offering quick and reliable execution and charging low fees. Thus, automation has brought to an end the classical market structure of local monopolies. Furthermore, the introduction of alternative trading systems has introduced competition for liquidity in identical securities.

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<sup>7</sup> Similarly, waves of demutualization in other industries have been caused by technological, regulatory or institutional changes of disruptive nature. For instance, many mutual insurance companies in the United States have opted for demutualization after the repeal of the Glass-Steagall Act (Chaddad, 2003).

<sup>8</sup> Opposing evidence is provided by Venkataraman (2001) who compares the trade execution costs of an automated exchange and a floor-based trading platform. Venkataraman's approach is based on an algorithm that matches securities on firm-specific characteristics. Yet his results may be affected by fundamental legal, regulatory and economic differences since the two exchanges he studies are based in different countries with unequal trading laws and differing degrees of competition.

Increasing competition among stock exchanges is facilitated by the fact that national capital markets grow together and by the harmonization of capital market regulation. Not long ago, listing a company on an exchange other than its home market was hindered by national conventions and restrictive legislation. Today, a competition for listings begins to unfold gradually. This competition is mostly restricted to secondary listings, which companies take up outside of their home market in order to access foreign investors. Yet there is also a limited competition for primary listings. For example, a large number of companies from Israel has decided to list on NASDAQ (Pagano et al., 2002) and *e-centives*, a Maryland based company, is listed in Switzerland only.<sup>9</sup> In such an increasingly competitive environment, a successful demutualization is an effective means for an exchange to sustain its competitive position. The transformation towards an open ownership structure resolves a number of deficits inherent in the mutual structure and aligns owners' interests with profit maximization.

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<sup>9</sup> For a detailed discussion on the competition for listings and the development of the exchange issuer relationship see Chapter 2 of this thesis.

### 3.2.3 The Determinants of Demutualization

The objective of this study is to identify the determinants of demutualization and to gain insight on the driving forces behind the fundamental changes in the securities trading industry. The decision to transform an exchange's ownership structure is influenced by both shareholders and stakeholders such as issuers and the local government. Decisions by both groups are motivated by factors that can either be related to the specific exchange or to the economy in which the exchange operates. Differences in these factors among stock exchanges can either accelerate or delay the process of demutualization. Exchange-related factors include variables that are apt to assess a single exchange's competitive position within the industry. Economy-related factors include variables that characterize the overall economy, in which a specific exchange operates.

The decision to demutualize is taken by the member-owners unless mandatory legal provisions oblige them to do so. Member-owners will only consent to giving up control over their exchange if maintaining the traditional form of ownership results in decreasing demand for intermediation services and thus in reduced profits. Especially owners of smaller exchanges face this situation, when experiencing the effects of automation and computerization of the industry. Turnover is shifting to larger and more liquid exchanges that dispose over more efficient trading systems and can afford to charge lower trading fees due to economies of scale. Opening up ownership for outside investors and transforming an exchange to act more efficient and closer to the market's needs becomes a viable option. For instance, the Greece stock exchange in Athens managed to raise turnover by a factor of ten after admitting outside investors in 1997 and floating the company in 2000. In contrast, owners of large exchanges are likely to display a reluctance to transform their organization since it generates sufficient profits. Along this line of argumentation, I suppose that member-owners of smaller exchanges with lower turnover volumes, are likely to agree on a demutualization earlier than member-owners of larger exchanges (H1).<sup>10</sup>

Together with the overall size of an exchange its competitive position is an important factor when deciding on the transformation of ownership. Member-owners of exchanges that do not face severe competition can be assumed to be interested in maintaining *status quo*. As long as providing intermediation services for issuers and investors generates sufficient profits, they have no incentive to give up control. Little competitive pressure can be assumed if an exchange lists securities exclusively or if other trading venues do not carry a substantial share of volume in multiply listed securities. In this study, the level of market activity serves as a proxy measure for the intensity of competition. Market

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<sup>10</sup> Table 3.1 provides an overview over all the hypotheses derived in this chapter.

Table 3.1: Hypotheses

Overview over the hypotheses for the multivariate analysis. H1 - H3 cover exchange-related hypotheses. H4 - H6 cover economy-related hypotheses.

Variable	Effect as presumed
Exchange-related hypotheses:	
H1 <i>ln_vol_equity</i>	The size of an exchange exerts a negative influence on an exchange's propensity to demutualize
H2 <i>velocity</i>	The level of competition an exchange faces exerts a negative influence on an exchange's propensity to demutualize
H3 <i>ln_listings</i>	The number of equity issuers on an exchange exerts a positive influence on an exchange's propensity to demutualize
Economy-related hypotheses:	
H4 <i>cap_to_gdp</i>	The economic importance of an exchange exerts a negative influence on on the propensity to demutualize of an exchange located within
H5 <i>openness</i>	The degree of openness of an economy exerts a positive influence on the propensity to demutualize of an exchange located within
H6 <i>ln_gdp</i>	The size of an economy exerts a positive influence on the propensity to demutualize of an exchange located within

activity is often measured using turnover velocity and is calculated as the ratio of overall turnover value of all listed equity securities and their market capitalization. Thus, it represents a measure of the liquidity a market generates as well as of its quality (Hasan and Schmiedel, 2003). Concentrating trading of listed securities in one single trading venue causes high trading velocity. Contrary, fragmented trading or illiquidity in listed securities evokes in low trading velocity. H2 assumes that increased trading velocity exerts a negative influence on the decision to demutualize.

Considerations on the preferability of a transformation on the member-owners' side are complemented by views on the same subject by other stakeholders. Equity issuers use an exchange to raise capital and have a strong interest in ensuring that trading in their securities is highly liquid. They can press the respective governing bodies to improving the efficiency of trading systems in order to reduce trading costs by threatening to take their listing to a different exchange. Domowitz and Steil (2002) show that a decrease of 10% in trading cost reduces an issuer's cost of equity by 1.5%. Apparently, this provides a strong incentive for equity issuers to urge to reforms the exchanges on which they list. Accordingly, I presume the number of equity issuers on an exchange to be positively related to the propensity to demutualize (H3).

The reason for not restricting the analysis to exchange-related factors only but for also extending it to economy-related factors stems from King and Levine (1993) and related studies: financial markets play a crucial role for the frictionless functioning of economies and are a precondition for economic growth. However, this effect is not onesided. The characteristics of an economy contribute largely to the potential development and transformative dynamics of the financial institutions within (Rajan and Zingales, 2003). Considering these factors may prove helpful for understanding the transformational process of the securities exchange industry.

Due to their immanently important economic role, many industrialized countries have put barriers to an uncontrolled transformation of their capital markets.<sup>11</sup> In many cases, governments or regulators have to approve changes directly. It is in their interest to assure that a for-profit exchange is able to maintain efficiency, integrity and fairness in trading and complies with its regulatory and market supervision duties (Elliott, 2002).<sup>12</sup> Such considerations gain importance as the economic importance of an exchange increases, since a malfunctioning of the exchange would affect large parts of the economy. Along this line of argumentation, the demutualization of an exchange may be significantly delayed due to its economic importance. Thus, H4 assumes that increased economic importance of an exchange exerts a negative influence on the propensity to demutualize.

Steil (2002) has argued that the internationalization of member-owners acts as a accelerator to demutualization. Smaller members that are active on one exchange only do often belong to the specialist and market-maker group and vote if favor of keeping up *status quo*. In particular, they reject any effort to modernize the trading system, as it bears the thread of disintermediation. Contrary, large international banks and other financial institutions that possess memberships rights on several exchanges are strongly declined towards a transformation of trading systems and ownership structures. Demutualization enables them to lift the equity value of their assets and according to their strategic needs either to increase or to terminate their position in an exchange. Typically, these large members are not long-time owners in an exchange, but have acquired their holdings by ways of acquisition of other banks or traders. Economies that enable such acquisitions are usually characterized by a strong degree of openness in both goods and capital flows. This argumentation is supported by Rajan and Zingales (2003) who find that there is a positive connection between an economy's degree of openness and the development and

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<sup>11</sup> Otto Naegeli, former head of EUREX and member of the board of Swiss Exchange is quoted in Angel (1998): "*Sometimes I have the impression that national stock exchanges are regarded like national airlines. A country needs one to prove its autonomy.*"

<sup>12</sup> Karmel (2002) also points to the unfavorable possibility of a fully demutualized exchange that has to oversee both its own listing as well as a direct competitor's. Though being bound to fixed rules it might be declined to interpret vaguely formulated rules in its own favor or to a competitor's disadvantage.

advances of its financial system. Therefore, I assume that the propensity to demutualize increases as the degree of openness of an economy increases (H5).

The first exchanges to initiate the process of demutualization were the exchanges of Stockholm, Helsinki and Copenhagen. All three operate in comparatively small economies and had thus found themselves in rather weak competitive positions. On the one hand, they were attracting only comparatively small trading volumes in mostly local companies. On the other hand, they faced severe competitive pressure by foreign competitors. For example, in 1999, seven of the 20 most liquid Swedish shares were simultaneously traded on the London Stock Exchange. This resulted in a considerable loss of trading volume for the Stockholm exchange. This evidence indicates that there is a potential link between an economy's size and the probability of a demutualization of the local exchange. Small potential markets and competitive pressure force them to reform. Accordingly, H6 assumes both to display a negative correlation.

## 3.3 Empirical Investigation

### 3.3.1 Data Set and Variables

The empirical analysis of the determinants of ownership changes in the securities exchange industry is based on a cross-sectional data set that contains both exchange-related and economy-related variables. Thus, the data comprises both the competitive situation of an individual exchange and the characteristics of the economy, in which it operates. Data has been gathered by combining information from various sources. Exchange-related data was obtained from the *World Federation of Exchanges*.<sup>13</sup> This has been supplemented and completed with data that was obtained from the individual exchanges. Economy-related data was taken from *Bloomberg* and *Datastream* and was supplemented with data from various national statistical offices. Originally, most of the data was on monthly basis, but has been aggregated to quarterly basis in order to avoid random fluctuations in single months.

Two constraints have been imposed upon the selection of the sample. First, exchanges without an equity market have been barred from entering the sample. This excludes pure derivative and commodity exchanges such as the Chicago Board of Trade or the Chicago Mercantile Exchange. Second, I include only those exchanges, for which data for the first quarter 1995 is available. These constraints reduce the sample to 49 exchanges from 40 countries. Though this number seems to be rather small to allow for a multivariate empirical analysis, the sample includes almost the entire securities exchange industry. The World Federation of Stock Exchanges, the industry's main body, currently comprises of 54 members. The missing exchanges that failed to provide sufficient data are either extremely small (e.g. Bermuda Stock Exchange) or operate in transforming economies (e.g. Shanghai Stock Exchange).

The final sample consists of a cross-sectional data set for the first quarter 1995 plus the ownership structure as of January 1<sup>st</sup> 2003.<sup>14</sup> Apparently, this procedure connects observations from two points in time. It has been selected because of the dynamic nature of the underlying transformation process of ownership structures. In order to identify the determinants of the transformation, one cannot collect data on cause and effect at the same point in time. Table 3.7 contains an overview over the exchanges included in the sample as well as their ownership structure as of January 1<sup>st</sup> 2003.

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<sup>13</sup> The *World Federation of Exchanges* is the international trade organization for regulated securities and derivative markets. It collects, aggregates and issues market data from its members and makes them available to the public.

<sup>14</sup> Ownership structures of exchanges that were object to merger or acquisition between 1995 and 2003 have been equated with that of the respective successor organization.

Table 3.2: Sample statistics

This table contains summary statistics for the entire sample of 49 exchanges as of the first quarter 1995. The analysis excludes pure derivatives and commodity exchanges. Exchange-related variables include the total value of shares traded across all market segments (*vol.equity*), the total value of bonds traded (*vol.bond*), the level of market activity proxied by its turnover velocity (*velocity*), the number of domestic and foreign listings (*listings*) and the market capitalization of domestic listings (*marketcap*). Economy-related variables include the degree of openness of the economy the exchange is located in (*openness*), its gross domestic product (*gdp*), imports and exports and a measure of importance of the exchange for the local economy proxied by the degree to which the economy is capitalized (*cap.to.gdp*).

		$\bar{x}$	$\tilde{x}_{0.5}$	<i>s.d.</i>	<i>MIN</i>	<i>MAX</i>
exchange-related variables	<i>vol.equity</i>	51658.71	8698.24	119892.10	166.87	674980.70
	<i>ln.vol.equity</i>	9.18	9.07	1.92	5.12	13.42
	<i>vol.bond</i>	56455.63	338.69	154827.20	.0	847422.50
	<i>ln.vol.bond</i>	6.09	5.83	4.28	.0	13.65
	<i>velocity</i>	14.53	11.13	14.14	.60	69.37
	<i>listings</i>	633.94	320.67	819.33	19.00	4898.67
	<i>ln.listing</i>	5.92	5.77	1.05	2.94	8.50
	<i>marketcap</i>	396542.50	122484.10	872219.90	262.27	4445914.00
economy-related variables	<i>cap.to.gdp</i>	53.38	33.43	51.43	.71	230.74
	<i>openness</i>	62.18	50.85	55.27	13.64	275.82
	<i>gdp</i>	255402.60	63324.10	450484.80	4385.10	1432800.00
	<i>ln.gdp</i>	11.30	11.06	14.81	8.39	14.18
	<i>exports</i>	36856.71	18786.80	42974.73	1258.20	138977.00
	<i>imports</i>	38367.73	18489.50	48748.36	1923.30	177533.00

Table 3.2 presents the descriptive statistics for the sample.<sup>15</sup> Exchange-related factors include parameters that are appropriate to assess the competitive position of an exchange. *vol.equity* (million of USD) is the total value of domestic and foreign shares traded across all market segments. If denoted in foreign currencies figures have been converted using end of month rates. To avoid double counting trades in investment funds have not been included. For the same reason only one site of the transaction has been considered. The average turnover during the first quarter 1995 was 51.7 billion USD. The smallest turnover was registered for Luxembourg, the largest for the NYSE. Apparently, this variable is considerably skewed to the right, since only a few exchanges share the bulk of the turnover.<sup>16</sup> Therefore, I use a log-transformation, *ln.vol.equity*, in the multivariate estimations.

The total value of trading in domestic and foreign, public and corporate dept (*vol.bond*) has been measured in the same way. The average turnover amounted to 56.4

<sup>15</sup> Additionally, Table 3.8 displays the correlation matrix for all variables that have been included into the multivariate analysis. Although some of the correlations register above 0.5, there are no significant signs of multicollinearity. An analysis of the variance inflation factors showed an average of 3.02 without any noteworthy outliers.

<sup>16</sup> The NYSE snaps up 26.6% of the entire transaction value of the first quarter 1995, followed by 16.3% seized by NASDAQ and 11% market share for the London Stock Exchange.

billion USD, with Milan seizing the highest share. Eight exchanges did not register any trading in debt securities.<sup>17</sup> Therefore, taking the logarithm to reduce the skewness is inappropriate. Instead, the variable was transformed in the following way

$$\ln\_vol\_bond = \ln(vol\_bond + 1), \quad (3.1)$$

taking on zero for exchanges that do not trade in bonds.

Turnover velocity (*velocity*) is the ratio of the overall turnover value of all listed equity securities and their market capitalization

$$velocity = \frac{vol\_equity}{marketcap} * 100. \quad (3.2)$$

It proxies the level of market activity of an individual exchange and the intensity of trading in listed securities. Following Hasan and Schmiedel (2003) turnover velocity also controls for the quality of a particular market. A value larger than 100 indicates that turnover exceeds the value of all shares outstanding within the period of time under regard. For this sample, the average turnover velocity registers at 14.53, indicating that trades in equities amounted 14.53% of the average market capitalization. The lowest value is recorded for Luxembourg, the highest for Ljubljana.

The variable *listings* reflects the number of domestic and foreign companies listed on a specific exchange. Investment companies and listed funds have been excluded. Firms with more than one equity issues have been counted once only. The values stated correspond to the mean value for the quarter. The smallest number of listings is recorded for Ljubljana, the largest for NASDAQ. Again, the variable is transformed to *ln.listings*.

The final exchange-related factor is *marketcap*, which comprises out of the product of overall value of all shares outstanding by domestic firms and their respective stock price at month end. Investment funds, options, futures, convertibles and foreign securities have been excluded. Figures are reported in million USD and have been converted to USD using end of month rates if necessary. Again the value displayed equals the quarter's mean. While the average market capitalization amounts to 397 billion USD, the smallest exchange (Ljubljana) has a market capitalization of 262 million USD only. In terms of this variable, the NYSE is the world's largest market.

Economy-related variables contain parameters that are apt to describe the characteristics of the economy, in which a specific exchange operates. *gdp* is the gross domestic

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<sup>17</sup> AMEX, Chicago, Hong Kong, Jakarta, Manila, Rio de Janeiro, Sao Paulo and Toronto.

product of the economy and measures the amount of economic production in million USD. Observations in foreign currencies have been converted to USD using end of quarter rates. The United States represent the largest economy in the sample, Luxembourg the smallest. Again, the variable is transformed to  $\ln\_gdp$ .

The variable *exports* reflects the value of goods and services an economy sells to others. Figures have been aggregated over the quarter's months and are reported in million USD. Again, values denoted in foreign currencies have been converted using end of month rates. The largest exporter in the sample are the United States, the smallest being Greece. *imports* contains the value of goods and services an economy buys from others. Largest and smallest importer in the sample are the United States and Peru. Calculation procedures are identical to those employed for *exports*.

The degree of openness of an economy is approximated by the degree to which an economy transacts with other economies. Analogous to Rajan and Zingales (2003) it is derived by calculating the ratio of a country's trade volume and GDP

$$openness = \frac{imports + exports}{gdp} * 100.^{18} \quad (3.3)$$

On average, openness registers at 62.18. The most open economy of the sample is Singapore, while Brazil is the least open.

Finally, market cap to GDP ratio (*cap.to.gdp*) is a hybrid variable that encloses both exchange- and economy-related information. It captures the degree to which an economy is capitalized and thus mirrors an exchange's importance for its home economy. Rajan and Zingales (2003) use this indicator to reflect the level of development of an economy. For annualization the denominator is multiplied by four, so that

$$cap.to.gdp = \frac{marketcap}{gdp * 4} * 100. \quad (3.4)$$

Values larger than 100 indicate that an exchange's market capitalization exceeds its economy's GDP. The average value is 53.38. Vancouver records the lowest ratio and Kuala Lumpur the highest market cap to GDP ratio. Apparently, this exchange acts as the dominant source of capital for its economy.

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<sup>18</sup> Alternatively, openness could also be calculated deploying capital flows. However, consistent data was unavailable for the 40 countries in this sample for the year 1995.

Table 3.3: Modeling of the dependant variable

This table displays the modeling of the dependant variable for the regression models. The dependant variable captures the ownership structure as of January 1<sup>st</sup> 2003. Different classifications have been used in order to account for the difficulties in clearly determining at what stage an exchange can be considered to be fully demutualized.

Dependant Variable	Binary Response Models		Ordered Response Model
	Reg I <i>ipo</i>	Reg II <i>outown</i>	Reg III <i>demutstatus</i>
Mutual	0	0	0
Corporation	0	0	1
Outside Ownership	0	1	2
Listed Company	1	1	3

### 3.3.2 Methodology

To derive the determinants of demutualization I estimate test three regression models, two binary response models and one ordered response model.<sup>19</sup> These models differ in the way the dependant variable is modeled. Binary response models are estimated using a narrow and a wide definition of demutualization. For the ordered response model, a dependant variable has been constructed that mirrors the progression of the transformation process. The categorization of this variable is identical to the ordinal process of demutualization as introduced in Chapter 3.2.1. The idea behind this three step procedure is to take into account the difficulties in clearly determining at what stage an exchange can be considered to be fully demutualized. Besides, this procedure allows to inspect the regression results more thoroughly, which seems to be appropriate due to the small size.

Table 3.3 summarizes the modeling of the dependant variable, ownership structure as of January 1<sup>st</sup> 2003, for all three regression models. The dependant variables reflects the ownership structure of a specific exchange as of January 1<sup>st</sup> 2003. *ipo* and *outown* are binary response variables that take on two mutually exclusive values. Hence, using regressions models for binary dependant variables is the apt procedure.<sup>20</sup> Binary response models are based on a structural equation with a latent dependant variable:

$$y_i^* = x_i\beta + \epsilon_i, \quad (3.5)$$

<sup>19</sup> Similar kinds of regression models are employed by Clayton et al. (1999) for determining what kind of trading mechanism exchanges select.

<sup>20</sup> The following illustration draws from Long and Freese (2003)

where  $i$  indicates the realizations of the random variable and  $\epsilon$  is the random error. It is important to note that  $y^*$  is a latent variable that cannot be observed. However, it is linked to the observable variable in the following way:

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases} \quad (3.6)$$

For a given vector  $x$  of the independent variables the probability of the event occurring is

$$Pr(y = 1|x) = Pr(y^* > 0|x). \quad (3.7)$$

Via substitution of equation (3.5) we obtain

$$Pr(y = 1|x) = Pr(\epsilon > [\alpha + \beta x]|x). \quad (3.8)$$

Thus, the probability of the event occurring depends on the distribution of the random error. Usually, this distribution is modeled in one of two ways, either probit or logit. Eventually, both ensure that the probability takes on values between zero and one. In this paper, I employ a probit distribution that assumes that  $\epsilon$  is distributed normally with  $E(\epsilon) = 0$  and  $Var(\epsilon) = 1$ . This gives us the following specification for the model:

$$Pr(y = 1|x) = \int_{-\infty}^{\alpha + \beta x} \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{t^2}{2}\right) dt \quad (3.9)$$

The independent variables are estimated using Maximum-Likelihood. Given the values of the independent variables, the probability of the event occurring is the cumulative density function of the random error

$$Pr(y = 1|x) = F(x\beta). \quad (3.10)$$

To assess the goodness of fit of a probit model either a  $\chi^2$ -distributed likelihood ratio test or a *Pseudo R<sup>2</sup> Test* (often *McFadden R<sup>2</sup> Test*) can be employed. Both tests make use of the distance between the maximum loglikelihood of an unrestricted model ( $\log(L_{UR})$ ) and a fully restricted model ( $\log(L_R)$ ) with an intercept only. Degrees of freedom equal the difference of dimensions of both models. The likelihood-ratio is defined as

$$LR = 2[\log(L_{UR}) - \log(L_R)] \quad (3.11)$$

and the *McFadden R<sup>2</sup>* with values between zero and one as

$$McFadden R^2 = 1 - \frac{\log(L_{UR})}{\log(L_R)}. \quad (3.12)$$

However, there is a caveat to these measures. Kennedy (2003) underlines that none of the goodness-of-fit figures are sufficiently reliable and generally accepted. Furthermore, Greene (2003) cautions against overinterpreting these measures and rather highlights the importance of the statistical and economic significance of the explanatory variables.

Apart from the two probit models, I also estimate a model for ordinal outcomes using the dependant variable *demutstatus* that captures the progress of the demutualization process. As for the probit model, the ordered-probit model is based on a regression model with a latent variable and can be derived from the same structural model (3.5). Yet the possible outcomes of  $y^*$  are extended to  $J$  ordinal categories,

$$y_i = m \quad \text{if} \quad \tau_{m-1} \leq y_i^* < \tau_m \quad \text{for} \quad m = 1 \text{ to } J, \quad (3.13)$$

so that the cut-points  $\tau_1$  to  $\tau_{J-1}$  can be estimated. For a given vector  $x$  of the independent variables the probability for  $y = m$  to be occurring equals

$$Pr(y = m|x) = F(\tau_m - x\beta) - F(\tau_{m-1} - x\beta), \quad (3.14)$$

where  $F$  is the cumulative density function of the normally distributed error term  $\epsilon$  with  $Var(\epsilon) = 1$ . The goodness-of-fit measures for an ordered response model can be obtained in the same way as for the binary response models.

### 3.3.3 Estimation Results

Table 3.4 presents regression results from estimating regression I. The response variable for this regression is *ipo*, taking values of one for listed exchanges and zero otherwise. This notion of demutualization is rather narrow as it focusses on exchanges that have completely opened up ownership to anonymous investors (cf. Table 3.3).<sup>21</sup> The table displays estimates for the coefficients of the independent variables as well as discrete and marginal

<sup>21</sup> A univariate analysis stratified by the binary outcomes of the dependent variable is provided in Table 3.9.

effects. A positive coefficient indicates that an increase in the independent variable leads to a greater likelihood of demutualization. Contrary, a coefficient with a negative sign indicates that an increase in the predictor variable leads to a smaller probability of demutualization. Discrete and marginal effects report a change in the predicted probability to demutualize due to a variation in a regressor variable while keeping the other independent variables constant at their means. *Min* → *Max* displays the difference in the predicted probability to demutualize as the independent variable changes from the sample minimum value to the sample maximum value. The hypothesis that the coefficients of all independent variables are jointly equal to zero is rejected due to the highly significant likelihood-ratio test statistic. *McFadden R<sup>2</sup>* registers at 0.473.

The coefficient for the number of equity issuers (*ln\_listings*) is positive and significant. This supports hypothesis H3 and indicates that the propensity to demutualize increases as the number of equity issuers augments. A plausible explanation for this effect is that a demutualization unlocks efficiency gains in trading, which yields beneficial effects on the cost of capital for listed companies (Domowitz and Steil, 1999). Thus, equity issuers have a strong incentive to work towards a demutualization. Since the interpretation of the overall value of the coefficients has its limits from a strictly economic point of view, I assess the size of the effect by using the discrete and marginal effects of the explanatory variable. To do so, I derive the difference in probabilities of the event occurring resulting from a variation of one independent variable while keeping all other variables constant at their mean. Thus, the likelihood to demutualize increases by 36.5% if *ln\_listing* is altered by half a standard error. This roughly equals the difference between the exchanges of Djakarta (222 listings) and Hong Kong (528 listings).

The coefficient for the intensity of competition a market faces (*velocity*) is negative and insignificant. Thus, it fails to support hypothesis H2. There are two possible explanations for this. Either, the intensity of competition does not have a significant influence on an exchange's probability to demutualize or the measure velocity fails to capture the intensity of competition properly. Low velocity can result from two sources: fragmented trading and investors favoring long holding periods. However, with the data at hand one cannot distinguish between the two effects. Thus, the causes of the observed effect remain ambiguous. Contrary to hypothesis H1, the coefficient for *ln\_volEquity*, the variable that captures the overall size of an exchange, is positive and significant. This indicates that larger exchanges have a higher probability to demutualize. A possible explanation for this could be owners interest in quickly turning their valuable assets into transferable shares. Furthermore, larger exchanges may have an advantage over smaller exchanges in fully

Table 3.4: Binary response regression - model I

Regression results from estimating regression I; the response variable is *ipo* (1 = listed exchanges; 0 = otherwise); discrete and marginal changes in the predicted outcomes are computed with all other regressors fixed at their respective means; *Min* → *Max* displays the change in predicted probability as the independent variable changes from the sample minimum to the maximum sample value;  $dF/dx$  is the partial derivative of the independent variable; *Std.Err*  $dF/dx$  is the standard error of the marginal effect; *LR Chi*<sup>2</sup> displays the likelihood ratio test; *McFadden R*<sup>2</sup> indicates the goodness of fit; \*\* and \* denote significance at the 5% and 10% level respectively.

	<i>Coef.</i>	<i>Std.Err.</i>	<i>Discrete and Marginal Effects</i>		
			<i>Min</i> → <i>Max</i>	$dF/dx$	<i>Std.Err.</i> $dF/dx$
<i>ln_vol_equity</i>	.967**	.456	.999	.215**	.083
<i>ln_vol_bond</i>	.033	.065	.103	.007	.015
<i>velocity</i>	-.045	.036	-.324	-.010	.007
<i>ln_listings</i>	1.546**	.503	.998	.343**	.119
<i>cap_to_gdp</i>	-.052**	.020	-.948	-.011**	.034
<i>openness</i>	.037**	.013	.998	.008**	.003
<i>ln_gdp</i>	-1.323**	.586	-.997	-.293**	.106
<i>.cons</i>	-3.256	2.890			
<i>N</i>	49				
<i>LR Chi</i> <sup>2</sup>	28.57**				
<i>McFadden R</i> <sup>2</sup>	.473				

reaping the benefits of a demutualization due to potential economies of scale, which gives them an additional incentive to demutualize early.

Analyzing the coefficients of the economy-related factors yields evidence supportive of the hypotheses. The coefficient for *cap\_to\_gdp*, the variable that covers the degree to which an economy is capitalized, is negative and significant. This indicates that a demutualization becomes less likely as the economic importance of an exchanges rises. The likelihood to demutualize increases by 58.7% if *cap\_to\_gdp* is altered by half a standard error. This roughly equals the difference between the economic importance of the exchanges of Denmark (27,97) and the NYSE (77,57). On the contrary, the degree of openness of an economy (*openness*) has a positive and significant influence. Apparently, economies that keep up close commercial ties with other countries are more open towards reforming their capital markets. This confirms existing evidence provided by Rajan and Zingales (2003). Altering *openness* by half a standard error (approximately the difference between the openness of Spain (35,3) and the Netherlands (82,72)) increases the propensity to demutualize by 45,7%. Finally, the negative and significant coefficient for *ln\_gdp* indicates that demutualizations are more likely to occur in smaller economies. Varying *ln\_gdp* by half a standard error (approximately the difference between Norway (37 billion USD) and Brazil

(159 billion USD) while keeping all others variables constant at their mean increases the likelihood to demutualize by 43,9%.

Table 3.5 displays the estimates for the second binary response regression model.<sup>22</sup> Different from the first regression, the response variable *outown* captures a broader notion of the term demutualization. It equals one for listed exchanges and those with outside investors (cf. Table 3.3). Again, estimates for the coefficients of the independent variables and discrete and marginal effects are displayed. The hypothesis that the coefficients of all independent variables are jointly equal to zero is rejected due to the highly significant likelihood-ratio test statistic. *McFadden R<sup>2</sup>* registers at 0.398. However, it is important to note that this value cannot be put in comparison with the *McFadden R<sup>2</sup>* of regression I since the dependant variable has been altered.

By and large, the second regression model supports the results of the first. With one exception, there are no considerable differences in coefficients or significance levels. Solely, the coefficient for *ln\_gdp* drops to 10%-level significance. Since the second regression model confirms the results of the first we can infer that listed exchanges and exchanges with an outside investor are quite alike and operate in similar economic environments. A possible explanation for this is that granting ownership rights to outside investors marks the decisive change in the transformational process towards for-profit orientation. Along this line of argumentation it is represents an intermediate step only in the process of listing an exchange. A different explanation could be that the parameters considered in this analysis do not have a significant explanatory power to capture the progress of this process accurately.

Finally, Table 3.6 shows the estimation results from regression model III.<sup>23</sup> For this model, estimation procedures have been modified. Instead of estimating a binary response model as for regression I and II, I estimate an ordered response model. The dependant variable *demut\_status* measures the progress of the process of demutualization on a ordinal scale with four values (cf. Table 3.3). In line with Aggarwal (2002), I assume that the process of demutualization can be decomposed into four consecutive stages: Mutually owned, for-profit corporation without outside ownership, for-profit corporation with outside ownership and publicly listed entity. Marginal effects are displayed separately for the four different stages of the process. Again, the highly significant likelihood-ratio test statistic permits to reject the hypothesis that the coefficients of all independent variables are jointly equal to zero. *McFadden R<sup>2</sup>* registers at 0.21.

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<sup>22</sup> A univariate analysis stratified by the binary outcomes of the dependant variable is provided in Table 3.10.

<sup>23</sup> A univariate analysis stratified by the ordered outcomes of the dependant variable is provided in Table 3.11.

Table 3.5: Binary response regression - model II

Regression results from estimating regression II; the response variable is *outown* (1 = listed exchanges or exchanges with outside ownership; 0 = otherwise); discrete and marginal changes in the predicted outcomes are computed with all other regressors fixed at their respective means; *Min* → *Max* displays the change in predicted probability as the independent variable changes from the sample minimum to the maximum sample value;  $dF/dx$  is the partial derivative of the independent variable; *Std.Err*  $dF/dx$  is the standard error of the marginal effect; *LR Chi*<sup>2</sup> displays the likelihood ratio test; *McFadden R*<sup>2</sup> indicates the goodness of fit; \*\* and \* denote significance at the 5% and 10% level respectively.

	<i>Coef.</i>	<i>Std.Err.</i>	<i>Discrete and Marginal Effects</i>		
			<i>Min</i> → <i>Max</i>	$dF/dx$	<i>Std.Err.</i> $dF/dx$
<i>ln_vol_equity</i>	.867**	.390	.999	.290**	.114
<i>ln_vol_bond</i>	.048	.059	.219	.016	.020
<i>velocity</i>	-.046	.032	-.518	-.015	.010
<i>ln_listings</i>	.774**	.385	.918	.259**	.123
<i>cap_to_gdp</i>	-.052**	.017	-.984	-.017**	.005
<i>openness</i>	.037**	.012	.992	.013**	.004
<i>ln_gdp</i>	-.847*	.442	-.968	-.284*	.134
<i>.cons</i>	-2.736	2.506			
<i>N</i>	49				
<i>LR Chi</i> <sup>2</sup>	26.07**				
<i>McFadden R</i> <sup>2</sup>	.398				

In the main, results from regression III support the results of regressions I and II. With one exception, coefficients and significance levels and do not vary substantially. Yet the coefficient for the intensity of competition a market faces (*velocity*) displays a negative sign and is significant on a 10%-level. This is contradictory to H2. Possible reasons for this and considerations on the general quality of the variable have already been discussed in the above. Furthermore, there is evidence that an ordered response model does not specify the underlying process correctly. Differing from the outside groups, the marginal effects of the medium groups (for-profit corporation without / with outside ownership) all register at values very close to zero. This might indicate that the fact that an observation belongs to the two medium groups yields little information and is of minor importance. Instead, splitting the sample into two groups only may be sufficient to fully capture the underlying causal relationship.

To sum up, all three models have been backed the economy-related hypotheses. Accordingly, exchanges that operate in small economies with a high degree of openness are likely to demutualize early. This effect increases with declining importance of an exchange for its home economy. However, the analysis fails to fully support the exchange-related hypotheses. In line with expectations, the propensity to demutualize increases with the

Table 3.6: Ordered response regression - model III

Regression results from estimating regression III; the ordered response variable is *demut.status* (0 = mutually owned exchanges; 1 = for-profit corporations without outside ownership; 2 = for-profit corporations with outside ownership; 4 = listed exchanges); the ordered-probit marginal effects  $dF/dx$  indicate how the probability of a specific parameter value of the dependent variable changes, given a one-unit change in the value of one explanatory variable;  $LR\ Chi^2$  displays the likelihood ratio test;  $McFadden R^2$  indicates the goodness of fit; \*\* and \* denote significance at the 5% and 10% level respectively.

	Coef.	Std.Err.	$dF/dx$			
			0	1	3	4
<i>ln_vol_equity</i>	.569**	.246	-.220	.010	.039	.171
<i>ln_vol_bond</i>	.057	.045	-.022	.001	.004	.017
<i>velocity</i>	-.039*	.023	.015	-.001	-.003	-.012
<i>ln_listings</i>	.727**	.311	-.281	.013	.050	.218
<i>cap_to_gdp</i>	-.033**	.010	.013	-.001	-.002	-.010
<i>openness</i>	.025**	.007	-.010	.000	.002	.007
<i>ln_gdp</i>	-.595**	.302	.230	-.011	-.041	-.179
N	49					
$LR\ Chi^2$	25.61**					
$McFadden R^2$	.211					

number equity issuers using an exchange as a listing venue. Contrary to expectations, the opposite effect can be perceived for an exchange's turnover volume. Possibly, owners of large exchanges are interested in quickly turning their valuable assets into transferable shares. Finally, I do not find any support for the hypotheses that an exchange's decision to demutualize is influenced by the competition it faces.

### 3.4 Conclusion and Outlook

The technological advances of the late 20<sup>th</sup> century have caused securities exchanges around the world to abandon their traditional mutual ownership structure and to pursue a demutualization instead. In the course of the last decade, exchanges with very different characteristics and from different economies have commenced the process of demutualization. Yet demutualization does not spread evenly across the industry. Instead, some exchanges have initiated the process very early, while others have not embarked to this date. In this analysis, I seek to identify the factors that determine an exchange's decision to demutualize.

This study is the first to empirically analyze this phenomenon and to shed light on the determinants of the demutualization of stock exchanges. Drawing from various data sources, I use a sample of 49 exchanges from 40 countries that comprises both the competitive situation of an individual exchange and the characteristics of the economy, in which it operates. Estimating binary response and ordered response models, I find that both exchange-related and economy-related factors have an effect on the propensity to demutualize. Exchanges that operate in small economies with a high degree of openness are more likely to demutualize. This effect declines with increasing importance of an exchange for its home economy. Furthermore, the propensity to demutualize increases with the number of equity issuers using an exchange as a listing venue. The effect of the level of competition an exchange faces remains ambiguous.

Though this analysis yields interesting insights in the determinants of organizational change in the securities exchange industry, the evidence presented here remains a retrospective snapshot of a singular industry. Thus, they cannot be applied to demutualizations in general without further consideration. This raises two interesting questions. How do these results relate to the patterns of change observed in other fields of commercial activity? And do those companies that embrace demutualization early fare better in the long run when compared to their peers? There are no studies that address these questions. Hansmann (1996) and Chaddad (2003) cite a number of industries that have undergone organizational change of the same kind and experienced literally waves of demutualization. Among these are the savings and loans industry, the insurance industry and agricultural cooperatives. It would be interesting to analyze the consequences of a firm's decision to demutualize early or late in the wave across a number industries. This might foster our understanding of organizational change considerably.

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# Appendices

- Sample overview
- Correlation matrix of independent variables
- Univariate analysis supplementing regression I
- Univariate analysis supplementing regression II
- Univariate analysis supplementing regression III

Table 3.7: Sample overview

Overview over the sample selected for this analysis. It consists of 49 exchanges from 40 different countries. Exchanges are categorized according to their ownership structure as of January 1<sup>st</sup> 2003. For the estimation of regression II, the third and the fourth category have been combined (cf. Table 3.3).

Ownership status	Exchanges
Mutually owned	AMEX, Bangkok, Buenos Aires, Chicago, Dublin, Istanbul, Jakarta, Johannesburg, Kuala Lumpur, Lima, Ljubljana, Luxembourg, Montreal, NYSE, Rio de Janeiro, Santiago, Sao Paulo, Seoul, Taipeh, Tel-Aviv, Warsaw
For-profit corporation without outside ownership	Auckland, Barcelona, Bilbao, Madrid, Manila, Mexico City, Osaka, Tokyo, Zurich
For-profit corporation with outside ownership	Copenhagen, Helsinki, Milan, Vienna
Publicly listed company	Amsterdam, Athens, Brussels, Frankfurt, Hong Kong, Lisbon, London, Nasdaq, Oslo, Paris, Singapore, Stockholm, Sidney, Toronto, Vancouver

Table 3.8: Correlation matrix of independent variables  
 This table displays correlation coefficients of the independent variables of the multivariate regression analyses. Figures reflect the respective values for the first quarter 1995. \*\* and \* denote significance at the 5% and 10% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) <i>ln_vol_equity</i>	1.0000						
(2) <i>ln_vol_bond</i>	0.2456*	1.0000					
(3) <i>velocity</i>	0.2398*	0.0767	1.0000				
(4) <i>ln_listings</i>	0.6804**	0.0348	-0.0685	1.0000			
(5) <i>cap_to_gdp</i>	0.1423	0.0109	-0.2177	0.1657	1.000		
(6) <i>openness</i>	-0.1513	-0.0653	-0.0893	-0.1682	0.6960*	1.0000	
(7) <i>ln_gdp</i>	0.7138**	0.0782	0.0178	0.6934**	-0.2904	-0.4683**	1.0000

Table 3.9: Univariate analysis supplementing regression I  
 Selected mean and median statistics for the sample of 49 securities exchanges. The sample is split into two groups that reflect the ownership status as of January 1<sup>st</sup> 2003. An exchange is considered to be demutualized if its shares trade freely (cf. Table 3.3). By this definition, 15 exchanges have demutualized whereas 34 have not. Figures are based on the first quarter 1995. Variable definitions stem from Table 3.2. Test statistics between both sub-samples are based on a simple two-sided *t*-test of differences of means. \*\* and \* denote significance at the 5% and 10% level respectively.

	Demutualized exchanges			Undermutualized exchanges			Difference T-test
	Mean	Median	Std.dev.	Mean	Median	Std.dev.	
<i>vol_equity</i>	70275.74	21022.55	120831.80	43445.32	6421.74	120360.60	-0.72
<i>ln_vol_equity</i>	9.88	9.95	1.75	8.87	8.77	1.94	-1.73*
<i>vol_bond</i>	99627.80	1192.35	162618.30	37409.08	319.97	149758.60	-1.31*
<i>ln_vol_bond</i>	6.91	7.08	5.02	5.72	5.77	3.94	-0.89
<i>velocity</i>	16.42	12.17	11.31	13.69	9.26	15.30	-0.62
<i>listings</i>	1052.29	527.67	1240.69	449.37	289.00	456.90	-2.50**
<i>ln_listings</i>	6.42	6.27	1.08	5.70	5.67	0.97	-2.31**
<i>marketcap</i>	296367.90	207198.50	334191.90	440737.10	115441.80	1025971.00	-0.53
<i>cap_to_gdp</i>	58.07	33.43	55.64	51.31	32.92	50.20	-0.42
<i>openness</i>	84.86	62.42	76.02	52.17	44.04	40.67	-1.96**
<i>gdp</i>	230587.40	83457.79	371947.60	266350.40	61637.06	485885.40	-0.25
<i>ln_gdp</i>	11.51	11.33	1.27	11.20	11.03	1.57	-0.68
<i>exports</i>	48594.12	45881.53	41175.50	31678.45	12869.46	43321.78	-1.28
<i>imports</i>	48884.15	41327.25	46089.61	33728.13	14205.50	49829.10	-1.00

Table 3.10: Univariate analysis supplementing regression II

Selected mean and median statistics for the sample of 49 securities exchanges. The sample is split into two groups that reflect the ownership status as of January 1<sup>st</sup> 2003. An exchange is considered to be demutualized if its shares trade freely or if it has significant outside ownership (cf. Table 3.3). By this definition, 19 exchanges have demutualized whereas 30 have not. Figures are based on the first quarter 1995. Variable definitions stem from Table 3.2. Test statistics between both sub-samples are based on a simple two-sided *t*-test of differences of means. \*\* and \* denote significance at the 5% and 10% level respectively.

	Demutualized exchanges			Undemutualized exchanges			Difference T-test
	Mean	Median	Std.dev.	Mean	Median	Std.dev.	
<i>vol_equity</i>	57673.86	20336.98	109582.00	47849.12	6696.18	127669.70	-0.28
<i>ln_vol_equity</i>	9.65	9.92	1.66	8.87	8.81	2.04	-1.40*
<i>vol_bond</i>	136734.50	1192.35	229424.00	5612.32	319.97	10491.96	-3.14**
<i>ln_vol_bond</i>	7.35	7.08	4.91	5.29	5.77	3.70	-1.67*
<i>velocity</i>	15.57	12.17	10.19	13.87	7.41	16.29	-0.41
<i>listings</i>	866.46	294.33	1155.48	486.68	327.17	473.88	-1.61*
<i>ln_listings</i>	6.12	5.68	1.15	5.79	5.79	0.98	-1.08
<i>mar_ketcap</i>	249418.70	130086.70	310446.30	489720.90	118246.00	1084536.00	-0.94
<i>cap_to_gdp</i>	50.34	30.04	51.57	55.31	37.72	52.13	-0.33
<i>openness</i>	77.88	53.16	68.47	52.23	40.03	43.38	-1.61*
<i>gdp</i>	204607.30	65024.05	335784.00	287572.90	61637.06	512982.00	-0.62
<i>ln_gdp</i>	11.44	11.08	1.20	11.20	11.03	1.65	-0.55
<i>exports</i>	44394.73	37589.00	44116.71	32082.63	12738.97	44977.70	-0.98
<i>imports</i>	44116.71	41082.36	43385.90	34726.70	14205.50	52245.97	-0.65

Table 3.11: Univariate analysis supplementing regression III

Selected mean and median statistics for the sample of 49 securities exchanges. The sample is split into four groups that reflect the progress of the process of demutualization as of January 1<sup>st</sup> 2003: 21 exchanges are mutually owned, 9 are for-profit corporations without outside ownership, 4 are for-profit corporations with outside ownership; 15 are listed (cf. Table 3.3). Figures are based on the first quarter 1995. Variable definitions stem from Table 3.2. Test statistics between sub-samples are based on a Kruskal-Wallis test. \* denotes significance at the 10% level.

	Mutual		Corporation		Outside Ownership		Listed Company		Difference KW-test
	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.	
<i>vol.equity</i>	45989.25	146462.90	52188.80	73669.05	10416.81	11946.04	70275.74	120831.80	4.02
<i>ln.vol.equity</i>	8.63	2.02	9.44	2.09	8.82	1.01	9.88	1.75	4.02
<i>vol.bond</i>	4290.47	9199.91	8696.64	13120.97	275884.80	399627.3	99627.8	162618.30	4.52
<i>ln.vol.bond</i>	4.72	3.67	6.61	3.62	8.99	4.74	6.91	5.02	4.52
<i>velocity</i>	15.33	17.95	10.44	11.72	12.36	2.82	16.42	11.31	4.44
<i>listings</i>	457.10	445.26	555.70	557.46	169.58	84.92	1052.29	1240.67	6.30*
<i>ln.listing</i>	5.71	1.05	5.98	0.81	5.01	0.61	6.42	1.08	6.30*
<i>marketcap</i>	361112.50	972222.40	789807.00	1325151.00	73359.07	68686.71	296367.90	334191.90	3.45
<i>cap.to.gdp</i>	57.62	60.31	49.89	26.64	21.35	9.50	58.07	55.64	2.77
<i>openness</i>	57.56	49.98	39.80	18.17	51.69	1.01	84.86	76.02	4.53
<i>gdp</i>	251471.70	496521.70	371809.10	571123.80	107182.00	121920.20	230587.40	371947.60	1.97
<i>ln.gdp</i>	10.98	1.65	11.73	1.60	11.17	0.98	11.51	1.27	1.97
<i>exports</i>	29766.05	46888.99	37488.00	42307.81	28647.05	32788.02	48594.12	41175.50	5.88
<i>imports</i>	35534.03	60199.85	32842.95	28795.72	26238.79	29000.68	48884.15	46089.61	6.87*

# Chapter 4

## The Impact of Demutualization\*

### 4.1 Introduction

Over the last decade, the securities exchange industry has witnessed a wave of demutualizations shifting ownership in exchanges from members and other insiders to outside investors. The demutualization of a stock exchange is a complex process that gradually takes it from being a mutual society to being a listed company. Over the course of this process fungibility of ownership increases while conflicts of interest among owners diminish (Steil, 2002). This phenomenon has been pioneered in Europe with *Stockholmsborsen* becoming the first for-profit exchange in 1993 and listing in 1998. Over the past 7 years more than a dozen of the world's largest exchanges have demutualized and listed their shares publicly. Today, demutualized exchanges control more than 75% of the European market for equity transactions.<sup>1</sup>

It is often claimed that demutualized exchanges become more efficient *ceteris paribus*, since they overcome the institutional inefficiencies inherent in mutual organizations (Chaddad, 2003). Employing the median-voter theorem and stressing the role of the pivotal voter, Hart and Moore (1996) demonstrate that mutually owned exchanges have incentives to oppose innovations even if they increase the exchange's overall value. Altering decision making from one-vote-per-member to one-vote-per-share streamlines the owners' interest with maximizing the value of the exchange. The resulting efficiency gains are mostly attributed to reformed corporate governance, for-profit business models, streamlined decision making, easier access to capital, and more focused operations (IOSCO, 2001).

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\* I would like to thank Philipp Jostarndt, Stefan Wagner and participants of the CEFS-Odeon research seminar for helpful comments.

<sup>1</sup> Chapter 3 of this thesis provides an extensive overview over the process of demutualization and the main economic drivers behind it.

The goal of this paper is to test the hypothesis that demutualization turns an exchange more efficient, and thus improves its competitive position and enhances liquidity. Previous work dealing with this question has focused on factor productivity (Schmiedel, 2003, 2002), performance, accounting and return-based measures (Mendiola and O'Hara, 2004) and transaction costs (Krishnamurti et al., 2003). Findings reveal that demutualized exchanges are more efficient than their mutual rivals. However, these studies encounter several drawbacks. With the exception of Schmiedel (2003, 2002), they face a severe causality problem, since they study the post-demutualization-situation only. Thus, the results obtained cannot be attributed to the event demutualization, but remain descriptive comparative evidence. In addition to this methodological *caveat*, it remains doubtful whether the efficiency proxies employed in some of these studies capture an exchange's efficiency accurately. While accounting measures often fail to reflect economic reality, input output measures can hardly capture it in its entirety. Also, comparing overall market figures neglects that different markets list different securities and, thus, can lead to spurious results.

In this paper, I attempt to overcome these shortcomings and to contribute to the ongoing debate by developing a new approach to assessing this question. First, I argue that liquidity is the key variable for assessing an exchange's efficiency. Although liquidity is a factor beyond an exchange's direct control, this factor ultimately reflects its efficiency, as it represents the core competitive variable of the industry. In absence of a unidimensional measure for liquidity, the different dimensions of liquidity are considered to collectively constitute the best measure for an exchange's efficiency. Second, I focus upon securities that are cross-listed on two markets: a demutualized one and a control market that does not undergo institutional changes. This allows to simultaneously study liquidity flows between markets and to assess changes in the industry's competitive pecking order. Third, my design is based on time series data that surrounds the demutualization event. Thus, the empirical setting can be considered to be quasi-experimental. It includes both pre- and post-demutualization observations and observations for a control group that is not affected by ownership changes. *In summa*, this enables me to clearly determine, whether demutualization has the presumed impact on a exchange's liquidity.<sup>2</sup>

The analysis employs a low-frequency panel of paired observations of liquidity measures for a sample of 216 equity securities. Observations comprise daily market figures and include trading volume, spreads and the liquidity ratio following Cooper et al. (1985). All securities are dually listed on the the world's largest securities market place NYSE (not

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<sup>2</sup> A similar approach is employed by Ahn et al. (1998) who test the impact of decimalization on liquidity on different markets and Arnold et al. (1999) who study the consequences of mergers among stock markets.

demutualized) and their respective home markets, which demutualize during the observation period. Covering daily data for a ten year period (August 1994 - August 2004), the data allows to control for systematic differences between the control and treatment group before and after the change in ownership. For the empirical analysis, I rely on estimation procedures for pooling cross-sections over time, difference-in-differences estimation and standard panel regression methods.

Results reveal that demutualized exchanges manage to draw a substantial amount of liquidity in cross-listed securities from their mutually owned rivals. This finding is genuine and has not been documented before. Results hold after controlling for underlying time trends and varied estimation periods. Also, results are robust against variations in the measurement of the liquidity variable. Overall, these findings suggest, that demutualization turns markets more liquid and, in turn, more efficient. To European exchanges, having pioneered this development, these results verify the appropriateness of their decision to abolish mutual structures and the effectiveness of this measure to strengthen an exchange's competitiveness.

## 4.2 Demutualization and Competition between Stock Exchanges

### 4.2.1 Theoretical Background

With the global integration of financial markets progressing rapidly, competition among stock exchanges is materializing. Over the last two decades, exchanges underwent drastic changes taking them from a period of local monopolies to an era of global competition. Several factors are causal for this development. Political reform and technological advances have initially sparked the transformation. In Europe, deregulation and the harmonization of capital markets law as well as the creation of a single currency removed competitive obstacles and contributed to creating a level playing field (Ramos, 2003). Parallel to this, every stage of the securities trading value chain has been subject to automation and computerization. Trading floors have been replaced with electronic trading systems, to which traders are given remote access. Demutualization, *i.e.* the transformation of an exchange's ownership and governance structures from a mutually owned to an outsider-dominated institution, has turned exchanges into market-oriented for-profit companies. Finally, for-profit conversion has triggered consolidation activities among exchanges. In an attempt to optimize cost efficiency and to reap economies of scale, both vertical and horizontal integration have been pursued in dozens of cases (Cybo-Ottone et al., 2000). Collectively, the factors described above have stimulated the emergence of a substantial competition among stock exchanges.

Competition among securities exchanges is not restricted to a single commodity. Rather, the objects of competition are manifold. The core business of an exchange is maintaining a liquid trading platform that allows investors to trade securities at high speed with low transaction cost and low execution risk. Simultaneously, it must enable companies seeking capital to quickly tap sufficiently large capital pools. Effectively, this resembles a two-sided market and an exchange has to strive to get two sides on board: companies for listings and traders for volume. As for all two-sided markets, both sides yield reciprocal external effects or as Economides and Siow (1988) put it: liquidity is self-reinforcing. Evidently, competition among stock exchanges extends over both sides as well.<sup>3</sup> Today, companies seeking a listing enjoy a large variety of possible listings venues to choose from. Exchanges are beginning to respond to this development and enter a competition for listings. For instance, The London Stock Exchange's Alternative Invest-

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<sup>3</sup> Apart from the objects of competition mentioned in the above, exchanges also compete in other fields such as the provision of real time data or trading systems to other exchanges. For instance, Deutsche Boerse has been successfully licensing its Xetra trading platform to the Shanghai exchange in a much contested bid recently.

ment Market (AIM) has managed to establish itself as the prime European trading venue for early stage high growth companies and attracts listings from all over the continent.<sup>4</sup> In 2004, NASDAQ announced waiving listing fees for cross-listed NYSE securities for one year in an attempt to lure companies away from the NYSE.<sup>5</sup>

In this paper, I focus on the other side of exchanges' two-sided markets, the competition for liquidity. Competition for order flow and liquidity can evolve, wherever exchanges list identical or highly similar securities, as this gives investors an effective choice among different markets.<sup>6</sup> Rational investors will opt to trade on the exchange that meets their needs best. The relevant parameters of an investor's decision include factors such as trading systems, transparency, market micro-structure, trading costs and the provision of clearing and settlement services. For competing exchanges, an investor's decision will either augment or decrease the exchanges' liquidity regardless of the motives guiding his decision. In the long run, an exchange's competitive position will ultimately be reflected in its liquidity. A prominent example of exchanges competing in identical securities is the successful attempt by Deutsche Terminboerse to snatch up the London International Financial Futures Exchange's volume in the Bund-Future contract in 1997.<sup>7</sup> DTB managed to draw traders away from LIFFE's open outcry trading floor by employing a superior electronic trading system.

Theory on the competition among stock exchanges has only emerged recently and does not share a single view on its outcome. Naturally, research on competing exchanges was virtually in-existent for as long as exchanges were entrenched in local monopolies. Instead, comparative studies of the organization, governance and market micro-structure installed in different exchanges dominated the field (Davis, 1966; Garbade and Silber, 1978; Michie, 1986). These studies mainly draw qualitative comparisons between markets and describe their organizational evolution, but fail to provide any approaches for assessing the effects of competition. The foundation for a quantitative empirical analysis of the competition among securities exchanges was laid by market micro-structure theory. Early works such as Stigler (1964) and Demsetz (1968) define measurements for a detailed assessment of a market's quality and come to the conclusion that as the trading activity in a security increases the cost of exchanging that security decreases. Therefore, in a competitive environment, economies of scale should cause liquidity to pool in one location. This

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<sup>4</sup> For example, in September 2005 the German SQS AG raised £10.8 million in an AIM listing.

<sup>5</sup> Chapter 2 of this thesis takes to the consequences of the competition for listings in more detail and evaluates how the current policy debates in Europe reflect the changing exchange issuer relationship.

<sup>6</sup> Apparently, this argumentation applies mainly to institutional investors. Private investors often face prohibitively high transaction costs for cross-border trades.

<sup>7</sup> Deutsche Terminboerse (DTB) was the precursor organization to EUREX, which was founded in 1998 and is a common subsidiary of Deutsche Boerse and Swiss Exchange. The London International Financial Futures Exchange (LIFFE) merged with Euronext in 2002.

finding is an early pointer to a group of models that argue that consolidation is the most probable outcome of competition in the securities exchange industry. An opposing strain of theory shows that fragmentation can arise from competition among stock exchanges.

Advocates of the consolidation theory usually build their argument upon the role of network externalities and economies of scale in the exchange industry. Economides (1993) describes exchanges as networks that reduce market uncertainty (measured by the variance of market prices) with the progressing expansion of the network. In such a setting, Di Noia (2001) shows that competition will finally result in a corner solution with only one exchange surviving. A different approach to modeling the consolidation disposition immanent in competition among stock exchanges is presented by Pirrong (1999). Pirrong focusses upon the governance of competing markets and derives conditions under which a group of trading intermediaries manages to deter trading in a certain security from a rival exchange. However, this model applies to mutual ownership structures only and fails to illuminate the competition in presence of different ownership structures.

The second strain of theory in this field yields results that are diametrically opposed to the first strain's. Several authors show that competing stock exchanges do not merge into one ultimately or are being drained all-but-one. Instead, they argue that specialization and differentiation can lead to a fragmented industry structure with viable competition. Foucault and Parlour (2004) develop a model in which two profit maximizing exchanges compete for listings. Exchanges compete through parameters like listing fees, trading rules and technology. Foucault & Parlour show that depending on the size of the economy and the different trading technologies available a number of exchanges can co-exist profitably. This finding is in line with Glosten (1994) who analyzes how an exchange with an open limit order book fares against other methods of exchanging securities and shows that the two institutions can take on different functions in processing information.

While the models described above cover various aspects of the competition among stock exchanges, they neglect the influence of different ownership and governance structures. This is surprising, since the role of different ownership structures has been emphasized for long. Hart and Moore (1996) demonstrate that decision makers in mutually owned exchanges have incentives to oppose innovations even if they increase the exchange's overall value. Instead, members tend to safeguard their individual interests. Altering decision making from one-vote-per-member to one-vote-per-share, which is one of the basic characteristics of a demutualization, streamlines the owners' interest with maximizing the overall value of the exchange. In absence of theoretical models that allow to gain insight on the effect of a demutualization on the competition among stock exchanges, empiri-

cal evidence remains the sole source of information. The following section presents the empirical studies available and reviews their findings.

#### 4.2.2 Prior Empirical Research

Empirical research on the competition among stock exchanges is scarce. While there is an abundant variety of studies relating market quality and liquidity to different market micro-structures there is hardly any work that focusses upon the liquidity effects caused by differences in exchanges' ownership and governance structures. I am aware of only two studies that assess the development of liquidity following a demutualization (Krishnamurti et al., 2003; Mendiola and O'Hara, 2004). Although these studies argue that demutualized exchanges operate more efficiently and achieve higher liquidity levels than their mutual counterparts, their findings cannot be conceived to yield unambiguous evidence. Furthermore, there is a second strain of literature that contains three studies that employ input-output ratios and use data envelopment analysis and stochastic frontier analysis to assess the efficiency of exchanges (Schmiedel, 2003, 2002; Serifsoy, 2005). These studies fail to provide clear evidence and remain contradictory. Besides, they do not establish a link between liquidity and demutualization. Finally, there is a growing body of research on cross-listed securities that, amongst other things, examines general liquidity properties of these financial instruments. Though not directly related to questions of exchange governance, these studies are helpful for developing an understanding of the research objects of this study.

Krishnamurti et al. (2003) analyze 40 pairs of common stock that are simultaneously traded on two Indian stock exchanges. While trading the same stock, both exchanges have adopted different organizational structures, one being demutualized and the other one being run as a members' cooperative. Employing a high-frequency transaction data set covering 15 million transactions during 120 days the authors compute the Hasbrouck (1993) method for measuring the deviations between actual transaction prices and implicit efficient prices. Controlling for factors such as general trading activity and trade size, they find that the demutualized exchange yields lower implicit transaction cost to investors as pricing error variances are significantly lower. They mainly attribute this finding to its superior governance.

Mendiola and O'Hara (2004) examine the effect of a demutualization on exchanges' performance. They restrict their analysis to exchanges that have been completely transformed into publicly listed companies. While relying mostly on performance, accounting and return-based measures, they briefly review the development of overall liquidity levels.

Setting a one year time-frame for a pre- and a post-demutualization period they analyze illiquidity ratios following Amihud (2002) for a sample of seven exchanges. However, their analysis fails to come up with a distinctive result. Four out of seven exchanges display improved illiquidity measures in the first year after conversion, while three deteriorate. Year two after demutualization yields again four improvements and three declines, yet illiquidity measures for two of the seven sampled exchanges switch signs, indicating a decrease in year two after demutualization after an increase in year one and *vice versa*. As for the other measures, results are mixed and inconsistent across measures.

Both studies face several shortcomings and problems and thereby motivate further analysis. First and foremost, both studies fail to establish a clear and definite link between demutualization and changes in liquidity. Mendiola and O'Hara (2004) fail to provide an unambiguous result, as they cannot report evidence of a distinct effect. Besides, their sampling procedure limits the interpretation of their results severely, as they do not include a control group, but rely on demutualized exchanges only. By contrast, Krishnamurti et al. (2003) focus upon the post-demutualization period only. Thus, results cannot be explicitly linked to the demutualization event and can only be considered to provide comparative descriptive evidence between two exchanges with different ownership structures. Second, the exchange regarded as demutualized by Krishnamurti et al. (2003), NSE - National Stock Exchange of India, does not meet the criteria generally applied to describe a demutualized entity. Though operating on a for-profit basis, its shares do not trade freely and ownership in the exchange is not fully separated from membership. Instead, it is controlled by a small number of banks and insurance companies. Third, there is a measurement issue in Mendiola and O'Hara (2004), as they use average illiquidity ratios compounded from different securities to assess the development of a market's liquidity in response to a demutualization. Such a setting allows to compare overall market liquidity between markets. Yet it cannot be used to comparatively evaluate the effect of a demutualization, since it neglects that different markets trade different securities. Thus, liquidity differences do not necessarily result from parameters that are at an exchange's disposition.

The second strain of literature attempts to measure the effect of a demutualization on an exchange's efficiency by examining the functional relation between inputs and outputs for European exchanges. Schmiedel (2002, 2003) uses capital employed and labor costs as inputs and quantifies output through four factors: the number of listed companies, their market capitalization, the number of share trades and resulting turnover value. From this, Schmiedel calculates productivity measures using parametric stochastic frontier models and non-parametric data envelopment analysis. In a second step, he regresses

the derived values on various factors including variables describing the ownership status of an exchange. Findings reveal that automation and computerization are important drivers of an exchange's efficiency. Concerning the ownership status, the analyses do not produce consistent results. Schmiedel (2003) presents evidence of a positive impact of a demutualization on cost efficiency, while Schmiedel (2002) finds cooperative exchanges to be more productive. Serifsoy (2005) who replicates Schmiedel's studies with a temporally extended data set finds evidence of increased productivity in demutualized exchanges.

A third group of studies closely interlinked with this research question focusses upon cross-listed securities. To a large extent, this literature contributes to understanding companies' motives to acquire a secondary listing abroad, stock markets' reactions to cross-listing announcements and the subsequent effect on the cross-listing firm's cost of capital.<sup>8</sup> Yet there are also a number of studies focussing on the liquidity effects generated by dual listings. Among others, Forster and George (1995) and Foerster and Karolyi (1998) show that overall liquidity is considerably increased in response to a newly initiated secondary listing. This improvement is mainly attributed to prolonged trading hours, increased potential liquidity pools and competitive responses by the exchanges involved. Yet liquidity does not split evenly between both trading venues. For example, Werner and Kleidon (1996), Foerster and Karolyi (1998) and Bacidore and Sofianos (2002) demonstrate that compared to primary markets secondary markets hold a smaller share of overall liquidity. This applies to all liquidity measures and is echoed in wider spreads and reduced volume. Furthermore, there are a few studies that examine liquidity reactions in dually listed securities to modifications of the market micro-structure at one trading venue. Ahn et al. (1998) study the impact of the Toronto Stock Exchange's decision to convert from fractional to decimal pricing on the liquidity of Canadian stocks that cross-list on American stock exchanges. While they find some evidence, that spreads on secondary markets decrease in response, they cannot detect any significant turnover flows between both markets. Yet their results may be influenced by a rather short sampling period, giving effects not enough time to unfold.

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<sup>8</sup> See Karolyi (1998, 2004) for a profound overview over the empirical literature on cross-listings and dually listed companies.

Table 4.1: Sample overview

This table lists all exchanges that have successfully demutualized before 2004 and serve as a primary listing venue to at least one equity security that is simultaneously cross-listed on the NYSE. Of the approximately 450 non-U.S. securities cross-listed on the NYSE, 228 stem from these exchanges. The second column reports the dates of the initial listing of the exchange's holding company. This event is taken as a proxy for demutualization. Column three indicates the total number of cross-listed securities between the respective primary market and the NYSE. The last column shows the number of securities contained in the final sample. Differences between column three and four are due to insufficient data coverage and multiple equity issues by the same company.

Primary market	Listed since	Cross-listings with NYSE	Final Sample
AX Amsterdam	Jul 2001	20	12
AT Athens	Aug 2000	5	2
AX Australia	Oct 1998	11	7
BR Brussels	Jul 2001	1	0
DE Deutsche Boerse	Feb 2001	16	10
HE Helsinki	Sep 2003	4	4
HK Hong Kong	Jun 2000	9	2
IN Lisbon	Jan 2002	2	2
L London	Jul 2000	53	33
NZ New Zealand	Mar 2003	2	1
OL Oslo	May 2001	4	2
PA Paris	Jul 2001	21	14
SI Singapore	Nov 2000	1	0
ST Stockholm	Jan 1998	1	1
TO Toronto	Nov 2002	78	66
		228	156

## 4.3 Empirical Investigation

### 4.3.1 Data Set and Variables

The empirical analysis of the impact of a demutualization on an exchange's competitive position is based on a data set that contains paired observations of daily liquidity measures for cross-listed equity securities. This sample spans across a time period of ten years (August 1994 - August 2004). All securities have their primary listing venue in their respective home market and share the New York Stock Exchange (NYSE) as a common second trading venue. Thus, the sample consists exclusively of non-U.S. firms cross-listing on an U.S. exchange. Usually, cross-listed securities trade in the form of American Depository Receipts (ADR). ADRs are U.S. securities representing ownership of publicly traded shares in a non-U.S. corporation. They facilitate holding and sale of non-U.S. securities by U.S. investors. The quasi-experimental setting of the analysis is reflected in the fact that all of the primary listing venues demutualize during the observation period whereas the NYSE does not alter its organizational structure.

Overall, there are approximately 450 non-U.S. companies listed on the NYSE. To enter the sample a company must have its primary listing on a market that has undergone a demutualization. The listing or initial public offering of the shares in the demutualized exchange itself serves as a proxy for demutualization.<sup>9</sup> Thus, dually-listed securities from 15 exchanges qualify. This restriction diminishes the potential sample size to 228 security issues. Of the 228 potential securities only 156 provided sufficient data records that allowed to calculate pre- and post-demutualization liquidity measures for both listing venues. This filters out cases of companies that commenced listing on the NYSE after the demutualization of their primary listing venue and firms with multiple classes of equity cross-listed. In the latter case, only the highest ranking issue was admitted to the sample. Table 4.1 displays the stock exchanges included in the sample as well as the respective number of cross-listings.<sup>10</sup> The final sample covers 156 securities from 13 stock exchanges.<sup>11</sup> Most cross-listed securities originate from Canada (66 issues) and Great Britain (33 issues).

For 156 cross-listed securities a low frequency panel data set was raised using daily market information retrieved from *Datastream*. The final data set contains paired observations of daily market figures, such as stock price, volume, and closing spreads, which allows to derive and compute various liquidity measures.

Liquidity is an elusive concept and difficult to measure. A market is considered to be liquid if market participants can rapidly execute large-volume transactions with small impact on prices. Liquidity is measured along three dimensions: tightness, depth and resiliency (Kyle, 1985). Tightness describes the cost of changing positions or, in other words how far transaction prices diverge from mid-market prices, which is seen as an equivalent for efficient prices. Market depth covers the tradable volume at a given price level. Resiliency, monitors the speed of adjustment to efficient prices after a shock, such as a large trade. The sample at hand permits to calculate liquidity measures covering all three dimensions. Resiliency measures, however, are usually computed along high frequency data panels that record market activities tick by tick (Engle and Lange, 1997). Given the temporal and spatial dimension of this analysis, a high frequency sample was impossible to raise. Therefore, I rely on a resiliency measure that is computable from low frequency data and assesses the long term resiliency of a market.

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<sup>9</sup> Lisbon stock exchange, which merged with already demutualized and listed Euronext without being listed previously, is considered to be demutualized from the date on that the merger became effective.

<sup>10</sup> The abbreviations used in Table 4.1 correspond to the exchanges' Reuters mnemonics.

<sup>11</sup> For reasons of brevity, an overview over the sampled equity securities is not reported here. It can be obtained from the author upon request.

*Trading volume* is an intuitive and widely applied liquidity measure that indicates the depth of a market retrospectively. Markets with extensive trading activity are considered to be liquid and to facilitate the matching of orders at low trading costs. Volume is either measured as the total number of shares traded in a security per unit of time or as the total value traded in that security. For my purpose, the choice among these alternatives remains irrelevant since both convey the same information when transformed into differences between markets. Yet volume measured as the total number of securities traded cannot be compared between markets without adjusting for ADR-ratios. ADRs are often issued in fractions or multiples of the underlying shares in order to permit cross-listed firms to trade at similar price ranges as peer US companies. After adjusting for ADR-ratios I use the total number of shares traded as a measure for volume (*vol*)

$$vol_{i,T} = \sum_{t=1}^T V_{it}, \quad (4.1)$$

where  $V$  is the number of shares traded on day  $t$ . Since this measure is highly skewed (cf. table 4.2) I also report log values ( $\ln\_vol$ ). In the context of this analysis, I expect demutualized exchanges to improve their competitive position and to attract more investors. Thus, they should increase their share of volume versus their undemutualized rivals, causing differences in volume traded during the same period to increase.

The general measure of *tightness* is the bid-ask spread (Demsetz, 1968). Bid-ask spreads can be measured in various ways.<sup>12</sup> The quoted spread is the difference between best quoted bid and ask prices. Apparently, it is only observable before a transaction takes places. Realized spreads are a measure of resiliency and compare the price of a transaction to the mid point of the quoted spread five to thirty minutes after the transaction. The data provided in this sample allows to compute relative spreads (*spr*) from closing bid and ask quotes, which equal quoted spreads divided by the spread midpoint:

$$spr_i = \frac{P_i^A - P_i^G}{(P_i^A + P_i^G)/2}, \quad (4.2)$$

where  $P^A$  is the best bid and  $P^B$  the best ask price. Relative spreads are measured on a percentage basis. Provided that demutualized exchanges are striving harder to improve efficiency, I expect spreads to tighten more strongly for demutualized than for undemutualized exchanges.

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<sup>12</sup> See Amihud (2002) for an extensive discussion on various bid-ask spread measures.

The third measure of volatility is a price impact proxy that determines the long term *resiliency* of a market. I employ the liquidity ratio (*lr*) as drafted by Cooper et al. (1985). It is defined as the average daily ratio of turnover value (volume  $V_i$  times price  $P_i$ ) to absolute return:

$$lr_{iT} = \frac{\sum_{t=1}^T V_{it} \cdot P_{it}}{\sum_{t=1}^T \left| \frac{P_{it} - P_{i,t-1}}{P_{i,t-1}} \right| \cdot 100} / 1000, \quad (4.3)$$

where  $T$  is usually a period of 20 trading days. Averages are computed over all non-zero return days, since the ratio is undefined for zero return days. This indicator is interpreted as the average turnover value necessary to cause a 1% change in price. High liquidity ratio values are taken to indicate that large volumes can be traded with little impact on prices. Again, I also report log values ( $\ln lr$ ) since this measure is highly skewed (cf. table 4.2). In many surveys, this ratio is considered to be of limited benefit since it is computed retrospectively. While this shortcoming is negligible for this study, one has to bear in mind that this measure does not distinguish between the different sources of volatility (Grossman and Miller, 1988). For instance, high volatility can either result from illiquidity or be caused by frequently updated fundamental information or changing expectations. *Ceteris paribus*, I expect that a demutualization exerts a positive effect on an exchange's competitive position and allows it to attract larger shares of trading. Thus differences in the average liquidity ratio should increase after a demutualization.

Table 4.2 displays summary statistics. It shows selected univariate statistics of various daily liquidity measures for 156 securities that are cross-listed on their respective primary exchange and the NYSE. Altogether, the sample consists of 285.551 observations. Thus, the average issue sampled is recorded over a period of 1.830 trading days or 7.3 years. The sample is split into a pre-demutualization subsample with 177.088 observations (62% of the entire sample) and post-demutualization subsample with 108.463 observations (38% of the entire sample). Note, that the subsamples do not split the sample at one distinct point of time, but depend on the dates of demutualization of the primary listing venues (cf. table 4.1). Thus, I employ an event time perspective, where the demutualization events occurred between January 1998 and September 2003.

Overall statistics clearly indicate that the primary markets dispose of considerably higher liquidity levels in cross-listed equity securities than the secondary trading venue. While primary markets trade on average 6.2m shares per day, the NYSE trades only a 13.5% share of the overall turnover. This disparity is also perceivable for the other measures. Spreads on the primary markets register at an average of 0.67%, while NYSE spreads come to about 1% of quoted prices. For a sample of predominantly blue-chip

Table 4.2: Sample statistics

This table exhibits summary statistics for 156 securities that are cross-listed on their respective primary exchange and the NYSE. The sample spans across a time period of 10 years (August 1994 - August 2004). All primary exchanges demutualize over the sampled period, whereas the NYSE does not alter its organizational structure. The table displays selected univariate statistics for daily liquidity measures. Liquidity figures include: *vol* (total number of shares traded measured in millions), *lr* (liquidity ratio after Cooper et al. (1985) measured in millions), *spr* (realized spreads) and log transformations of the former two. Figures are displayed separately for the primary listing venue (I) and the common cross-listing venue (II). Furthermore, the overall sample is split into two subsamples: a pre- and a post-demutualization sample, depending on the transformative status of I.

	<i>vol</i>		<i>lr</i>		<i>spr</i>		<i>ln.vol</i>		<i>ln.lr</i>		
	I	II	I	II	I	II	I	II	I	II	
Overall sample											
N=285,551											
$\bar{x}$	6.16	0.96	1.191	0.007	0.0061	0.0089	13.80	11.20	10.50	6.75	
$\tilde{x}_{0.5}$	1.35	0.05	0.027	0.001	0.0034	0.0052	14.11	11.26	10.20	6.77	
<i>s.d.</i>	(26.90)	(7.62)	(4.040)	(0.020)	(0.0102)	(0.0121)	(2.24)	(2.36)	(3.01)	(2.24)	
Pre demutualization											
N=177,088											
$\bar{x}$	3.63	0.95	0.613	0.007	0.0068	0.0100	13.44	11.10	10.05	6.76	
$\tilde{x}_{0.5}$	0.96	0.05	0.018	0.008	0.0040	0.0063	13.77	11.14	9.82	6.72	
<i>s.d.</i>	(15.40)	(8.99)	(1.922)	(0.020)	(0.0095)	(0.0124)	(2.17)	(2.37)	(2.86)	(2.17)	
Post demutualization											
N=108,463											
$\bar{x}$	10.30	0.96	2.135	0.007	0.0049	0.0070	14.40	11.36	11.23	6.75	
$\tilde{x}_{0.5}$	2.61	0.05	0.062	0.009	0.0024	0.0034	14.77	11.52	11.04	6.84	
<i>s.d.</i>	(38.60)	(4.58)	(5.959)	(0.019)	(0.0112)	(0.0113)	(2.23)	(2.34)	(3.12)	(2.34)	

issues these spreads are comparatively high, but could result from employing closing bid and ask quotes for computing spreads.<sup>13</sup> Also, higher NYSE spreads result from the use of fractional pricing instead of decimal pricing before February 2001. Liquidity ratios differ significantly among primary and secondary listing venues. Furthermore, there is considerable evidence that *vol* and *lr* are skewed to the right. Skewness is reduced in the corresponding log variables.

A closer comparison of the pre- and post-demutualization subsamples yields interesting insights. Overall turnover has more than doubled during the sampling period, soaring from 4.58m shares traded daily in the pre-demutualization period to 11.26m in the post-demutualization period. Yet, while volume in primary markets has almost tripled, turnover at NYSE stagnates, causing its share of overall trading to drop from 20.7% to 8.5%. Similarly, the liquidity ratio rise substantially for primary markets, indicating that larger volumes become tradable without considerable impact on prices, while remaining static for the secondary market. A different picture arises when comparing spreads. Between pre- and post-demutualization period, relative spreads in primary markets decrease by 0.19% in absolute terms, which corresponds to a 38.77% reduction. In the same period, relative spreads on the NYSE decrease by 0.3% in absolute terms, which equals a 42.85% drop. This causes the gap between average spreads on primary and secondary markets to tighten from 0.032% to 0.021%. Again, this effect may be caused by the NYSE's decision to convert from fractional to decimal pricing. Overall, the data suggest that compared to the NYSE primary listing venues were able to enhance their competitive position substantially. However, it remains doubtful whether this finding is attributable to the beneficial effects of a demutualization exclusively, necessitating a multivariate analysis.

Table 4.3 reports differences in liquidity by exchange. Figures are derived by differencing between average liquidity values for primary and secondary markets for the pre- and the post-demutualization period separately. Results clearly state that primary markets attain permanently higher liquidity levels than secondary trading venues. This finding applies to all observations of the pre-demutualization period without any exception. Furthermore, figures for volume and liquidity ratio show that most demutualizing exchanges manage to widen the liquidity gap against the NYSE after transforming their ownership and governance structure. Yet there is also evidence that in a few cases the NYSE has improved its competitive position compared to other markets. Conforming with the results displayed in Table 4.2, differences in spreads decline on an overall basis. Additionally, for four primary markets differences in spreads turn positive, which indicates that NYSE spreads are smaller on average. Of all exchanges covered, London Stock Exchange is far-

<sup>13</sup> Among others, Chung et al. (1999) document that intraday spreads follow a U-shaped pattern and provide strong evidence that spreads rise during the last minutes of trading.

Table 4.3: Pre- and post-demutualization liquidity differences by exchange

This table exhibits pre- and post-demutualization liquidity differences for 156 securities that are cross-listed on their respective primary exchange and the NYSE. The sample is split into 13 subsamples depending on the primary listing venue of every security. Definitions for liquidity measures stem from table 4.2. The figures reported are differences between the liquidity level of the primary listing venue and that of the secondary market. Figures are displayed separately for the pre-demutualization period (I) and the post-demutualization period (II).

Primary market	vol		lr		spread		N	
	I	II	I	II	I	II	I	II
AX Amsterdam	2.94	5.21	.04	.05	-.0022	-.0009	12,392	9,212
AT Athens	.48	.65	.01	.01	-.0039	-.0089	609	1,954
AX Australia	4.78	6.29	.03	.07	-.0073	-.0018	6,816	9,158
DE Deutsche Boerse	1.34	4.17	.05	.06	-.0033	-.0039	3,137	8,593
HE Helsinki	1.99	7.84	.02	.06	-.0021	-.0005	5,585	924
HK Hong Kong	11.60	11.20	.09	.17	-.0035	-.0080	1,263	1,971
IN Lisbon	3.76	5.99	.02	.02	-.0048	-.0028	2,685	874
L London	10.60	25.50	2.82	6.89	-.0015	-.0019	36,976	32,998
NZ New Zealand	3.59	6.53	.02	.05	-.0021	-.0008	2,151	298
OL Oslo	1.37	.70	.36	.16	-.0122	-.0122	2,750	1,564
PA Paris	1.60	5.08	.04	.06	-.0051	-.0081	13,024	10,677
ST Stockholm	.42	.37	.17	.08	-.0008	-.0004	174	1,604
TO Toronto	.36	.57	.01	.02	-.0033	-.0005	89,526	28,483
Overall	3.19	10.10	.61	2.13	-.0032	-.0021	177,088	108,310

ing best against NYSE. Not only do turnover and resiliency improve considerably after demutualizing, but differences in spreads increase as well. It is important to note that these findings are based on cross-listed securities only and have to be applied cautiously to the overall performance of demutualized exchanges.<sup>14</sup>

### 4.3.2 Methodology

To determine the impact of a demutualization on an exchange's competitive position I apply a two-stage approach that makes use of the research question's quasi-experimental character and takes into account the data set's longitudinal structure. At first, I employ a difference-in-differences (DiD) estimation to determine the changes in liquidity that result from a demutualization. Since this procedure condenses the available information considerably, the second stage of the analysis builds upon the sample in its entirety. To do so, I estimate a panel regression model that supplements the first analysis and serves as a means to cross-check the DiD estimation results.

DiD estimation is an effective way to estimate causal relationships.<sup>15</sup> It is mainly applied within the scope of quasi-experiments (also called natural experiments). Quasi-experiments occur when a specific exogenous intervention or event changes the environment in which the objects of investigation operate. To derive the effect of the treatment one compares the differences in outcomes before and after the treatment for observations affected by the intervention (treatment group) and a control group that remains unaffected. Thus, unlike with a true experiment where both groups are chosen at random in a quasi-experimental setting sampling of control and treatment group arises from the particular treatment. In order to control for systematic differences between both groups the data set has to consist out of pre- and a post-treatment observations for both groups. Apparently, the drawback of such a setting is a lack of randomness and replicability, which is a general drawback of quasi-experimental research designs (Meyer, 1995; Wooldridge, 2002).

In the context of this analysis, the object of investigation is the average liquidity level recorded for securities that are simultaneously listed on two different exchanges. One of the exchanges demutualizes during the period under observation, whereas the other one does not alter its organizational structure. This setup generates paired observations for each security. For all securities the demutualizing exchange corresponds with their

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<sup>14</sup> Mendiola and O'Hara (2004) report that from investor's perspective, the London Stock Exchange's initial equity offering was among the worst performing stock exchange IPOs with a 360-days return of -17.9%.

<sup>15</sup> The following discussion is based upon Meyer (1995) and Wooldridge (2002).

primary listing venue. Those observations that stem from primary markets fall into to the treatment group (*prime*) with the counterparts forming the control group (*control*). The specific event that marks the quasi-experimental treatment is the demutualization of a securities exchange. I use the event of listing an exchange's equity as a proxy for demutualization.<sup>16</sup> Average liquidity levels are calculated using a 300 days observation period before and after the event with a 200 day lock-up period around the event. Assigning observations to a before (*pre*) or after (*post*) treatment period adds the temporal dimension that is required for DiD estimation. Thus, all observations fall in one of four groups: treatment group before demutualization (*prime, pre*), treatment group after demutualization (*prime, post*), control group before demutualization (*control, pre*) or control group after demutualization (*control, post*).

The DiD estimator,  $\hat{\delta}_1$ , is the difference of the differences in the average liquidity level,  $\overline{LIQ}$ , between treatment and control group before and after demutualization:<sup>17</sup>

$$\hat{\delta}_1 = (\overline{LIQ}_{treat,pre} - \overline{LIQ}_{control,pre}) - (\overline{LIQ}_{treat,post} - \overline{LIQ}_{control,post}) \quad (4.4)$$

To determine whether the DiD estimator is statistically different from zero, a simple multivariate regression with three dummies regressors is estimated. The first dummy variable (*prime*) equals one for observations in the treatment group and zero otherwise. It captures structural differences between treatment and control group. The second dummy variable (*post*) measures temporal differences that apply to both groups. It equals one if an observation stems from the post-demutualization period and zero otherwise. The third dummy variable (*demut*) is the parameter of interest. It is an interaction term of *prime* and *post*, that equals one for those observations only that belong to both the treatment group and the post-demutualization period. The final regression model presents itself as

$$LIQ = \beta_0 + \delta_0 treat + \beta_1 post + \delta_1 demut + \epsilon, \quad (4.5)$$

where  $\beta_0$  is an intercept and  $\epsilon$  is an error term.  $\delta_1$  equals  $\hat{\delta}_1$ , but in addition equation (4.5) allows us to compute its standard error, which could not be obtained from equation (4.4). In this model, the interaction term captures the change in liquidity that is neither due to temporal effects nor due to general differences between both trading venues. In-

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<sup>16</sup> An alternative proxy for the demutualization event is the sale of equity to outside investors. The analysis carried out in chapter 3 has shown that both proxies have similar explanatory power. Bertrand et al. (2004) and Conley and Taber (2005) stress the importance of having a transparent exogenous intervention that the clearly determines the assignment to treatment or control group. Both proxies equally display that feature.

<sup>17</sup> where  $LIQ$  can be any of the liquidity measures introduced in Chapter 4.3.1

stead, it states the change in liquidity that results from an improvement of an exchange's competitive situation following a demutualization. Apparently, the results of this DiD regression model have to be interpreted with care as it neglects other individual control variables.<sup>18</sup> Thus, it is only valid under the restrictive assumption that in absence of a demutualization event changes in liquidity over time would be identical for both groups.

The second stage of the empirical examination proceeds with a panel data analysis.<sup>19</sup> Compared to the DiD analysis this procedure has the advantage of making fully use of the temporal and spatial information contained in the sample, as it does not condense information into averaged pre- and post-treatment values. Thus, it presents a good instrument to supplement and to cross-check the results of the DiD estimation. There are various types of panel data models.<sup>20</sup> I employ a random effects (RE) model (Balestra and Nerlove, 1966). Such a model is applicable for this setting, since I include time-invariant variables among the regressors (Greene, 2003).<sup>21</sup> A RE model is build upon the general unobserved effects model for panel data:

$$y_{it} = \beta_0 + \beta_1 x_{it1} + \dots + \beta_k x_{itk} + a_i + u_{it}, \quad (4.6)$$

with  $i$  denoting the spatial unit,  $t$  the time period and  $k$  an index over the number of regressors. The variable  $a_i$  reflects all unobserved, time-constant factors that have an effect on  $y_{it}$ . Due to the intercept variable,  $\beta_0$ ,  $a_i$  has a zero mean.  $u_{it}$  is a time-varying error term that captures the remainder effects and

$$\text{cov}(a_i, u_{it}) = 0. \quad (4.7)$$

RE models share all assumptions with fixed effect models, but additionally require  $a_i$  to be independent from all regressors. To estimate the variables' coefficients we define the composite error term as

$$v_{it} = a_i + u_{it} \quad (4.8)$$

and substitute  $v_{it}$  into equation 4.6

<sup>18</sup> For reasons of simplicity and brevity I do not include additional dummy variables for every exchange in the DiD regressions, but in panel regressions only.

<sup>19</sup> The following description of a random effects model draws mainly on Wooldridge (2002).

<sup>20</sup> For a broad discussion of the various models as well their applicability and shortcomings see Wooldridge (2002) and Greene (2003).

<sup>21</sup> Hausman tests conducted with different sets of exogenous variables cannot reject the nullhypothesis that coefficients from random and fixed effects specification are different on a 10% level (Hausman, 1978). Therefore, applying a RE model seems to be appropriate.

$$y_{it} = \beta_0 + \beta_1 x_{it1} + \dots + \beta_k x_{itk} + v_{it}, \quad (4.9)$$

with the following covariances:

$$\text{cov}(v_{it}v_{js}) = \begin{cases} \sigma_a^2 + \sigma_u^2 & i = j, s = t \\ \sigma_a^2 & i = j, s \neq t \\ 0 & \text{otherwise} \end{cases} \quad (4.10)$$

From this we could obtain consistent estimates using pooled ordinary least squares estimation procedures. Yet this ignores serial correlation between the composite error terms causing standard errors to be biased. Thus, it becomes necessary to use general least squares transformation to eliminate serial correlation in the errors. It can be demonstrated that the RE estimator is obtained by applying pooled ordinary least squares regression after the following transformation known as quasi-demeaned data (Wooldridge, 2002)

$$(y_{it} - \theta \bar{y}_i) = \beta_0(1 - \theta) + \beta_0(x_{it1} - \theta \bar{x}_{i1}) + \dots + \beta_k(x_{itk} - \theta \bar{x}_{ik}) + (v_{it} - \theta \bar{v}_i), \quad (4.11)$$

where

$$\theta = 1 - \sqrt{\frac{\sigma_u^2}{T\sigma_a^2 + \sigma_u^2}}. \quad (4.12)$$

Since the transformation is obtained by subtracting only a fraction of the averages ( $\theta$ ) it allows for time-invariant variables to be included among regressors. For  $\theta = 1$  the RE estimator is identical with the fixed effect estimator and for  $\theta = 0$  it is identical with the pooled ordinary least squares estimator. To assess the goodness of fit of a panel model either a  $\chi^2$ -distributed Wald test or a  $R^2$  test can be employed.

### 4.3.3 Estimation Results

Table 4.4 presents results from estimating DiD estimators. Drawing from a panel data set of daily liquidity measures, I compute average values using a 300 days observation period before and after the demutualization of the primary market with a 200 day lock-up period around the event. Thus, the sample is reduced to one pre- and one post-demutualization observation per security and trading venue. Differencing between the the average liquidity

Table 4.4: One-sided t-test on difference-in-differences in liquidity

This table displays t-test statistics for difference-in-differences estimations. It shows the average differences in liquidity before ( $\Delta$  *pre demut*) and after ( $\Delta$  *post demut*) demutualization as well as the difference between the two (*DiD*). Averages have been calculated using a 300 days observation period before and after the event with a 200 day lock-up period around the event. Calculations are based upon a sample 156 securities that are simultaneously listed on an exchange that demutualizes and one that does not. Liquidity definitions stem from table 4.2. \*\*\* and \*\* denote significance at the 1% and 5% level respectively.

	<i>vol</i>	<i>lr</i>	<i>spr</i>	<i>ln.vol</i>	<i>ln.lr</i>
$\Delta$ <i>pre demut</i>	3.45	.67	-.00205	2.50	3.55
$\Delta$ <i>post demut</i>	6.36	1.30	-.00212	2.66	3.73
<i>DiD</i>	-2.91**	-.63***	.00006	-0.16***	-0.18***
t-value	-1.98	-3.37	.13	-2.40	-2.55
N	156	156	156	156	156

values registered for primary and secondary markets yields pre- ( $\Delta$  *pre demut*) and post-event ( $\Delta$  *post demut*) differences. Differencing again between pre- and post-event averages produces DiD estimates (*DiD*).

In line with previous empirical work (Werner and Kleidon, 1996; Foerster and Karolyi, 1998; Bacidore and Sofianos, 2002), I expect primary markets to attain permanently higher liquidity levels than secondary trading venues, so that  $\Delta$  *pre demut* > 0 and  $\Delta$  *post demut* > 0. This assumption holds for all liquidity measures but spreads. Since higher liquidity levels correspond with tighter spreads, I assume the inversion of the inequality to apply for spreads. Additionally, I assume that a demutualization exerts a positive effect on an exchange's efficiency and subsequently improves its liquidity relative to competitors', so that  $\Delta$  *pre demut* <  $\Delta$  *post demut* and *DiD* < 0. Again, for spreads I assume the inverse.

Table 4.4 shows that pre- and post-event averages and DiD estimators are in line with expectations. On average, demutualized exchanges attain higher liquidity levels in the pre- and in the post-demutualization period. Yet this effect cannot be attributed to a demutualization, but is caused by the identity of primary and demutualized markets in this sample. As expected, demutualized exchanges accomplish to widen the liquidity gap after demutualizing. The DiD estimator for traded shares (*vol*) registers an average increase of 2.9m shares traded daily. Similarly, the long term resiliency (*lr*) of a demutualized market improves by a factor of two. Testing for the equality of means indicates that both results are highly significant. Obviously, DiD estimates for the corresponding log variables register at smaller values. They are also highly significant. Pre- and post-event averages for realized spreads (*spr*) show that spreads on primary markets are clearly tighter. Due

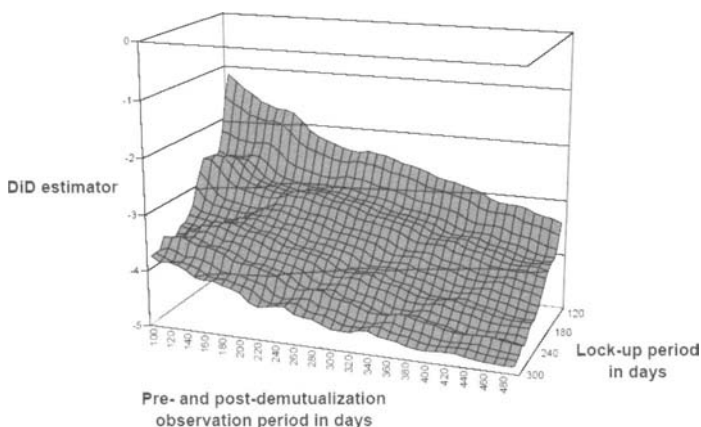


Figure 4.1: Range of DiD values obtained for varying the length of the observation and lock-up period.

to a larger post-demutualization difference, the DiD estimator is positive. Thus, it yields the expected sign. However, it is almost indistinguishable from zero and fails to show significance. Though demutualized exchanges manage to reduce spreads by 0.2% on average, this reduction is almost completely met by their undemutualized counterpart. Supplementary analysis shows that these results are robust against variations of the length of the observation period and remain constant irrespective of the choice of lock-up periods. To illustrate this, I have computed DiD estimations with changing observation windows and varying lock-up periods. The process was simulated for 800 different set-ups. Figure 4.1 shows that variations in these parameters affect DiD estimators only marginally.<sup>22</sup>

Table 4.5 shows results from estimating difference-in-differences regressions. These permit to determine whether the DiD estimators are statistically significant from zero. Additionally, this analysis allows to study structural differences in liquidity between both markets (*prime*) as well as temporal changes in liquidity (*post*) that apply to both listing venues. This analysis differs from the DiD estimation displayed in Table 4.4 in two crucial points: first, DiD coefficients (*demut*) do not capture differences in means, but instead the additional effect attributed to a demutualization. Though equal in size, effects switch signs. Second, observations have quadrupled due to extending the sample to four observations per security (cf. Chapter 4.3.2).

<sup>22</sup> The range displayed is derived from the liquidity measure volume. Similar ranges are obtained for varying the other variables. Importantly, in none of the DiD estimators switches signs in any of the cases.

Table 4.5: Difference-in-differences estimations

This table displays results from estimating difference-in-differences regressions. Calculations are based upon a sample of 156 securities that are dually listed on an exchange that demutualizes (treatment group) and one that does not (control group). Averages in daily liquidity measures are regressed on a set of dummy variables. *prime* captures structural liquidity differences between treatment and control group that are not due to the demutualization event. *post* measures temporal liquidity differences in the pre- and post-demutualization period. *demut* is an interaction term of *prime* and *post* and captures changes in liquidity that result from a demutualization. The intercept states the average liquidity of the control group before demutualizations occur in the treatment group. Liquidity definitions stem from Table 4.2. \*\*\* and \*\* denote significance at the 1% and 5% level, respectively.

	<i>vol</i>	<i>lr</i>	<i>spr</i>	<i>ln_vol</i>	<i>ln_lr</i>
<i>prime</i>	3.45*** (.68)	.67*** (.15)	-.00205*** (.00048)	2.50*** (.15)	3.55*** (.21)
<i>post</i>	.06 (.64)	.00 (.00)	-.00153*** (.00051)	.03 (.07)	.02 (.10)
<i>demut</i>	2.91** (1.47)	.63*** (.19)	-.00006 (.00049)	.16** (.07)	.18** (.07)
<i>cons</i>	.80*** (.28)	.01*** (.00)	.00837*** (.00059)	11.46*** (.16)	6.90*** (.16)
<i>F - Test</i>	19.35***	6.96***	14.23***	105.87***	93.52***
<i>R</i> <sup>2</sup>	.027	.054	.032	.302	.356
<i>N</i>	624	624	624	624	624

Conforming to expectations, primary markets attain fundamentally higher liquidity levels across all variables. For example, primary markets (3.45m shares traded) outnumber secondary markets (0.80m shares traded) on average by a factor of four in shares transacted in the pre-demutualization period. Also in line with expectations, all liquidity measures are affected positively by a demutualization. For turnover and liquidity ratio, these effects almost equal the size of the structural liquidity difference. With the exception of spread, they are all highly significant. Spread is the only liquidity measure to display a significant overall temporal effect. As already indicated by descriptive statistics, the overall level of spreads has declined considerably over the sampling period. This effect could be attributed to the general rise in turnover and the introduction of new trading technologies. Rising turnover volumes facilitate the matching of orders and decrease execution risk, making tighter spreads economically viable. Furthermore, modifications of market micro-structures, such as the reduction of the minimum tick size by the NYSE, could have caused spreads to contract. I tend to this issue in more detail below. The hypothesis that the coefficients of all independent variables are jointly equal to zero is rejected due to the highly significant F-test statistic for all five specification.

Table 4.6: Panel regression results

This table displays results from estimating RE GLS panel regressions based upon a sample of 156 securities that spans 10 years (Aug 1994 to Aug 2004) and contains 285,551 observations. Regressands are obtained by differencing between liquidity measures in a primary market that demutualizes and a secondary that does not. Liquidity measures stem from Table 4.2. *demut* is a dummy variable, that equals one after the demutualization of the primary market. *time* captures temporal effects. *decimal* is a dummy variable that equals one after the NYSE changed from fractional to decimal pricing. The remainder regressors are dummy variables that indicate the primary listing venue of a security (cf. Table 4.1). Figures in parentheses refer to standard errors. Wald  $\chi^2$  statistics test the hypothesis that all variables in the model equal zero simultaneously. \*\*\* and \*\* denote significance at the 1% and 5% level respectively.

	$\Delta vol$		$\Delta lr$		$\Delta spr$		$\Delta ln vol$		$\Delta ln Jr$	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
<i>demut</i>	2.20*** (.13)	2.19*** (.13)	.42*** (.02)	.41*** (.02)	-.0016*** (.0001)	-.0016*** (.0001)	.03*** (.01)	.03*** (.01)	.02*** (.01)	.02*** (.01)
<i>time</i>	.96*** (.02)	.96*** (.02)	.21*** (.00)	.21*** (.00)	.0004*** (.0000)	.0004*** (.0000)	.04*** (.00)	.04*** (.00)	.08*** (.00)	.08*** (.00)
<i>decimal</i>					.0017*** (.0001)	.0017*** (.0001)				
<i>D_AS</i>		4.42 (12.70)		12 (2.54)		-.0007 (.0062)		41 (1.76)		-1.84 (1.62)
<i>D_AT</i>		-.37 (15.10)		-.24 (2.99)		-.0093 (.0073)		2.09 (2.07)		-.38 (1.91)
<i>D_AX</i>		6.70 (13.20)		.40 (2.61)		-.0046 (.0063)		2.69 (1.80)		.64 (1.67)
<i>D_DE</i>		2.68 (12.90)		-.18 (2.56)		-.0048 (.0062)		1.49 (1.77)		-.88 (1.64)
<i>D_HE</i>		3.50 (13.80)		.18 (2.73)		-.0032 (.0066)		1.38 (1.89)		-1.20 (1.74)
<i>D_HK</i>		9.75 (15.10)		.12 (2.99)		-.0072 (.0072)		-.58 (2.07)		-.57 (1.91)
<i>D_JN</i>		5.74 (15.10)		.34 (2.99)		-.0053 (.0072)		2.19 (2.07)		-.30 (1.91)
<i>D_L</i>		15.50 (12.50)		4.88** (2.46)		-.0022 (.0060)		2.10 (1.71)		3.81*** (1.58)
<i>D_NZ</i>		5.73 (17.40)		.53 (3.46)		-.0028 (.0084)		.48 (2.39)		-1.39 (2.21)
<i>D_OL</i>		2.00 (15.10)		.48 (2.99)		-.0015*** (.0072)		1.96 (2.07)		1.24 (1.91)
<i>D_PA</i>		3.58 (12.80)		.08 (2.55)		-.0078 (.0061)		1.99 (1.75)		-.68 (1.62)
<i>D_TO</i>		1.33 (12.40)		.17 (2.46)		-.0036 (.0060)		.02 (1.70)		-1.80 (1.57)
<i>cons</i>	19.10*** (.44m)	19.10*** (.46m)	41.70*** (.55m)	41.60*** (.61m)	.0074*** (.0003)	.0074*** (.0003)	80.93*** (2.74)	80.05*** (3.21)	162.91*** (1.92)	163.21*** (2.47)
Wald $\chi^2$	7507***	7539***	20986***	21084***	2937***	2960***	2284***	2340***	16285***	16594***
R <sup>2</sup>	.011	.070	.018	.073	.009	.031	.010	.195	.002	.646

Applying DiD methods to panel market data bears the disadvantage that the information at hand is not made fully use of. Instead, observations are condensed into pre- and post-event averages. The appropriate way to exploit all the information contained in the sample is to estimate panel regressions. Table 4.6 presents results from estimating random-effects generalized least squares regressions. Calculations are based upon the entire sample of 156 equity issues. Overall, the sample contains 285.551 daily observations that span across 10 years. The difference between the respective liquidity measure on the primary and the secondary market serves as a regressand. For each liquidity measure, I estimate two groups of models. In the first group, models contain a demutualization dummy (*demut*) and an additional variable representing an independent time trend (*time*). In the second group, further explanatory variables are added that control for structural differences between primary listing venues. These variables are coded as dummies with the reference group being Stockholm Stock Exchange.

Table 4.6 shows that the RE panel regression estimates support the DiD results. Coefficients for demutualization display the same sign and significance level as before. They are also comparable in size. Furthermore, there is considerable evidence of a temporal effect (*time*) indicating that the liquidity gap between primary and secondary markets increases constantly over time. The trend extends over all measures covered. Together, these findings are consistent with the flow-back hypothesis and the view expressed by many issuers that dual listings have failed to meet their expectations in terms of volume traded on secondary markets Halling et al. (2005). One source of this lack of turnover is primary markets facilitating access to their trading platforms, which enables foreign investors to tap primary liquidity pool directly. It also reflects the NYSE's refusal to adapt to evolving markets as observed during the sampling period, such as its clinging on to floor trading. Furthermore, this development could be influenced by factors beyond the exchanges' sphere of control such as the modification of reporting and disclosure rules. The second group of specifications is consistent with the first. Exchange-specific variables document large differences in liquidity compared to the reference group Stockholm Stock Exchange, but mostly fail to be significant. This indicates that there are no time-consistent structural liquidity differences between the sampled exchanges. Solely, the dummy for the London Stock Exchange ( $D_L$ ) shows significant additional effects in structural liquidity differences for both resiliency measures. There is no obvious explanation for this finding, as the variable fails to be significant for the other liquidity measures.

The panel regressions also facilitate an understanding of the development of spreads during the sampling period. As for the DiD models, the coefficient for demutualization shows the expected sign. Yet additionally, it is substantially different from zero and

Table 4.7: Decimalization NYSE

This table documents the impact of the NYSE's conversion from decimal pricing to fractional pricing. On January 29<sup>th</sup> 2001, the NYSE implemented full decimalization for all securities listed, reducing the minimum tick size from formerly 6.25 cent to one cent. Average pre and post decimalization spreads and average reductions are displayed for securities trading at three different price levels.

	NYSE		Demut.	
	Mean	Obs.	Mean	Obs.
Panel A: Securities trading below \$ 10:				
pre decimal	0.0205	23.992	0.0131	23.992
post decimal	0.0166	22.696	0.0113	22.696
change (in %)	-19.07%		-13.38%	
Panel B: Securities trading below \$ 5:				
pre decimal	0.0317	6.525	0.0199	6.525
post decimal	0.0243	7.458	0.0162	7.458
change (in %)	-23.29%		-18.65%	
Panel C: Securities trading below \$ 3:				
pre decimal	0.0402	2.631	0.0247	2.631
post decimal	0.0284	3.011	0.0207	3.011
change (in %)	-29.21%		-16.23%	

highly significant. Thus, it provides evidence for a considerable tightening of spreads following a demutualization. As suggested by the descriptive analysis, this effect is offset in part by temporal effects. With every additional year, the liquidity gap decreases by 0.04%. In contrast to the regressions on the other liquidity variables, the specification using  $\Delta spr$  as independent variable contains one extra parameter. On January 29<sup>th</sup> 2001 the NYSE implemented full decimalization for all securities listed. In an attempt to compete more efficiently with other markets and to attract more volume, the minimum tick size was reduced from formerly 6.25 cent to one penny (Oppenheimer and Sabherwal, 2003). To capture the effect of this substantial modification of the NYSE's market microstructure I include a dummy variable that equals zero before NYSE's decimalization and one thereafter. The coefficient for decimalization is positive and significant and indicates that the liquidity gap decreases substantially after the pricing modification. Precisely, the observed effect equals the demutualization effect in size but is contrary in direction. Thus, it helps to explain, why for the DiD estimation the demutualization effect for spread was virtually indistinguishable from zero. In order to further illustrate the decimalization effect on spreads, Table 4.7 shows average pre- and post-decimalization spreads for a subsample of securities trading at different price levels. In particular, decimalization should have an strong impact on the spreads of securities trading at lower price levels.

Therefore, I have computed average spread changes for three different price levels in the lower ranges. Again, it becomes apparent that the change in minimum tick size is responsible for a large decrease in spreads at the NYSE. The decimalization effect increases with a decrease in the pricing level of the underlying securities.

Overall, the results presented here are supportive of previous empirical research by Werner and Kleidon (1996), Foerster and Karolyi (1998) and Bacidore and Sofianos (2002) in finding that primary markets attain permanently higher liquidity levels than secondary trading venues. More importantly, this analysis provides significant evidence of a substantial improvement of an exchange's liquidity following a demutualization. Both the DiD models and the panel regression models support this finding. This finding is genuine and has not been documented before. The improvement in liquidity applies to all liquidity dimensions and includes an increase in volume, an improvement of the market's long-term resiliency and a reduction of spreads. However, in this setting with the NYSE as the sole secondary trading venue the latter effect is offset by a change in the NYSE's market micro-structure. Apparently, the transformation of an exchange's ownership and governance structure is an effective means to improve its competitive position and to draw volume from its rivals.

## 4.4 Conclusion and Outlook

Economic theory offers strong indications that a demutualization boosts an exchange's efficiency, since it abolishes institutional inefficiencies inherent in mutual organizations. In this paper, I have examined this proposition. In contrast to existing studies, I have assumed liquidity to be the key variable for assessing an exchange's efficiency. Though it is not under the direct control of an exchange, it can be considered to ultimately reflect efficiency, as liquidity represents the core competitive variable among securities exchanges. I employ a quasi-experimental framework to estimate the effect of a demutualization on the liquidity flows between competing exchanges. My analysis draws from a panel data set that contains paired observations for 156 cross-listed equity issues and extends over a period of ten years. This allows me to compute several liquidity measures that reflect the various dimensions of liquidity over entire period of the industry's transformation.

In line with existing literature, the analysis shows that liquidity levels on primary markets are consistently higher than on secondary markets. Employing difference-in-differences estimation and standard panel regression methods, I find that a demutualization yields significant beneficial effects on a demutualizing exchange's liquidity in dually listed securities. The improvement in liquidity applies to all liquidity dimensions and includes an increase in volume, an improvement of the market's long-term resiliency and a reduction of spreads. This analysis strongly suggests that the transformation of an exchange's ownership and governance structure is an effective means to improve its position in the industry's competitive pecking order and to draw volume from its rivals.

It would be premature, though, to generally apply the results of this study to the competition among stock exchanges without further examinations. In particular, further evidence on the beneficial effects of a demutualization would be helpful to confirm the results. Obviously, the approach employed in this analysis could be extended to other markets and securities. It would be particularly interesting to examine how demutualized exchanges fare against electronic communication networks (ECNs) such as Archipelago or Instinet. These systems have been particularly successful in America, where exchanges were slow to adopt electronic trading, and have secured market shares of up to 30%. As the NYSE currently reviews the prospects of demutualizing this might offer an interesting event study analysis, as it would allow covering a large number of securities that are simultaneously traded on an ECN. Also, the competition among commodities and derivatives exchanges could mark a promising point of departure for two reasons. First, as

for securities exchanges, this industry has witnessed a wave of demutualizations lately.<sup>23</sup> Second, the products traded on these markets are highly standardized and are traded by highly professional investors. Such analyses would help to broaden our comprehension of the competitive effects triggered by demutualizations in the securities exchange industry.

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<sup>23</sup> For instance, the Chicago Mercantile Exchange demutualized in 2000, followed by the Chicago Board of Trade in 2005. Several European commodities and derivatives markets, like LIFFE and EUREX are owned by demutualized exchanges.

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