

**Taking Stock in Stock Markets:  
The Changing Governance of Exchanges**

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## Taking Stock in Stock Markets: The Changing Governance of Exchanges

Stock exchanges around the world are experiencing a seismic shift with respect to corporate governance. Whereas 5 years ago there were no publicly traded exchanges, now there are 10, with a market value exceeding \$15 billion dollars. Over this period, nineteen stock markets demutualized, with several of these, such as the Nasdaq, now planning their IPOs. Of the world's 10 largest stock markets, only the New York Stock Exchange and the Tokyo Stock Exchange remain non-shareholder owned entities. This departure from the traditional structure of member-owned cooperatives represents a shift not only for individual firms, but for the broader exchange industry as well. Indeed, the recent listing of the Chicago Mercantile Exchange on the New York Stock Exchange testifies to a similar governance revolution occurring in the ranks of futures exchanges.<sup>1</sup>

In this paper, we examine the equitization of equity markets. Because stock markets traditionally eschewed corporate ownership, their shift to being publicly traded entities is interesting in and of itself. But because stock exchanges, in turn, often dictate corporate governance standards for listed companies, the corporate governance of equity exchanges takes on an added importance. Indeed, an intriguing problem confronting at least some exchanges is their inability to meet their own listing requirements. Finance research (for example, LaPorta, Lopez-de-Sillanes, Shleifer, and Vishny [1997], Daouk and Bhattacharya [2002]) has highlighted the important role of legal, regulatory, and market structures in affecting firms' cost of capital. As equity exchanges join the ranks of traded firms, the impact of their corporate governance change may thus influence the behavior of their listed firms as well.

Our particular focus in this research is the effect of exchange conversions on exchange performance and valuation.<sup>2</sup> There are a number of theories regarding why firms adopt particular

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<sup>1</sup> The Chicago Mercantile Exchange (CME) listed on the NYSE on December 2, 2002.

<sup>2</sup> In this paper we focus only on exchanges that have publicly traded shares. A number of exchanges have demutualized, but do not traded equity, for example, the Borsa Italiano or the National Stock Exchange (India). For

corporate governance structures, and the change in this industry gives us an excellent venue in which to investigate whether this shift from cooperative to corporate governance is value enhancing. To address this, we evaluate how these new corporate exchanges have fared, looking at both accounting data and return performance. A unique feature of these exchange conversions is that the exchange lists on itself, suggesting a natural comparison of the exchange's return to that of its underlying index. We also compare the return behavior of these newly-listed exchanges to other IPOs on each exchange, allowing us to control for any risks unique to the listing process. Finally, we look at the impact of economic factors on exchange performance, and in particular examine the effects of conversions on measures of stock exchange liquidity.

We caution at the outset that the recent nature of exchange conversions imposes limitations on our analysis. Virtually all of these exchange stock offerings have occurred in the past three years, a period characterized by rather dramatic declines in equity values world-wide. Moreover, our sample size is small, curtailing our ability to draw statistically significant inferences for some of the questions we pose. Nonetheless, our analysis does provide a number of intriguing results, suggesting at least some preliminary findings on these equity market conversions.

Perhaps the most important of these findings is that exchange equitizations appear to be value-enhancing changes. We find that exchange performance tends to improve after the change in corporate governance. This value enhancement is reflected in the investment performance of these shares, as stock exchange offerings typically outperform both the stocks that are listed on its index and other IPOs in the exchange's home market. We find that in common with IPOs in general, exchange IPOs exhibit first day under-pricing, but unlike the typical IPO, exchange stock offerings continue to do well in the months and years after the offering. We present evidence that this successful long-run performance is due to the change in exchange corporate governance. We also

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an interesting comparison of mutual versus demutualized exchange behavior in India see Krishnamurti, Sequeira, and Fangjian [2003].

investigate how economic factors influence exchange performance, and we establish that exchange performance measures such as the liquidity index generally improve after conversions. We also show that, for at least some exchanges, changing corporate governance cannot overcome the challenges posed by their adverse economic environment.

This paper is organized as follows. In the next section, we detail the particular features that characterized traditional exchange governance, and we review the rather limited literature on exchange governance. We then set out the general issues we will investigate in the paper. Section 2 describes our specific sample of converting exchanges. An intriguing feature of the data is that only a subset of these exchanges has actually had a public offering; the others have outstanding stock because of a distribution of shares to their members. We review the specifics of these IPOs and stock offerings. In Section 3, we investigate the performance of these converting exchanges, with a particular focus on whether exchange conversion has been value-enhancing. To control for the influence of market factors, we examine the post listing performance of exchanges relative to the returns on that stock index for that exchange. We incorporate more specific risk factors by investigating the performance of exchange IPOs relative to other IPOs in their home markets, and we look at the market risk sensitivity of exchange stocks. We also provide regression analysis linking exchange performance to economic factors, and to the production of liquidity. Section 4 concludes by considering the implications of our research for exchange structure and performance.

## **1. The Corporate Governance of Stock Exchanges**

Stock exchanges have traditionally been organized as member-owned cooperatives. Unlike the more standard corporate structure, there are no outside owners of a cooperative, and the members are the residual claimants of the firm. Cooperative governance structures can be found both in commercial settings, such as mutual insurance companies, savings banks, and agricultural co-ops, and in non-commercial settings, such as country clubs. A feature common to all of these venues is

that the members own the entity, and they typically have equal votes in corporate governance matters.

That stock exchanges have such a cooperative structure could be ascribed partly to historical reasons. The New York Stock Exchange traces its roots to 1792, although its formal incorporation as a cooperative dates to 1817. The Boston Stock Exchange was founded in 1834, while the New York Curb Market (later renamed the American Stock Exchange) dates from 1849. The London Stock Exchange is even older, claiming an inception of 1760, while the Amsterdam Stock Markets has roots to the early 1600's.<sup>3</sup>

Certainly, prior to the 20<sup>th</sup> century, non-corporate forms of enterprise were quite common, and the early stock exchanges were initially formed as clubs.<sup>4</sup> The London Stock exchange, for example, began when 150 brokers, expelled from the Royal Exchange for rowdy behavior, formed a club at Jonathan's coffee house to buy and sell shares. The resulting entity, renamed the London Stock Exchange, became a regulated exchange in 1801. In the 19<sup>th</sup> century, it was also standard for some industries (for example, savings banks) to be legally restricted to the mutual or cooperative form, a restriction imposed in part to protect their customers from rapacious corporate behavior.

Yet, history alone cannot provide the explanation for why exchanges are cooperatives, as firms of similar vintage did opt for a more standard corporate structure with outside ownership. A more compelling explanation may lie in the economic function of the stock exchange. There is an extensive literature (see Shleifer and Vishny (1997) for a review) arguing that the corporate governance structure of the firm is designed to minimize contracting and other costs. In some of the earliest work on non-corporate structures, Hansman (1988) argued the cooperative structure may be

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<sup>3</sup> The Stockholm Exchange is also one of the oldest beginning with King Carl Johan signing the first Exchange Act on 8 September 1818. In April 1819 the Christiania Exchange opened for business between 11:00 and 13:00 on Mondays and Thursdays, a schedule thought to be sufficient for the level of activity expected.

<sup>4</sup> An exception to this is the Vienna Stock Exchange which opened in response to an edict by Empress Maria Theresa in 1771 (see Kongden [1998]). The Vienna Exchange represented an unusual governance structure in that it was state-owned and operated. Kongden attributes this to its use by the government to float issues needed to finance wars. Indeed, at the time of its founding, the Empress ordered all existing exchanges in Austria to close, thus removing competition from the cooperatively owned exchanges.

optimal when the employees of a firm are highly homogeneous because employee ownership reduces contracting costs. Hart and Moore (1996) suggest that the cooperative structure may be optimal when concentrated ownership gives non-shareholder constituencies too few rents to make relationship-specific investments. In these setting, a cooperative structure may lead to more efficient decision-making.

A number of authors have applied this reasoning to explain the structure of stock exchanges. DiNoia (1998), drawing on ideas from Hansman (1996), argues that stock exchanges typically had large monopoly power in dealing with their customers. By organizing the exchange as a customer-owned entity, the users of the exchanges services could protect themselves against monopoly expropriation. Hart and Moore (HM) (1996) emphasize the decision-making aspect of governance in their analysis of stock exchange structure. HM argue that both outside (corporate) ownership and a members' cooperative are inefficient, but for different reasons. Outside owners focus on maximizing profits, and so tend to focus decision making on the marginal user (the analogy they draw upon is that of the monopolist who inefficiently restricts supply to raise prices). The cooperative is inefficient because "the views of the decisive voter are not necessarily those of the membership as a whole". To the extent that the membership is homogeneous, this latter cost is minimized. HM argue that the traditional homogeneity of stock exchange members gives a rationale for its cooperative structure.

Kongden [1998] and Macey and O'Hara (MOH) (1999) argue that the nature of the exchange product was partially responsible for its original corporate structure. MOH note that historically listing firms and exchanges made reciprocal, firm-specific investments in one another. Exchanges provided a vector of services (including monitoring, reputational capital, clearing, standardized rules, and liquidity), while listing firms provided the shares that the exchange traded. Because both sides had non-diversifiable investments in the relationship, both sides were vulnerable to being exploited by the strategic behavior of the other. It follows that to protect their investment both sides would

want a stake in governing the enterprise. Thus, these corporate governance needs were better met by a cooperative structure in which both sides had voting rights.<sup>5</sup>

It is our view that all of these factors (historical antecedents, monopoly power, customer homogeneity, and relationship investments) played a role in influencing traditional exchange governance structures. What is less apparent is what is causing exchanges now to depart from this structure. As noted in the Introduction, the shift to corporate ownership for exchanges is very recent, with virtually all exchange governance changes occurring in the past 5 years. After a century or more of a cooperative governance structure, why is it now optimal for exchanges to organize as publicly traded firms?

The economic environment for exchanges provides one explanation. The past decade has witnessed tremendous change in the competitive landscape confronting exchanges. Technology has both allowed the rise of new competitors such as ECNs, and forced existing exchanges to install new and expensive trading platforms. While these new competitors offer only a liquidity function, Macey and O'Hara [2002] argue that the other traditional exchange functions are now readily available from other sources. Thus, competition has become focused on who can provide liquidity more efficiently. Technology has also contributed to the demise of national boundaries, as now where a stock trades need not be where the company operates (or even where its shares are listed). With many venues able to trade stocks, the virtual monopoly traditionally enjoyed by exchanges has evaporated.<sup>6</sup> Moreover, since many of the new trading systems are owned by member firms of the exchanges, the interests of exchange members are often divergent.<sup>7</sup>

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<sup>5</sup> The voting structure of the NYSE exemplified this point. The Board of Directors is composed of 27 members, with three from the Exchange, 12 members representing the public and 12 members representing the securities industry. Recent proposals to change the Board are intended to increase the independence of the board.

<sup>6</sup> Macey and O'Hara [1999] discuss the role of technology in affecting exchange competition. Aggarwal [2002] also discusses this technology linkage, and presents some early evidence of the success of exchange demutualizations.

<sup>7</sup> Fluck and Stomper [2003] investigate these divergences in members' interests and their implications for exchange governance and fee structures.

The result of this upheaval is that exchanges now face extreme competitive pressures. Updating trading platforms is capital-intensive, and this has forced exchanges large and small to consider how they can finance such investments. Furthermore, because liquidity is more easily attained with scale, many smaller exchanges are questioning whether they can ever operate with the efficiency needed to survive. This factor has surely contributed to the mergers of more than 16 exchanges in the past five years. But even large exchanges are grappling with how to attain efficiency in this new trading environment.

Against this competitive backdrop, the cooperative structure of exchange corporate governance appears anachronistic. With their monopoly power diminished and the members' interests increasingly divergent, the benefits of the cooperative structure are greatly diminished. And with the relationship nature of the business now transformed to that of providing a commodity (liquidity), little ties either issuers or members to the exchange. A further complication of the cooperative structure is the limitations it places on raising new capital; since only members can be owners, raising capital by selling shares in the public markets is not an option.<sup>8</sup> Viewed from a transactions cost perspective, the costs of organizing as a cooperative are now greater than the benefits.

This analysis suggests that replacing the cooperative structure with a corporate structure would allow for a corporate governance framework better suited to the exchange's competitive environment. With the exchange better positioned to compete, we would expect improved performance from the exchange, and thus exchange conversion should be a value-enhancing strategy for the exchange's owners.

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<sup>8</sup> Some evidence of these effects is given by the Deutsche Borse's explanation of why it went public: "Deutsche Borse AG was floated on the stock market in order to consequently pursue its internationalization strategy. The fresh capital will allow us, as a fully-integrated European exchange organization, to finance our growth within the sector of e-commerce in securities and derivatives, consolidate our existing markets and also create new ones: in Germany, in Europe and beyond. Furthermore the floatation was a prerequisite for both major international investment banks as well as private investors to exert an influence on our course and participate in our success."



However, there are a number of factors that may complicate attaining this positive outcome. One is that exchanges have typically opted to offer shares in response to adverse economic conditions. If economic and competitive conditions for the exchange are bad enough, then corporate governance changes may not be enough to restore exchange viability. A related concern is that the fortunes of an exchange are not independent of the fortunes of its underlying listed firms. Thus, to the extent that the entire market may be facing difficult times, the stock exchange will also face economic difficulties even with an enhanced governance structure.

Moreover, whether exchange behavior changes with its corporate governance structure may depend, in part, on how much this transformation affects the actual ownership of the exchange. An interesting feature of exchange equitizations is that they typically involve an initial distribution of shares to their members. Specifically, because the exchange is member-owned, shifting to tradeable equity requires distributing shares to these owners, a process known as demutualization.<sup>9</sup> Following the demutualization, the exchange can then issue shares to outside investors through a private placement or public offering.

How much of the new exchange is sold to outside investors may be an important signal to investors. For IPOs in general, Habib and Ljungvist [2001], Loughran and Ritter [2002] and Bradley and Jordan [2002] find evidence of a negative relation between the initial return and the fraction of the issuers' outstanding shares that are sold. Thus, selling fewer shares to outsiders is generally a positive signal of firm value. In the case of stock exchanges, however, a confounding effect may arise. In particular, DeNoia [1998] argues that as customer-owned entities, the operating decisions of exchanges were focused primarily on maximizing the user of the exchanges utility. To the extent that exchange ownership remains vested in its members, the exchange may continue to maximize

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<sup>9</sup> In the Nasdaq demutualization, for example, the Company effected a 49,999 –for-one stock dividend creating 100 million shares of common stock outstanding, all of which were initially owned by the NASD.

these insiders' interests rather than to maximize profits. This suggests that outside investors may fare better in exchange privatizations in which a greater percentage of the firm is sold to outsiders.

In the remainder of the paper, we turn to investigating these effects of exchange equitizations. The discussion above suggests investigating not only the individual performance of these exchanges, but also their performance relative to other listed firms in their market and to other initial public offerings. Our argument that corporate governance changes reflect economic pressures suggests also looking at the economic factors affecting returns. In the next section, we begin this examination by setting out the sample of exchanges that have undertaken conversions, their method of doing so, and the data we will use in this study.

## **2. The Converting Exchanges: Data**

As noted in the Introduction, the advent of listed stock exchanges is a recent phenomenon. Currently there are 10 traded stock exchanges, with one additional stock exchange owned by a publicly traded company. **Table 1** gives a summary of these publicly-listed exchanges. As a useful preliminary, we give a short history of the exchange conversions thus far, and we provide specific details of the currently trading offerings. The conversant reader can skip this subsection and proceed directly to the next subsection where we discuss the data we use in this analysis

### *2.1 The Conversion and Listing Process*

The exchange conversion process began with the privatization of the Stockholm Stock Exchange in 1993. The stock exchange reorganized into a joint-stock company, Stockholm Fondborgs AB, which was owned in equal parts by the Exchange's members and its issuers. The Stockholm Exchange did not remain an independent entity, however, and merged with OM Stockholm, a technology company, in 1998 to form Stockholm Exchanges. The parent company, OM Gruppen, is

listed on the Stockholm Exchange.<sup>10</sup> In our analysis, we do not include OM as the corporation encompasses far more the stock exchange, and thus its performance is not as directly linked to the issues we are interested in here.

The Australian Stock Exchange (ASX) demutualized in 1998, with the process resulting in 606 initial shareholders each holding 166,000 shares. The company then listed its shares on the ASX on 14 October 1998. The stock was actively traded on the listing day, with volume of more than 6 million shares. The stock continues to trade on the ASX, but it has not yet had an initial public offering.

The Hong Kong Exchanges and Clearing Limited (HKEx) was formed as a result of market reforms initiated by the Hong Kong Financial Secretary in 1999. As part of the reform, the Stock Exchange of Hong Kong Limited and the Hong Kong Futures Exchange Limited demutualized, and along with the Hong Kong Securities Clearing Company Limited formed the single holding company HKEx. The merger was completed in March 2000, and the shares of the firm listed on the stock exchange in June 2000. The original listing involved a little over a billion shares with a par value of 1\$HK each. The HKEx has also not yet had a public offering.

The Singapore Exchange (SGX) also listed in 2000, having incorporated in August 1999 following the merger of the Stock Exchange of Singapore (SES) and the Singapore International Monetary Exchange (SIMEX). The demutualised SGX then initiated its listing as part of a public and private placement of securities in November 2000.

The Athens Stock Exchange became part of Hellenic Exchanges Holdings SA (HELEX) in March 2000. HELEX combined the Athens and Thessaloniki Stock exchanges, as well as the Athens Derivative Exchange, and several other clearing and settlement houses. The resulting company held

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<sup>10</sup> The OM 1997 Annual Report (pg. 15) explains the rationale for this merger: “The threat to both OM and the Stockholm Stock Exchange lies in the trade of equity and equity derivatives associated with major Nordic companies being shifted to other market places. If this occurs, and if the Nordic exchange structure remains fragmented, then there is a risk that Stockholm will play an increasingly marginal role as a financial centre. The merger creates an internationally competitive and attractive marketplace.”

a public offering in August 2000, and its shares were listed on the Athens Stock Exchange at that time.

The London Stock Exchange traces its conversion to the “Big Bang” of financial reforms in 1986. As part of these reforms, the ownership of member firms was allowed and the stock exchange itself became a private limited company with a Board of Directors drawn from the Exchange’s executives and users. The shareholders voted in 2000 to convert to a public limited company, and dealing in their shares began on an off-market facility. The LSE then listed on the exchange in July 2001.

The Nasdaq market reorganized in 2000, following a vote of its owners (the National Association of Securities Dealers (NASD)) to restructure the organization through a two-phase private placement to all NASD members. The first phase was completed in June, 2000 with the company selling 23.7 million new issued shares to the members. The second phase of restructuring was completed in January 2001, with the company selling another 5 million shares. In April 2001, the company announced its decision to become a publicly traded company in 2002 following a public offering. The offering has now been postponed several times, but the company’s stock began trading in the over-the-counter market (NDAQ) on July 1, 2002.

Euronext was formed in September 2000 by the merger of the exchanges in Amsterdam, Brussels and Paris. A global share offering took place on July 10, 2001, following which the exchange had approximately 119 million shares outstanding. The new entity’s shares then listed on the Euronext exchanges under the call symbol NXT. In January 2002, Euronext expanded its operations to add the LIFFE (London International Financial Futures Exchange) and the BVLP ( a Portuguese entity combining all the Portuguese exchanges).

The Canadian equities markets reorganized in 2001, with the Toronto Stock Exchange purchasing the Canadian Venture Exchange (the organization formed by combining the former Alberta and Vancouver Exchanges). The combined organization, the TSX, then controlled all equity

trading in Canada. The Toronto Stock Exchange (TSX) was owned by 90 member brokerage firms, who then agreed to sell 64% of their holdings in an initial public offering on November 12, 2002. The TSX listed for trading on the exchange on that date, with a total of 33.8 million shares outstanding.

The Deutsche Borse completed its public offering in February 2001. The Offering consisted of 2.8 million ordinary shares, with approximately 2.5 million shares being issued to raise capital, and the remaining shares coming from selling shareholders. The existing shareholders (who were largely German financial institutions) retained ownership of approximately 80% of the company.

Finally, the Oslo Exchange also went public in May 2001. This event stemmed from the Stock Exchange Act of November 2000 that required the activities of stock exchanges in Norway to be carried out by a public limited company. The Act required that the Oslo Exchange, as the only securities exchange in Norway, either convert to a public company or go out of business within 2 years. Pursuant to this, Oslo Bors AG was granted a license as a public company in April 2001, and there followed a complicated conversion in which the proceeds of the new stock offering were transferred partially to the Norwegian State.

## *2.2 Sample Firms*

The exchanges in Table 1 constitute the current universe of traded stock exchanges. Table 1 provides comparative data on the operations of the stock exchanges, providing the number of listed firms, market capitalizations of the listed firms, trading volume, and measures of liquidity and concentration. As is apparent, these exchanges represent a diverse group, including some of the world's largest exchanges (such as Nasdaq, London, and Euronext) and some of more moderate size (such as Athens and Oslo).<sup>11</sup>

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<sup>11</sup> Note that while Athens and Oslo are small relative to the global markets such as London, they are still relatively large exchanges by world standards, ranking 24<sup>th</sup> and 28<sup>th</sup> in WFE market capitalizations. See World Federation of Exchanges.

The small sample size imposes some obvious challenges for our analysis, as does the recent nature of some of these exchange conversions. We focus our analysis on eight of the exchanges, deleting from our analysis the Oslo Exchange, the Toronto Stock Exchange, and the Stockholm Exchange. The Oslo Exchange is deleted due to lack of trading volume; over our sample period the stock did not have a single trade on two-thirds of the trading days.<sup>12</sup> The Toronto Exchange had been trading for less than 6 months, and consequently we are unable to draw inferences beyond its very short-term behavior. The Stockholm Exchange is not listed separately, but instead trades as part of its parent, OM. As our focus is on exchange behavior, the linkage here seemed too indirect to be meaningful. The final sample contains eight exchanges, four of which have completed a public offering (Singapore, Athens, Deutsche Borse, and Eurnext) and four that have listed shares but no public offering (Australia, Hong Kong, London, and Nasdaq).

**Table 2** sets out the specific ownership and listing details of each publicly-owned exchange (we include Oslo, Toronto, and Stockholm for comparison purposes only). As noted earlier, while all of these exchanges have listed shares, not all of them have had a public offering. Thus, in what follows, we use either the date of the IPO or the date at which shares were listed (if there has been no IPO) as the beginning date for measuring the exchange's performance as a public firm.

Listing and offering information on the stocks in our samples were obtained largely from each exchange's web site, and this was also supplemented by announcements in the financial and other press. Financial data on IPOs were taken from DataStream and Bloomberg Online Service. Daily data on returns, volumes, and index behavior was taken from Data stream for all firms. Information regarding volume, market capitalization, concentration and liquidity of exchanges is from the World Federation of Exchanges.

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<sup>12</sup> Oslo Bors currently trades OTC on the Oslo Bors (this is similar to the situation of Nasdaq which also currently trades OTC). The stock is also traded on the German exchanges, but it is similarly illiquid there. This illiquidity is probably due to the concentrated ownership structure of the Oslo Bors, which is largely owned by Norwegian financial institutions and pension funds. Indeed, the largest 20 owners of the exchange currently hold 84.7% of the stock (data from Oslo Bors financial statements).

### 3. Analysis

We now turn to investigating the effects of exchange equitizations on exchange performance. Our analysis argues that exchanges have changed their corporate governance structures to adapt better to changing economic conditions. This would suggest that switching from a cooperative governance system to a shareholder-owned organization is value-enhancing.

Examining this proposition empirically presents some challenges. In more standard event studies, issues of value enhancement are often addressed by using either a control group, or by employing a market measure of what would have been expected return in the absence of the change. Here, however, forming a control group of exchanges is problematic as virtually all of the largest exchanges are part of our sample. A second difficulty is that prior to conversion exchanges do not have traded stock, making it impossible to determine what the market performance would have been in the absence of the conversion. Moreover, virtually all of the privatizations occurred in the last 3 years, a period of notable difficulty for asset markets world-wide. These difficulties suggest looking at a wide range of measures and tests, bearing in mind the limitations of sample size and sample period.

#### *3.1 Accounting-based measures of performance*

As a useful starting point, we consider standard accounting measures of exchange performance. Comparing data across exchanges is complicated by their differing dates of conversion by different fiscal reporting periods, and by different currencies. We define as Year 0 the period ending with the first annual financial statements after the IPO date or the first listing date.<sup>13</sup> This results in a Year 0 period of from 6 – 10 months for each of the firms in our sample. To capture performance both before and after conversion, we present data from the 2 fiscal years preceding the

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<sup>13</sup> For example, the London Stock exchange listed in July 2001, and the first annual financial statements were March 2002. Thus, our year 0 for London would include 8 months of data.

conversion (denoted years -2 and -1 respectively), the converting year (year 0), and for up to two fiscal years after the conversion. Because of the different conversion dates, only 2 exchanges have post conversion data of 2 years. Finally, all variables are calculated in the home country currency.

**Table 3** presents data on Return on Assets and Return on Equity for each of the firms in our sample. Return on Assets is calculated as Profit from operating activities / Total assets. The Return on Equity is calculated as Net profit after taxes and contribution / Shareholder's equity. The ROA and ROE data provide mixed evidence on the relation between exchange performance and privatizations. Some exchanges, such as Australia, have clearly fared much better after privatization than before, showing dramatic improvements in both ROA and ROE. As Australia is also the earliest converting exchange in our sample, its continued success is encouraging evidence in support of our hypothesis. Other exchanges, however, have fared less well. The Deutsche Borse, for example, has seen both its ROA and ROE drop precipitously.

Comparing ROA in years -1 and 0, four exchanges experienced a decrease in ROA, while four experienced an increase in this measure. The ROE results for this period are stronger, with five exchanges showing an improvement and three showing a decrease. The post-performance comparisons between years 0 and 1 are similarly mixed. Based on this data, it would be hard to conclude that privatizations are value-enhancing in general.

**Table 4** provides data on three other accounting-based measures of performance and structure. Profitability from operations is defined as Profit from Operating Activities / Total revenue, and it is a measure of operational profitability. Asset turnover is defined as Sales / Total Assets; this variable proxies for efficiency in the use of assets. Financial leverage is Total Liabilities / Equity, and it is simply a measure of the exchange's debt-equity ratio.

These data provide a somewhat different picture of performance than our earlier evidence. The profitability data show general overall improvement in connection with the conversion. Four exchanges show improvement in this variable between years -1 and 0, while two exhibit the opposite



trend. Examining the post conversion period from years 0 and 1, again four exchanges show improvement, and two show a modest slippage in this measure. The leverage data show the expected result that exchanges which have completed an initial public offering show decreases in their debt-equity ratios. This change in capital structure partially explains our earlier results on ROE. The Deutsche Borse, for example, saw its profitability from operations increase from 26.1% in the year ending December 2000 (year 0) to 30.9% in December 2001( year 1), but its equity capital grew from 922.7 million Euro to 2, 135.0 million Euro over this time period. This caused its ROE to fall from 52.5% to 13.0% over this same period.

The Asset Turnover data is ambiguous. While exchanges such as Australia show improvement, others show declines, and there is little in the data to suggest an overall trend in any case. Part of the challenge in interpreting this data is that some exchanges have undertaken mergers and other corporate acquisitions in connection with the change to a corporate structure (see Section 2 for details). Such activities increase total assets, and thus complicate interpretation of measures based on this. Similarly, the issuance of equity as noted above complicates interpretation of measures based on equity levels.

In summary, while these data are not inconsistent with exchange equitizations leading to improved performance, the accounting evidence is too mixed (or too difficult to interpret) to provide much evidence to evaluate whether exchange conversions are value-enhancing. An alternative approach to address this value-enhancement issue is to consider the stock market performance of these exchanges. As stock prices include expectations of future earnings and growth, this approach provides a better means to capture the overall effects of changes in corporate governance on corporate long-run performance.

### *3.2 Return-based measures of performance*

We calculated the total return to shareholders measured for various time periods following the exchanges' listing or IPO. Returns are calculated using closing prices, and all stock prices and

returns are measured in the home country currency. These data are given in **Table 5**. As a simple comparison across exchanges, the last column gives the return for all exchanges measured from their listing to Dec. 31, 2002. By this metric, 5 of the nine exchanges have positive returns, while 4 do not.

One difficulty with this total return measure is that it does not account for the differing listing dates for our sample. To address this, we look at returns defined over specific trading intervals. Looking at returns after a year for the seven exchanges with sufficient history, we find that four exchanges had positive returns, while 3 did not. Interesting, most, but not all of the exchanges initiating trading had positive first day returns. We return to this first day behavior in the next subsection when we investigate the IPO on these exchanges in more detail.

Of course, one factor not considered in this analysis is that of overall market movements. The time-period we are considering has been one of considerable difficulty for stock markets worldwide, and it is clearly important to control for market risk in evaluating exchange return performance. As noted earlier, stock exchanges typically list on their own exchange, so the index of the underlying market provides a natural venue for comparison. In **Table 6** we compare the monthly returns on the exchange stock and the monthly returns on the exchange index. The top panel gives data for the entire period since the exchange conversion, while the lower panels compares monthly returns for periods six, twelve, and 24 months following the conversion.

The data provide striking evidence that exchange stocks outperform the stocks of their underlying index. Looking over the entire sample period, over 6 of the 8 exchanges outperform their index, and the difference is both statistically and economically significant. What is particularly intriguing here is that 7 of the 8 stock indexes actually had negative returns over the relevant sample periods. Thus, even though Euronext's stock return was -9.6%, this still far exceeded the Euronext index return of -26.7% over this period. A similar pattern is found in Singapore, where the exchange's return of -9.5% is more than 8% above the Singapore's index return of -17.6%. The

German market fared even worse over this period, losing almost 32%, but the stock of the Deutsche Borse actually posted an 18.6% gain. Only the Australian stock index managed a positive return over its sample period, but here again the exchange's stock was a far better investment, yielding a premium of 148% above the index market return.

Two exchanges, Nasdaq and Athens, provide a different pattern of returns. Both of these exchanges under-perform their relevant indexes, and these differences are also statistically significant. The Hellenic Stock Exchange has stumbled from the outset, and managed to lose almost half of its market value in the first year. Whether evaluated at 6 months, 12 months, or 24 months after its conversion, the Athens exchange has posted miserable returns. The underlying index has also done poorly over these intervals, losing 14%, 28% and 44% respectively. Nasdaq only listed in July 2002, so only 6 month returns are available, but again both the exchange stock and the index have done poorly over this period.

What can account for these differences in performance? A natural conjecture is that the future prospects of these markets is poor, and these underlying economics problems are causing the exchanges's stocks to be viewed negatively. Earlier, we argued that exchange conversions should be value-enhancing because they replace an anachronistic governance structure with one better suited to its economic environment. But, of course, a major impetus for such change has been the increased competitiveness of the market, and the resulting negative economic pressure on the exchange business. The returns to converting exchanges should reflect both these positive governance and negative economic factors. Viewed from this perspective, the prospects for the Athens and Nasdaq markets are so bad that even a change in governance cannot cure the problem.

Alternatively, one could argue that these exchanges are somehow subject to greater (or at least different) market risks than their constituent stocks, and so the index per se is not capturing their risk exposure. To evaluate this possibility, we calculated the exchange's stock beta with respect to the appropriate domestic exchange index and with the Morgan Stanley World Index. The data, given

in **Table 7**, reveal an intriguing difference between the larger exchanges and the smaller exchanges. In particular, the smaller exchanges (Athens, Australia, Hong Kong, and Singapore) all have betas that are significantly related to their domestic index, while the market risk of the larger exchanges (the Deutsche Borse and Euronext, in particular) is better captured by exposure to the world index. These results seem sensible given the overall composition of each exchange's trading, so it seems unlikely that it is market risk differences that are driving the exchanges's divergent behavior.

Conversely, one could argue that looking at individual exchange stock returns may be misleading due to idiosyncratic factors affecting an exchange during our very short-run sample period. A better gauge of the investment returns of exchange equitizations is to consider the performance of the portfolio of converting exchanges. Because the exchanges have gone public at different dates, the number of exchanges in such a portfolio increases over time. To capture this shifting population, we form portfolios of listed exchanges every six months and we compare their return in that period to the return on a portfolio composed of the indexes of each of the exchanges. For example, we form an initial portfolio for the first six months of 2001 which contains the four exchanges trading by that time (Athens, Singapore, Australia, and Hong Kong) and we compare the return of the portfolio to the return on a portfolio composed of the indexes of these four exchanges.

We first consider the performance of an equally-weighted portfolio composed of one share in each of the converting exchanges. Because the exchanges are of differing sizes, we also formed a value-weighted portfolio of converting exchanges, where the weights for each exchange are based on its market capitalization and the weights for the index portfolio were based on the exchange's total stock market capitalization. The data are given in **Table 8**. In four of the five sub-periods, the portfolio of exchanges' yields a higher return than the index portfolio. This return premium is found in both the equally-weighted and value-weighted portfolios, but it is generally larger in the value-weighted portfolio. The premium is also increasing over time, reflecting both the addition of more converting exchanges and the increasingly positive performance of the exchanges as a whole.

### *3.3 Risk-based measures of performance: Exchange listings and home country IPOs*

The empirical return evidence detailed above supports our premise that exchange equitizations are value-enhancing by showing that exchange stocks generally outperformed the stocks on their underlying stock indexes. While this comparison seems sensible as a way to control for market risk effects, it could be argued that exchange stocks face additional risks not captured by this approach. In particular, there is extensive research in finance showing distinct patterns in the returns of newly –listed stocks, with both first day under-pricing and long-run underperformance.<sup>14</sup> This raises the natural question: How does the performance of exchange stocks compare to that of other newly-listed firms?

We address the relative performance of exchange IPOs and listings by forming a comparison group of non-exchange IPOs. Because IPO performance differs across countries, we collected data on all IPO listings on each sample exchange in the period 6 months before and 6 months after the initial listing date (or IPO) of the stock exchange itself.<sup>15</sup> We then calculated the returns of these regular IPOs for various time periods between 1 day and 360 days following their IPOs. IPOs tend to be highly volatile, and outliers in returns are not unusual. To provide a basis for comparison, we calculated a distribution of returns across each exchange’s regular IPOs, and we computed a 95% confidence interval around these returns. We then compared each sample exchange’s return over these time periods to this 95% cut-off level, as well as to the mean return of the IPO group.

**Table 9** presents these results. The sample size of other IPOs ranged from 54 offerings in Singapore to 28 offerings on the Nasdaq. Most of these IPOs are occurring in the period 2000 -2002, and their first day return behavior is far more restrained than was typically the case in the more

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<sup>14</sup> For an intriguing analysis reconciling these two seemingly inconsistent price patterns see Swaminathan and Purnananandam [2003].

<sup>15</sup> A more complete analysis would be to compare exchange offerings to home country IPOs matched with respect to factors such as size, industry, offer size etc. However, the sample size of IPOs is simply not large enough to make such an analysis feasible.

frenetic 1990's. For example, the first day returns for IPOs on Singapore was 8.7%, for Euronext it was 6.25%, and for the 28 issues on the Nasdaq it was actually a negative 1.7%.

Turning now to the behavior of our exchange listings, four of our sample stocks exhibit under-pricing: Singapore's first day return was 21%, the Deutsche Borse shares rose 11.4 percent, Hong Kong shares rose 17.9%, and Australia's first day return was 3.7%. Three exchanges shares fell on the offer day, with Euronext down by 8.3%, Athens by 6.4%, and the London Stock Exchange by 5.2%, while the Nasdaq market price was unchanged in its listing day. Comparing these first day performances to their control sample reveals a slightly different picture, with 5 exchanges outperforming (Singapore, Australia, Hong Kong, London and Nasdaq), while 3 exchanges underperformed (Athens, Euronext, and Deutsche). Restricting our attention to just exchanges performing IPOs reveals 3 of the 4 first day returns are below those of their control group. Overall, based on first day returns, we cannot reject the hypothesis that exchange IPOs are any different than other IPOs.

The long-run return results, however, are more striking. Comparing the returns after a year of exchange IPOs to other IPOs, we find that 6 of 7 sample firms outperform their control groups, with 5 of the 6 performing above the 95 percent cut-off level. The exception to this result is Athens, which consistently underperforms its control group over every time interval considered. Nasdaq also underperforms as time progresses, but its recent listing provides only 150 days of data.

Examining the time-series of return patterns suggests that exchange listings generally outperform other IPOs, and this dominance grows over time. Thus, while Singapore, Hong Kong, Australia, and London always dominate their control groups, Deutsche Borse and Euronext only do so after 90 days and 11 months, respectively. What causes this superior performance is unclear, in part because it is not apparent what causes more standard IPOs to do so badly in the long run. Nonetheless, the data show that on average exchange equitizations have proved better long-term investments than standard IPOs.

One conjecture for this enhanced relative performance is the link to the underlying corporate governance shift. While a standard IPO results in broadening the firm's ownership, the stock exchange offering involves a transition from the exchange being run to benefit the members to one benefiting the stock holders. As explained in Section 2, this transition effect suggests that selling more shares to outsiders is a positive influence in an exchange IPO. Since empirical research on IPOs has typically found a negative relation between the fraction sold to outsiders and returns, testing for this opposite prediction provides a natural way to discern this corporate governance effect.

**Table 10** presents evidence relating the proportion of shares sold to outsiders and returns for stock exchange IPOs. We measure returns from the closing price on the offer day both cumulatively over the period from listing until Dec. 31, 2002, and also annualized. Again, because we can only include exchanges that have had a public offering, the small sample size warrants caution in interpretation. For the five exchanges with an IPO, however, there is a striking relation between the proportion of outsiders in the IPO and returns. The Athens Exchange, which sold less than 10% of its equity to outside investors, fares the worst, while the Toronto Stock Exchange, with almost 60% outside ownership, is the most prosperous. More important is that the data suggest a positive monotonic relation between returns and outside holdings. This result is consistent with the hypothesis that exchanges are better able to shift to a corporate focus when insiders retain less of the firm.

Overall, these results support our contention that shifting exchange governance from cooperative to corporate is a value-enhancing strategy for stock exchanges. Nonetheless, the negative performance of some exchanges suggests this shift is only part of the story; stock exchange viability also depends upon the economic environment exchanges face. We now turn to understanding this economic linkage in more detail.

### *3.4 Exchange performance and economic variables*

Because the revenue and profits of the exchange depend, in part, on the trading patterns of its underlying stocks, the return of the exchange should depend on factors such as the exchange volatility, price level, and volume. These relations can be captured by the following regression

$$r_{it} = \alpha + \beta_1 RNFirm_t + \beta_2 RV_t + \delta_k X_{kt} + \lambda_j D_j + \varepsilon_{it}$$

where  $r_{it}$  is the cumulative return on the stock of exchange  $i$  at month  $t$ ,  $RNFirm_t$  is the change in the number of listed firms in month  $t$  and  $RV_t$  is the change in the traded value (i.e. price times volume of shares traded) of listed firms,  $RValue_t$ , or the change in the trading volume of listed firms,  $RVolume_t$ . The variable  $RNFirm_t$  is included to capture the fact that many exchanges derive significant amounts of revenues from listing fees; changes in the number of listed firms is thus a barometer of exchange health. Similarly, we included the value or volume variables because exchanges derive fee revenue from trading volume, and this is typically calculated based on the value of trades.<sup>16</sup> Following research in international finance (see Henry [2000], Foerster and Karolyi [1999], Bekeart and Harvey [2000]), we also include a set of instrumental variables ( $X_{kt}$ ) to control for economic differences across the economies. These variables include interest rate volatility, exchange rate variables, the local exchange index return, and the Morgan Stanley World index return. Finally, we also define a set of dummy variables to control for firm-specific differences in between the exchanges.

**Table 11** presents the results from our regressions. In general, we find a positive and significant relation between the exchange's returns and changes in the number of listed firms. A similar positive and significant relationship is found with respect to returns and trade value or trade volume. As argued above, this relation is consistent with changes in an exchange's revenue stream

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<sup>16</sup> There is an interesting divergence here between practice in U.S. markets and markets in the rest of the world. The U.S. exchanges charge fees based strictly on volume, whereas virtually every other market bases their fees on the value of the trade.



affecting its returns. Interesting, the local index is significant when volume is considered, but is not significant otherwise. The world index does not enter significantly in any case.

The economic dummies suggest that interest rate volatility is also important. All regressions reveal that movements in the U.S. interest rate play a significant, positive role for exchange returns. This positive effect contrasts with the effects of changes in domestic interest rates, which tend to exhibit a negative, and only sporadically significant, relationship with exchange returns. That volatility affects exchange return is not surprising; that it is linked to the U.S. interest rates and not to domestic interest rates is more intriguing. Exchange rate movements appear to play a role only in that they affect the value of the underlying market; when we include trade value as opposed to trade volume, exchange rates are not significant.

Our last set of variables attempts to capture the extent to which return behavior is purely idiosyncratic (or location specific) to the exchange. Earlier, we found that Australia and Athens were outliers in terms of their economic performance. The results here confirm this, with both IG (Athens) and IA (Australia) dummies entering quite significantly and with the expected coefficients. Perhaps more consequential is the lack of significance on the third dummy, IE, which captures the differential behavior of European exchanges (excluding Greece). This result suggests that the European, Asian and North American exchanges are not different from each other in terms of return behavior. We interpret this evidence as suggesting that exchange returns are driven by economic factors, a result consistent with the new competitive environment confronting exchanges world-wide.

### *3.5 Economic Performance Revisited: Exchanges and Liquidity Production*

How then are exchanges actually performing in this new competitive world? If our arguments regarding the positive effects of corporate governance changes are correct, then we should also expect to see exchanges operating more effectively with respect to their core

business: the provision of liquidity. One metric often applied to calibrate the liquidity of a market is the illiquidity ratio, or the extent to which daily volume moves daily prices (see Amihud [2002] for a discussion and derivation of this measure). To assess whether liquidity provision has improved following the exchange equitization, we collected daily volume and price change data for a sample of stocks trading on each of our exchanges. This sample was chosen to capture the “market” for each exchange, and it comprised approximately 80 – 120 stocks for each market (with the exception of Athens, where only 14 stocks provide the bulk of all trading). We then calculated the illiquidity ratio for each stock on a daily basis one year before and one year after each exchange’s listing or IPO date. The overall market illiquidity ratio is calculated as the average across the constituent stocks.

**Table 12** provides evidence that liquidity production is improving in the wake of exchange conversions. Panel A shows that illiquidity is reduced for 4 of the seven firms in our sample in the first year after the conversion, and Panel B shows that this improvement continues into the second year for the majority of sample exchanges. While some exchanges have not shown improvement, most notably Deutsche Borse and Athens, overall the evidence is supportive of enhanced exchange performance.

#### **4. Conclusions**

This paper has investigated the intriguing effects of stock exchange conversions from co-operative ownership to corporate ownership. Using data from the universe of exchange conversions, we found that listed stock exchanges generally outperformed both the stocks on their markets and the IPOs listed on these exchanges. Moreover, we presented evidence that the performance of stock exchanges with public offerings was positively linked to the fraction of the equity sold to outsiders. We also found a general improvement in measures of liquidity production following conversions.

While not every converting exchange exhibited enhanced performance, we interpret our overall results as providing strong evidence that shifting corporate governance from a cooperative to a corporate structure is value-enhancing for exchanges.

We have argued that changes in the exchanges' economic environment and the increasing heterogeneity of the exchange ownership have undermined the traditional basis for the cooperative structure of exchanges. If this is the case, then the question remains whether it is optimal for any exchange to retain its cooperative structure. Certainly, there is a growing trend among equity markets to convert, and the recent conversion of the Chicago Mercantile Exchange suggests that futures markets may follow suit. Yet, the New York Stock Exchange has now retracted its earlier announced decision to convert, deciding instead to remain a member-owned cooperative. While the exact reason for this decision was not articulated, the hostile takeover attempt of the London Stock Exchange by OM was widely viewed as a catalyst for this decision. Moreover, the faltering of the Nasdaq market has reduced competition for the NYSE, thus reducing the economic pressures for conversion.<sup>17</sup> This suggests that for at least some exchanges, the costs of a corporate governance structure do not yet outweigh the benefits. Whether this remains the case in the long run remains to be seen.

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<sup>17</sup> Similarly, competition from the American Stock Exchange has also diminished due to competitive problems at that market. Indeed, the American Stock Exchange was recently sold by the NASD (its owner) to GTCR Golden Rauner, a private equity firm. However, the sale may face a regulatory challenge from the SEC over violations of the rule limiting single ownership to no more than 20% of a U.S. exchange.

**Table 1****Publicly Listed Exchanges: Market Characteristics**

	<b>NFIRMS</b>	<b>MCAP</b>	<b>TVOL</b>	<b>ATVOL</b>	<b>LIQUIDITY</b>	<b>CONC</b>
Nasdaq	3649	1,994.5	441.7	735.0	319.5	38.8
London Stock Exchange	2824	1,785.2	922.3	24,081.7	97.3	45.7
Euronext	n.a.	1,538.7	80.4	1,245.1	153.6	32.1
Deutsche Borse	934	686.0	68.0	928.3	125.1	42.7
Toronto Stock Exchange	1344	573.4	46.3	1,747.2	67.9	26.6
Hong Kong Stock Exchange	978	463.1	1,611.9	78,488.9	39.7	64.1
Australian Stock Exchange	1441	380.1	153.7	10,979.0	76.2	46.3
Singapore Stock Exchange	385	99.8	111.8	n.a.	53.8	60.0
Athens Stock Exchange	314	67.1	5.1	563.4	31.0	45.6
Oslo Stock Exchange	204	54.2	13.6	6,650.9	71.8	71.7

Source: World Federation of Exchanges

NFIRMS	Number of listed firms (domestic and foreign)
MCAP	Market capitalization of domestic firms (Main and parallel markets)—Billion US\$
NTRA	Number of transactions—Million
TVOL	Number of traded shares—Billion
ATVOL	Average number of shares per transaction
LIQUIDITY	Traded value/Market capitalization—(%)
CONC	Turnover value of the top 10 firms—(%)

**Table 2**

**Publicly Listed Exchanges: Listing and Offering Data**

	Exchange Name	Holding Company Name	TICKER	IPO	First Trading Date	IPO or Opening PRICE – Local Currency	IPO or Opening PRICE- US\$	Number of SHARES	SHREMPLOYEE	
									NSHREMP	PSEMP
1	Singapore Stock Exchange	Singapore Stock Exchange	SGX	YES	16-Nov-00	S\$ 1.10	0.63	469,700,000	13,000,000	2.8%
2	Athens Stock Exchange	Hellenic Exchanges Holding	EXAE	YES	28-Jul-00	Dr. 5, 250	13.23	5,000,000	350,000	7.0%
3	Deutsche Borse AG	Deutsche Borse	DB1	YES	5-Feb-01	Euro 33.50	31.49	3,200,151	27,741	0.9%
4	Oslo Bors ASA	Oslo Bors Holding ASA	OSLO	YES	28-May-01	Between NOK75 -95	Between US\$8.18 -10.37	5,150,000	150,000	3.0%
5	Euronext	Euronext N.V.	NXT	YES	10-Jul-01	Euro 24	20.54	36,707,716	3,500,000	9.5%
6	Toronto Stock Exchange	T S X Group	X	YES	12-Nov-01	C\$18.00	11.40	21,824,974	500,000	2.3%
7	Stockholm Stock Exchange	O.M.	OM	YES	1-Jan-93	100.00	14.11	249,500		
8	Australian Stock Exchange	ASX	ASX	NO	14-Oct-98	4.10	2.59	100,596,000		
9	Hong Kong Stock Exchange	Hong Kong Stock Exchange and Clearing House	HKREX	NO	27-Jun-00	7.00	0.90	1,040,664,846		
10	London Stock Exchange	London Stock Exchange	LSE	NO	20-Jul-01	385.00	549.78			
11	Nasdaq	Nasdaq	NDAQ	NO	1-Jul-02	15.00	15.00			

NSHARES IPO number of shares offered (including employee offers and over-allotment options) or Number of shares that started to be traded  
NSHREMP IPO number of shares offered to employees  
PSEMP Proportion of shares offered to employees with respect to total offer

**Table 3**  
**Publicly Listed Exchanges: Return on Assets and Return on Equity**

	<b>IPO?</b>	<b>MFIN</b>	<b>IDATE</b>	<b>Y(-2)</b>	<b>Y (-1)</b>	<b>Y(0)</b>	<b>Y(+1)</b>	<b>Y(+2)</b>
<b>Return on assets (ROA)</b>								
Singapore Stock Exchange	Yes	(2)	Nov-00	3.5%	3.4%	2.3%	2.3%	
Athens Stock Exchange	Yes	(1)	Jul-00		49.7%	44.3%	20.7%	
Deustche Borse AG	Yes	(1)	Feb-01	9.3%	23.5%	13.0%	5.4%	
Euronext	Yes	(1)	Jul-01	2.1%	3.3%	1.0%	2.6%	
Toronto Stock Exchange	Yes	(1)	Nov-02	28.6%	15.0%	19.8%		
Australian Stock Exchange	No	(2)	Oct-98	7.4%	11.3%	12.5%	29.3%	29.3%
Hong Kong Stock Exchange	No	(1)	Jun-00	5.5%	4.7%	6.9%	6.0%	4.6%
London Stock Exchange	No	(3)	Jul-01	12.7%	19.7%	21.7%		
Nasdaq	No	(1)	Jul-02	n.a.	n.a.	n.a.		
<b>Return on equity (ROE)</b>								
Singapore Stock Exchange	Yes	(2)	Nov-00	15.5%	12.7%	5.8%	6.8%	
Athens Stock Exchange	Yes	(1)	Jul-00		n.a	n.a	n.a	
Deustche Borse AG	Yes	(1)	Feb-01	30.1%	52.5%	13.0%	10.9%	
Euronext	Yes	(1)	Jul-01		11.7%	4.1%	11.0%	
Toronto Stock Exchange	Yes	(1)	Nov-02	10.7%	10.0%	16.2%		
Australian Stock Exchange	No	(2)	Oct-98	9.9%	9.6%	21.0%	36.0%	32.2%
Hong Kong Stock Exchange	No	(1)	Jun-00	17.3%	12.7%	17.9%	14.1%	10.8%
London Stock Exchange	No	(3)	Jul-01	13.1%	6.3%	17.7%		
Nasdaq	No	(1)	Jul-02	3.6%	7.8%	12.3%		

MFIN

Closing month for the annual financial statements

(1) December; (2) June; (3) March.

IDATE

IPO date or First Trading Day

Y(0)

ROA and ROE determined using the first financial statements after the IPO date or the first trading date. (For example, for London Stock Exchange, Y(0) correspond to the financial statements of March 2002.

Y(-n) or Y(n)

ROA and ROE determined using the financial statements "n" periods before or after the Y(0) financial statements.

**Table 4**  
**Publicly Listed Exchanges: Profitability from Operations, Asset Turnover and Financial Leverage**  
**Considering Financial Statements in the Home Country Currency**

	IPO	MFIN	IDATE	Y(-2)	Y (-1)	Y(0)	Y(+1)	Y(+2)
<b>Profitability from operations</b>								
Singapore Stock Exchange	Yes	(2)	Nov-00	59.2%	53.0%	34.7%	28.0%	
Athens Stock Exchange	Yes	(1)	Jul-00	n.a.	n.a.	n.a.	n.a.	n.a.
Deustche Borse AG	Yes	(1)	Feb-01	20.1%	26.1%	30.9%	31.7%	
Euronext	Yes	(1)	Jul-01	24.2%	22.3%	5.7%	18.5%	
Toronto Stock Exchange	Yes	(1)	Nov-02	44.9%	29.4%	35.4%		
Australian Stock Exchange	No	(2)	Oct-98	13.8%	19.1%	21.8%	38.8%	37.2%
Hong Kong Stock Exchange	No	(1)	Jun-00	26.1%	34.8%	42.4%	41.1%	35.8%
London Stock Exchange	No	(3)	Jul-01	28.2%	33.1%	36.9%	39.2%	
Nasdaq	No	(1)	Jul-02	n.a.	n.a.	n.a.	n.a.	
<b>Asset turnover</b>								
Singapore Stock Exchange	Yes	(2)	Nov-00	0.06	0.07	0.07	0.08	
Athens Stock Exchange	Yes	(1)	Jul-00	n.a.	n.a.	n.a.	n.a.	n.a.
Deustche Borse AG	Yes	(1)	Feb-01	0.46	0.90	0.42	0.17	
Euronext	Yes	(1)	Jul-01	0.09	0.15	0.18	0.14	
Toronto Stock Exchange	Yes	(1)	Nov-02	0.64	0.51	0.56		
Australian Stock Exchange	No	(2)	Oct-98	0.54	0.59	0.57	0.76	0.79
Hong Kong Stock Exchange	No	(1)	Jun-00	0.21	0.14	0.16	0.15	0.13
London Stock Exchange	No	(3)	Jul-01	0.45	0.59	0.59	0.56	
Nasdaq	No	(1)	Jul-02	0.72	0.65	0.68		
<b>Financial leverage</b>								
Singapore Stock Exchange	Yes	(2)	Nov-00	3.88	3.33	2.66	2.15	
Athens Stock Exchange	Yes	(1)	Jul-00	n.a.	0.88	0.45	0.25	n.a.
Deustche Borse AG	Yes	(1)	Feb-01	3.49	1.20	0.37	2.04	
Euronext	Yes	(1)	Jul-01	6.88	2.74	2.59	3.56	
Toronto Stock Exchange	Yes	(1)	Nov-02	0.17	0.16	0.16		
Australian Stock Exchange	No	(2)	Oct-98	0.41	0.34	0.47	0.71	0.54
Hong Kong Stock Exchange	No	(1)	Jun-00	2.20	2.51	1.90	1.63	1.55
London Stock Exchange	No	(3)	Jul-01	0.49	0.34	0.30	0.33	
Nasdaq	No	(1)	Jul-02	0.80	1.56	3.35		

MFIN

Closing month for the annual financial statements

(1) December; (2) June; (3) March.

IDATE

IPO date or First Trading Day

Y(0)

Ratio determined using the first financial statements after the IPO date or the first trading date. (For example, for London Stock Exchange, Y(0) correspond to the financial statements of March 2002.

Y(-n) or Y(n)

Ratio determined using the financial staments "n" periods before or after the Y(0) financial statements.

**Table 5****Publicly Listed Exchanges: Accumulated Returns**

	<b>Stock Exchange</b>	<b>IPO</b>	<b>IDATE</b>	<b>Offer price to Open price return</b>	<b>First day return- Open to Close</b>	<b>Overall First day return- Offer to Close</b>	<b>First week Return</b>	<b>First 30 days Return</b>	<b>180 day Return</b>	<b>First year Return</b>	<b>Overall Return Listing- Dec. 2002</b>
1	Athens Stock Exchange	Yes	28-Jul-00	n/a	n/a	-6.4	-2.3	3.4	-22.6	-49.1	-83.7
2	Singapore Stock exchange	Yes	16-Nov-00	18.2	3.1	21.8	19.1	20.9	-4.5	14.5	11.8
3	Deutsche Borse	Yes	5-Feb-01	8.1	3.1	11.4	11.5	-3.3	17.2	25.1	13.4
4	Euronext	Yes	10-Jul-01	-8.4	0.0	-8.4	-4.3	-16.7	-8.3	-9.2	-12.1
5	Toronto Stock Exchange	Yes	12-Nov-02	6.9	5.7	13.1	10.8	22.2	-.-	-.-	18.1
6	Australian Stock Exchange	No	14-Oct-98			3.7	4.6	70.0	150.4	270.4	178.3
7	Hong Kong Stock Exchange	No	27-Jun-00			17.9	66.4	145.7	117.1	50.7	40.0
8	London Stock Exchange	No	20-Jul-01			-5.2	-16.6	-7.0	12.5	-17.9	-17.9
9	Nasdaq	No	1-Jul-02			0.0	-6.7	-19.0	-.-	-.-	-33.3



**Table 6**  
**Stock Exchange Returns and Stock Index Returns**

	<b>Australia Stock Exchange</b>	<b>Deutsche Borse</b>	<b>Euronext</b>	<b>Hellenic Exchange Holding</b>	<b>Hong Kong Stock and Clearing House</b>	<b>London Stock Exchange</b>	<b>Nasdaq</b>	<b>Singapore Stock Exchange</b>
Month	54	26	21	32	34	21	9	29
Exchange stock return	178.2%	18.6%	-9.6%	-52.0%	51.8%	1.2%	-38.6%	-9.5%
Exchange index return	29.7%	-31.8%	-26.7%	-32.0%	-25.3%	-14.5%	-9.2%	-17.6%
Difference	148.5%	50.3%	17.1%	-19.9%	77.1%	15.7%	-29.4%	8.2%
t-stat	(30.61)	(13.47)	(5.15)	(13.24)	(20.24)	(6.78)	(9.58)	(4.60)
Month	6	6	6	6	6	6	6	6
Exchange stock return	235.8%	13.4%	-6.8%	-40.0%	98.8%	15.6%	-33.3%	-9.0%
Exchange index return	20.0%	-11.7%	-11.7%	-14.0%	-13.4%	-3.2%	-9.2%	-11.2%
Difference	215.8%	25.1%	4.9%	-26.0%	112.2%	18.8%	-24.2%	2.3%
Month	12	12	12	12	12	12		12
Exchange stock return	135.3%	22.4%	-14.4%	-42.3%	70.9%	12.7%		-22.4%
Exchange index return	18.4%	-23.1%	-23.4%	-28.2%	-18.5%	-13.2%		-29.5%
Difference	116.9%	45.4%	9.0%	-14.1%	89.4%	26.0%		7.1%
Month	24	24		24	24			24
Exchange stock return	148.7%	3.0%		-70.3%	70.9%			-13.4%
Exchange index return	37.0%	-58.6%		-44.3%	-30.0%			-24.6%
Difference	111.8%	61.7%		-26.0%	101.0%			11.1%

Month Complete months from the IPO or Listing month  
If IPO date was Feb.09.2000, 6 months refer to the last trading day of August 2000

Exchange stock return Exchange stock closing price at the end of the month with respect to Exchange stock closing price at IPO or listing day

Exchange index return Exchange index at the end of the month with respect to Exchange index at IPO or listing day

Difference Exchange Stock return - Exchange Index return

**Table 7**  
**Betas Coefficients of Exchange's Stock**

<b>Exchange</b>	<b>NObs</b>	<b>ERLIUS</b>	<b>ERWIN</b>	<b>R-Square</b>
Athens	30	1.09	0.12	0.45
		<i>4.17</i>	<i>0.26</i>	
Australian	52	1.67	-0.09	0.30
		<i>3.27</i>	<i>-0.15</i>	
Hong Kong	32	2.00	-0.99	0.40
		<i>3.73</i>	<i>-1.46</i>	
Singapore	27	0.68	0.16	0.49
		<i>3.53</i>	<i>0.64</i>	
<hr/>				
Euronext	19	0.007	1.32	0.44
		0.01	1.66	
Deutsche Borse	24	-0.23	1.64	0.52
		-0.57	2.41	
London	19	1.15	-0.58	0.16
		1.42	-0.81	

NObs                      Number of stocks

**Dependent variable**

ERPUS                      Excess returns of the Exchange's Stock

**Independent variables**

ERLIUS                      Excess returns in the Domestic Exchange Index

ERWIN                      Excess returns in the Morgan Stanley World  
Exchange Index

All the excess returns are estimated in US dollars.

The return in the US 30 day T-Bill is considered as risk free.

**TABLE 8**  
**Exchange's Stock Portfolio Returns**

	2001		2002		2003
	1st Sem.	2nd Sem.	1st Sem.	2nd Sem.	1st Sem.
<b>Exchange's Stock Return</b>					
Equally weighted portfolio	-16.1%	-5.0%	2.0%	-11.4%	22.6%
Market capitalization weighted portfolio	-18.1%	-0.1%	4.9%	-6.7%	20.8%
<b>Exchange's Index</b>					
Equally weighted portfolio	-12.4%	-7.0%	-4.8%	-15.9%	11.6%
Market capitalization weighted portfolio	-9.9%	-11.6%	-4.8%	-20.6%	11.8%

All returns are calculated in US Dollars

Market capitalization refers to the exchange's stock market value.

Weighted portfolios were estimated considering exchange's stock market capitalization

The stocks included in each portfolio are:

2001 - 1st Semester:	Athens, Singapore, Australia, Hong Kong
2001 - 2nd Semester:	Athens, Singapore, Australia, Hong Kong, Deutsche B.
2002 - 1st Semester:	Athens, Singapore, Australia, Hong Kong, Deutsche B., Euronext, LSE
2002 - 2nd Semester:	Athens, Singapore, Australia, Hong Kong, Deutsche B., Euronext, LSE
2003 - 1st Semester:	Athens, Singapore, Australia, Hong Kong, Deutsche B., Euronext, LSE, Nasdaq, Toronto

**Table 9**  
**A. Exchanges that performed an IPO to start listing their stock -**  
**Exchange stock return with respect to the return of the IPOs that started 6 months**  
**before and after the initial listing day of the exchange's stock**

Trading days	Singapore Stock Exchange (+)					Deutsche Borse (+)					Euronext (+)					Athens Stock Exchange (+)				
	Obs.	Return	Mean return	Upper Limit	Outperform	Obs.	Return	Mean return	Upper Limit	Outperform	Obs.	Return	Mean return	Upper Limit	Outperform	Obs.	Return	Mean return	Upper Limit	Outperform
1	54	21.8%	8.7%	18.6%	Y*	45	11.4%	28.4%	53.2%	N	33	-8.3%	6.2%	10.6%	N*	32	-6.4%	42.3%	69.9%	N*
5	54	19.1%	4.6%	15.7%	Y*	45	11.5%	26.3%	51.4%	N	33	-4.3%	8.9%	14.2%	N*	33	-2.3%	36.7%	59.1%	N*
30	54	20.9%	-6.1%	3.8%	Y*	45	-3.3%	17.1%	39.1%	N	33	-16.7%	9.3%	18.9%	N*	33	3.4%	34.8%	56.7%	N*
60	54	19.1%	-11.8%	-0.9%	Y*	45	6.9%	5.7%	24.3%	Y	33	-33.5%	11.4%	27.0%	N*	33	-11.8%	37.4%	62.1%	N*
90	54	-1.8%	-20.9%	-11.6%	Y*	45	27.8%	-6.6%	12.0%	Y*	33	-11.7%	11.6%	32.6%	N*	33	-25.9%	32.8%	58.0%	N*
120	54	10.9%	-20.4%	-9.5%	Y*	45	12.2%	-16.1%	0.9%	Y*	33	-14.3%	19.0%	45.1%	N*	33	-42.2%	19.4%	44.0%	N*
150	54	10.0%	-23.4%	-12.5%	Y*	45	18.1%	-29.0%	-14.0%	Y*	33	-13.1%	19.5%	48.9%	N*	33	-22.4%	10.9%	33.0%	N*
180	54	-4.5%	-20.1%	-6.0%	Y*	45	17.2%	-33.1%	-19.4%	Y*	33	-8.3%	18.2%	47.0%	N	33	-22.6%	0.3%	21.1%	N*
210	54	-9.1%	-17.6%	-2.7%	Y	45	23.3%	-46.3%	-34.9%	Y*	33	-2.5%	11.0%	36.0%	N	33	-32.3%	-8.7%	10.9%	N*
240	54	-6.4%	-16.8%	-2.7%	Y	45	31.2%	-51.2%	-40.9%	Y*	33	-9.6%	14.8%	40.1%	N	33	-51.7%	-13.0%	6.0%	N*
270	54	14.5%	-16.2%	-0.7%	Y*	45	29.3%	-53.8%	-44.1%	Y*	33	-15.4%	4.2%	29.4%	N	33	-44.1%	-8.7%	9.8%	N*
300	54	18.2%	-14.4%	3.8%	Y*	45	40.6%	-53.9%	-43.8%	Y*	33	-8.5%	-4.4%	18.8%	N	33	-52.7%	-9.1%	12.0%	N*
330	54	17.3%	-15.6%	3.5%	Y*	45	42.1%	-59.6%	-50.5%	Y*	31	-19.2%	-13.0%	11.2%	N	33	-43.1%	-16.2%	3.7%	N*
360	54	14.5%	-16.4%	3.3%	Y*	45	25.1%	-61.3%	-51.9%	Y*	29	-9.2%	-20.5%	5.8%	Y	33	-49.1%	-20.0%	-0.8%	N*

Trading days      Number of trading days from the day that the stock started to be traded.  
Obs                    Number of observations considered in the determination of the return interval.  
Return                Exchange's stock closing price after "n" trading days / Exchange IPO suscription price  
Mean return         Mean return of the 95% confidence interval determined by the returns of the IPOs that occurred  
6 months before and after the exchange's IPO.  
Upper limit         Upper limit of the 95% confidence interval determined by the returns of the IPOs that occurred  
6 months before and after the exchange's IPO.  
Outperform         Y\* (N\*) Exchange's stock return is above (below) the 95% confidence interval.  
Y (N)                Exchange's stock return is above (below) the mean return of the 95% confidence interval.

**Table 9**  
**B. Exchange stock accumulated return with respect to the accumulated returns of the stocks**  
**that started to be traded 6 months before and after the initial listing day of the exchange's stock**

Australia Stock Exchange (+)					Hong Kong Exchange (+)					London Stock Exchange (+)					Nasdaq (+)				
Obs.	Return	Mean return	Upper Limit	Outperform	Obs.	Return	Mean return	Upper Limit	Outperform	Obs.	Return	Mean return	Upper Limit	Outperform	Obs.	Return	Mean return	Upper Limit	Outperform
27	3.7%	-4.5%	0.0%	Y*	26	17.9%	-4.3%	5.5%	Y*	47	-5.2%	0.6%	4.2%	N*	28	0.0%	-1.7%	0.4%	Y
27	4.6%	-4.3%	3.0%	Y*	26	66.4%	-6.6%	10.0%	Y*	47	-16.6%	4.1%	12.0%	N*	28	-6.7%	-4.3%	0.5%	N
27	61.0%	-2.4%	15.0%	Y*	26	145.7%	-7.8%	16.6%	Y*	47	-7.0%	3.3%	13.9%	N	28	-19.0%	-8.3%	-0.1%	N*
27	116.3%	15.1%	44.4%	Y*	26	120.7%	-7.6%	14.5%	Y*	47	-13.8%	0.9%	14.2%	N*	28	-36.7%	-11.5%	-0.2%	N*
27	187.8%	18.7%	47.4%	Y*	26	91.4%	-8.2%	11.0%	Y*	47	0.0%	1.7%	16.4%	N	28	-44.1%	-6.0%	7.3%	N*
27	245.2%	21.0%	49.6%	Y*	26	154.3%	-4.4%	15.7%	Y*	47	8.1%	-1.9%	11.7%	Y	28	-31.7%	-0.9%	13.7%	N*
27	217.1%	25.5%	52.8%	Y*	26	161.4%	-0.3%	21.8%	Y*	47	3.4%	2.5%	16.6%	Y	25	-46.7%	-1.3%	17.3%	N*
27	150.4%	29.5%	57.1%	Y*	26	117.1%	2.2%	22.6%	Y*	47	12.5%	0.4%	14.5%	Y					
27	178.0%	30.0%	58.4%	Y*	26	98.6%	6.3%	32.4%	Y*	47	19.2%	-5.8%	11.6%	Y*					
27	151.2%	42.8%	82.3%	Y*	26	115.7%	9.6%	40.7%	Y*	47	7.8%	-11.4%	3.5%	Y*					
27	123.7%	56.8%	108.6%	Y*	26	77.9%	6.7%	34.7%	Y*	47	-4.9%	-13.8%	0.2%	Y					
27	161.2%	55.4%	105.2%	Y*	26	67.9%	8.3%	33.4%	Y*	47	-8.2%	-14.8%	1.0%	Y					
27	217.1%	54.8%	100.7%	Y*	26	34.3%	4.3%	26.5%	Y*	43	-9.2%	-22.6%	-8.0%	Y					
27	270.4%	70.1%	124.4%	Y*	26	50.7%	12.8%	38.8%	Y*	37	-17.9%	-37.9%	-20.7%	Y*					

Trading days      Number of trading days from the day that the stock started to be traded.  
Obs                    Number of observations considered in the determination of the return interval.  
Return                Exchange's stock closing price after "n" trading days / Exchange stock open price at the first trading day.  
Mean return        Mean return of the 95% confidence interval determined by the returns of the stocks that started to be traded 6 months before and after the initial listing day of the exchange stock.  
Upper limit         Upper limit of the 95% confidence interval determined by the returns of the stocks that started to be traded 6 months before and after the initial listing day of the exchange stock.  
Outperform        Y\* (N\*)    Exchange's stock return is above (below) the 95% confidence interval.  
                          Y (N)      Exchange's stock return is above (below) the mean return of the 95% confidence interval.

**Table 10****Publicly Listed Exchanges and Outside Ownership in Exchange IPOs**

		<b>IPO DATE</b>	<b>TRADING DAY</b>	<b>% OUTSIDERS</b>	<b>OVERALL RETURN</b>	<b>AVERAGE RETURN</b>
1	Athens Stock Exchange	28-Jul-00	886	9.5%	-83.7%	-52.64%
2	Euronext	10-Jul-01	539	29.8%	-12.1%	-8.36%
3	Singapore Stock exchange	16-Nov-00	775	47.0%	11.8%	5.39%
4	Deutsche Borse	5-Feb-01	694	31.1%	13.4%	6.84%
5	Toronto Stock Exchange	12-Nov-02	49	59.6%	18.1%	-.

IPO DATE

IPO date

TRADING DAY

Calendar days from IPO date to Dec.31.2002

% OUTSIDERS

Proportion of outsiders in IPO (including over allotment and employee shares)

OVERALL RETURN

Stock return: Close Stock Price (Dec.31.2002) to IPO stock price

AVERAGE RETURN

Average annual return

**TABLE 11**  
**Exchange's Stock Returns**

<b>Variable</b>	<b>Reg1</b>	<b>Reg2</b>	<b>Reg3</b>	<b>Reg4</b>	<b>Reg5</b>
RNFirm	1.70 <i>4.94</i>		1.44 <i>4.64</i>	1.60 <i>5.08</i>	
Rvalue		0.66 <i>7.07</i>	0.61 <i>6.83</i>		
Rvolume				0.52 <i>6.11</i>	0.54 <i>5.99</i>
RINTUS	0.32 <i>4.08</i>	0.40 <i>5.25</i>	0.42 <i>5.80</i>	0.43 <i>5.83</i>	0.41 <i>5.16</i>
REXCRATE	0.50 <i>1.71</i>	0.35 <i>1.28</i>	0.12 <i>0.46</i>	0.56 <i>2.11</i>	0.86 <i>3.10</i>
RINTEREST	0.13 <i>0.64</i>	-0.62 <i>-3.02</i>	-0.39 <i>-1.95</i>	-0.15 <i>-0.74</i>	-0.37 <i>-1.80</i>
RWIN	-0.94 <i>-1.65</i>	-0.51 <i>-0.94</i>	-0.33 <i>-0.64</i>	-0.53 <i>-1.01</i>	-0.77 <i>-1.39</i>
RLIUS	1.11 <i>2.78</i>	0.56 <i>1.44</i>	0.56 <i>1.52</i>	0.98 <i>2.67</i>	1.02 <i>2.63</i>
IG	-0.71 <i>-11.05</i>	-0.62 <i>-9.81</i>	-0.60 <i>-10.11</i>	-0.69 <i>-11.73</i>	-0.71 <i>-11.44</i>
IE	-0.02 <i>-0.19</i>	-0.09 <i>-1.08</i>	-0.02 <i>-0.19</i>	-0.06 <i>-0.72</i>	-0.14 <i>-1.69</i>
IA	1.30 <i>12.06</i>	1.16 <i>11.04</i>	1.08 <i>10.63</i>	1.17 <i>11.62</i>	1.28 <i>12.20</i>
R-Square	0.91	0.92	0.93	0.93	0.92
Observations	188	188	188	188	188

**Dependent variable**

RBHReturn Returns with respect to Exchange stock closing price at IPO or listing date.

**Independent variables**

RNFirm Change in the number of firms listed in the exchange

Rvalue Change in the monthly traded value

Rvolume Change in the monthly traded volume (# of shares)

RINTUS Change in the US interest rate

REXCRATE Change in the domestic exchange rate with respect to the US dollar

RINTEREST Change in the domestic interest rate

RWIN Return in the Morgan Stanley World exchange index

RLIUS Return in the domestic exchange index

IG Dummy variable: Greece

IE Dummy variable: European exchanges except Greece

IA Dummy variable: Australia

Observations Number of observations included in regression analysis. Include all the month - year since the privatization of the following exchanges: Australia, Hong Kong, Singapore, Euronext, Deutsche Borse, London, Athens. Nasdaq and Toronto were not included, as privatizations are recent.

**Table 12**  
**Illiquidity differences pre and post the exchange's privatizations**

**A. One year before and one year after.**

<b>Exchange</b>	<b>NObs</b>	<b>mvon1</b>	<b>mvop1</b>	<b>mvon1p1</b>	<b>tvon1p1</b>
Athens	14	0.238	0.260	-0.022	1.29
Australia	81	0.272	0.071	0.201	2.63
Deutsche Borse	93	3.957	5.468	-1.511	2.95
Euronext	93	0.145	0.132	0.014	1.03
Hong Kong	87	0.028	0.022	0.006	1.91
London	92	0.017	0.011	0.006	1.36
Singapore	122	2.229	4.031	-1.803	4.07

**B. One year after and two years after**

<b>Exchange</b>	<b>NObs</b>	<b>mvop1</b>	<b>mvop2</b>	<b>mvop1p2</b>	<b>tvop1p2</b>
Athens	14	0.260	0.264	-0.004	0.15
Australia	81	0.071	0.050	0.021	2.11
Deutsche Borse	93	5.468	8.412	-2.944	3.73
Euronext	93	0.132	0.121	0.010	0.66
Hong Kong	87	0.022	0.043	-0.022	1.57
London	92	0.011	0.010	0.001	0.47
Singapore	122	4.031	3.137	0.895	2.19

mvon1	Average illiquidity ratio one year before privatization
mvop1	Average illiquidity ratio one year after privatization
mvop2	Average illiquidity ratio two years after privatization
mvon1p1	mvon1 - mvop1
mvop1p2	mvop1 - mvop2
tvon1p1	t-stat for Ho: mvon1p1 = 0
tvop1p2	t-stat for Ho: mvop1p2 = 0



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