

Growth strategies and value creation: What works best for stock exchanges? *

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Abstract

In recent years, demutualized stock exchanges increasingly have been engaging in M&A and alliance activities. To examine the effect of these growth strategies on exchange shareholders' value creation, we focus on 15 public stock exchanges and investigate their short-run share price responses to the formation of 111 M&As and alliances around the world spanning the period 2000-2008. Our findings show that the average stock price responses for M&As and alliances are positive. M&As create more value than alliances. For alliances, joint ventures generate more value than non-equity alliances. More value accrues when the integration is horizontal than when it is vertical. Cross-border integration creates more value than domestic integration. Additionally, there is evidence of learning-by-doing effects in stock exchange integration activities. Finally, we find that when the partnering exchange is located in a country with better shareholder protection, accounting standards, and capital market development, more shareholder value accrues to our sample exchange. These patterns are consistent when we examine the exchanges' long-run performance.

Keywords: exchanges; mergers and acquisitions; strategic alliances; joint ventures; network organization

JEL classification: L22; G32; D23

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1. Introduction

Stock exchanges constitute fundamental components of the financial market by providing an efficient trading place for all investors and a necessary governance mechanism for all listed firms.² Since the 1990s, there has been a trend toward stock exchange mergers and acquisitions (M&As) and alliances to expand the exchanges' business globally.³ This trend can be attributed to the formation of global capital markets, the demand for a larger exchange from institutional investors, and innovations in technology (Knowledge@Wharton, 2006).^{4,5} Such global consolidations among stock exchanges may well promote competition, improve governance mechanisms, enhance the effectiveness of cross-border capital flows, and lower the cost of equity financing for listed firms; thus, they have the potential to benefit markets and investors around the world (U.S. Securities and Exchange Commission, 2007).

A key issue that has emerged is whether certain global integration activities create value for the shareholders of the partnering stock exchanges. Because integration initiatives involving large, publicly traded stock exchanges are a relatively new phenomenon, there is little reliable information available to the market, or even to the

² Stock exchange disclosure (rules, monitoring, and enforcement) is an important element of investor protection and is positively associated with financial market development (Frost et al., 2006).

³ For example, the NYSE Group and Euronext merged their businesses under a U.S. holding company, NYSE Euronext, to create the first trans-Atlantic equities market. In addition, the Nasdaq recently announced an agreement to buy the Nordic stock exchange operator, OMX.

⁴ Starting in the early 1990s, stock exchanges around the world have been undergoing major organizational and operational changes by converting from mutual, not-for-profit organizations into publicly traded, for-profit firms. Following the example of the Stockholm Stock Exchange, institutions such as the Deutsche Börse, the London, Tokyo, Hong Kong, and Toronto Stock Exchanges, and the Sydney Futures Exchange have demutualized. In the United States, the two largest stock markets (the New York Stock Exchange and Nasdaq) and the three main futures exchanges (the Chicago Mercantile Exchange, the Chicago Board of Trade, and the New York Mercantile Exchange) all have adopted the for-profit form.

⁵ The advent of advanced computers and other forms of communication has allowed markets to operate worldwide, even as the marketplace itself has changed. Compared with the traditional floor trading activity, remote membership, electronic order book trading, alternative trading systems, and the internalization of order flows by financial intermediaries have all emerged in recent years.

involved exchanges themselves, regarding which types of mergers and alliances would create the most value or which exchanges would be good at planning and executing mergers and alliances. The growing number of demutualized stock exchanges also has made this question more important and interesting because the shareholders of these stock exchanges request management to maximize their share value.⁶

We try to answer this question empirically by examining whether and to what extent M&As and alliances create value for the shareholders of the partnering stock exchanges. In addition, we investigate the importance of differences in the characteristics of stock exchanges and integration activities in determining the valuation consequences across stock exchanges. Specifically, our research focuses on 15 public stock exchanges and evaluates their short-run share price responses to the formation of 111 M&As and strategic alliances around the world during the 2000–2008 period. We employ a standard event study methodology using a market model and extend it by adding another U.S. market return term to adapt to our multi-country event-testing environment. The overall results of this study reveal that the average stock price responses for stock exchange M&As and alliances are positive. Stock exchange M&As create more value than alliances. For alliances, joint ventures generate more value than non-equity alliances. More value accrues when the integration is horizontal than when it is vertical. Cross-border integration creates more value than domestic integration.

In the cross-sectional analysis, we use the three-day cumulative abnormal return as the dependent variable and control for deal characteristics, learning-by-doing variables, exchange characteristics, macroeconomic variables, technological integration levels,

⁶ In 1998, only 38% of exchanges were for profit. In 2008, the number had increased to 82% (World Federation of Exchanges, 2009).

differences in legal system and language, as well as country and year fixed effects. We obtain similar results to those shown in the event study. Additionally, there is evidence of learning-by-doing effects in stock exchange integration activities. Finally, we find that the better the shareholder protection, accounting standards, and capital market development in the partner exchange's country, the more value accrues to our sample stock exchange.

To examine whether these integration activities have a long-run impact on stock exchange performance, we also employ long-run performance measures such as the three-year buy-and-hold abnormal return, the change in industry-adjusted ROA, liquidity, and market capitalization of IPO between the year +2 and the year -2.⁷ Our results are consistent with the patterns that we find using the short-run performance measure. We acknowledge that these results should be interpreted with caution because these long-run performance measures are more likely to be contaminated by confounding events. This problem is more severe when our sample public stock exchanges conducted more than one integration activity in our sample period.

Our study contributes to the literature in several important ways. First, the research in the stock exchange industry has focused on theoretical analyses, liquidity, and

⁷ There is extensive research on merger premiums (e.g., Nielsen and Melicher, 1973), which tries to examine why the price paid for the target firm may be higher or lower than its market price (measured by the difference between the initial bid price and the target market price four weeks prior to the initial merger announcement divided by the same target price four weeks prior to the announcement). Our study is different because we try to investigate whether M&As create value for the acquirers' stockholders (measured by the acquirers' three-day CARs in M&A deals) instead of examining it from the targets' perspective. In addition, we focus on the shareholder value creation instead of the merger premium because the data used to construct the merger premium measure is not available in our sample. Specifically, we only have 30 stock exchange M&A events. There are only three target stock exchanges that are publicly traded companies. Thus, we do not have the initial bid price data and the target market price data to construct the merger premium measure. Moreover, to make our sample size reasonably large, we focus not only on M&As, but also joint ventures and non-equity alliances. Thus, we cannot examine the merger premium for these alliance deals.

the estimation of cost functions of stock exchanges.⁸ We add to existing research by examining the value creation for the shareholders of partnering stock exchanges. Second, to date, there is no evidence regarding which types of integrations would create the most value in the stock exchange industry or which exchanges would be good at planning and executing integrations. Our study shows the managers of stock exchanges the best growth strategy and gives investors some guidance on how to value stock exchange shares after their integration activities. Third, given the importance of the stock exchange industry as a key component of the financial market, our research increases understanding of the wealth effect of integration activities in this important and highly regulated industry. Thus, our study complements existing M&A and alliance research in other industries, such as the banking (e.g., DeLong, 2001). Finally, DeLong and Deyoung (2007) find that banks and investors learn by observing previous bank mergers to apply that knowledge to executing and evaluating subsequent mergers. We complement this strand of research by showing the existence of experience effects in the integration activities of the stock exchange industry.

2. Related research and hypothesis development

2.1. Wealth effect of stock exchange M&As and alliances

⁸ Pirrong (1999) presents theory and evidence regarding the economics of exchanges themselves. Santos and Scheinkman (2001) construct a theoretical model and show that competition among exchanges leads to an efficient but constrained outcome. Nielsson (2009) shows that Euronext stock exchange mergers have increased the liquidity of the firms listed on them. Hasan and Malkamäki (2001) confirm the existence of economies of scale and scope among the stock exchanges. Serifsoy (2007) reveals that most diversified stock exchanges are less efficient than exchanges that remain focused on the cash market. Huang et al. (2010) investigate how decimalization affects preferenced trading in NYSE-listed stocks. Charoenwong et al. (2010) try to investigate the effect of trade sizes on stock prices on the Stock Exchange of Thailand.

Existing research confirms the existence of economies of scale and scope among stock exchanges (Hasan and Malkamäki, 2001).⁹ Thus, the shareholders of stock exchanges would benefit from increased trading volume and IPOs. Additionally, M&As and alliances between two exchanges enable each of them to acquire knowledge, skills, and governance mechanisms from the partnering exchange (Dessein, 2005; Gomes-Casseres et al., 2006). Thus, shareholders of stock exchanges also would benefit from the synergy gains from improved knowledge, skills, and governance mechanisms.

Despite the several sound reasons for M&As and alliances between exchanges, stock exchanges cannot compete as ordinary business enterprises because of the manner in which they are regulated and because they function as self-regulatory organizations (U.S. Securities and Exchange Commission, 2007). Thus, such deals have to incur some costs to overcome legal barriers to benefit from synergy gains. Such integrations also need to overcome other barriers to capital flows, such as market frictions and differences in the price of risk across markets (O'Brien, 1992). The integration activities of exchanges also reduce competition and opportunities for cross-listings (Santos and Scheinkman, 2001). This decreases the efficiency and future revenue of the partnering exchanges. In summary, it is still an empirical question whether the integration activity of stock exchanges creates value for their shareholders. We summarize the related hypotheses as follows:

Hypothesis 1: The average stock price response to the announcement of a stock exchange integration activity (M&A, joint venture, or non-equity alliance) is positive.

Another important question for the shareholders of stock exchanges is which growth strategy is relatively better. The available growth strategies can range from a

⁹ For example, Arnold et al. (1999) and Nielsson (2009) show that stock exchange mergers have increased the liquidity of the firms listed on them, attracted market share, and reduced the trading cost.

simple contract (a non-equity alliance) to an M&A; joint ventures occupy an intermediate point. Because drafting, organization, and coordination costs increase as one moves from a non-equity alliance to an M&A, economic efficiency implies that firms choose a non-equity alliance over an intermediate position or an M&A (Williamson, 1979). Agency theory makes the same prediction since alliances avoid the agency costs associated with the management empire-building behavior of an M&A (Jensen, 1986a, b).

On the other hand, M&As might be preferred to joint ventures or alliances in the stock exchange industry. The reason is that new companies' listing and transaction fees are the most important revenue source of stock exchanges (Aggarwal, 2002). Equity-involving integrations can allow a stock exchange to become materially involved with the new business (Arnold et al., 1999). Based on these arguments, we provide the following two hypotheses.

Hypothesis 2a: More value accrues when stock exchanges choose M&As over joint ventures.

Hypothesis 2b: More value accrues when stock exchanges choose joint ventures over non-equity alliances.

2.2. Horizontal and vertical activities

In recent years stock exchanges have increasingly been diversifying their operations into related business areas such as derivatives trading, post-trading services, and software sales. We define a deal as vertical integration if the partnering stock exchanges have a different business focus and horizontal integration otherwise. Horizontal M&As and alliances benefit stock exchanges more than vertical deals because more knowledge and governance transfers will happen between two stock exchanges

with the same business model (Dessein, 2005; Gomes-Casseres et al., 2006).¹⁰ Moreover, horizontal integration activities can increase the stock exchange's market power and generate more revenue for them.

Hypothesis 3: More value accrues when stock exchanges' integration activities are horizontal.

2.3. Domestic and international cooperative activities

The demand for global exchanges has grown as more investors, both large and small, look beyond their own countries' borders for investment opportunities (U.S. Securities and Exchange Commission, 2007). Cross-border business opportunities are an important driver of stock exchange consolidation activities (Nielsson, 2009). Thus, we expect cross-border integration activities to create more value as a result of increased overseas business opportunities than domestic deals.

Hypothesis 4: More value accrues when stock exchanges' integration activities are cross-border.

2.4. Learning-by-doing effects

Existing studies confirm that experience matters in the corporate decision-making process. For example, Arrow (1962) and Hartley and Corcoran (1978) find that the differences in efficiency between British and U.S. airframe manufacturers after World War II were caused by the difference in their experience. Ghemawat (1985) finds that experience effects also exist in other industries. The stock exchange industry is a highly regulated industry and strict regulation had prevented exchanges from operating across country borders (U.S. Securities and Exchange Commission, 2007). Consolidations

¹⁰ For example, Serifsoy (2007) shows that diversified exchanges mostly are less efficient than focused exchanges.

involving large, publicly traded exchanges were a relatively new phenomenon in the 2000s (Nielsson, 2009). As more exchange consolidations occurred over time, however, it is reasonable to expect that exchanges learn how to plan and execute integration activities better based on previous experiences, and it is similarly reasonable to expect that investors learn how to value exchange consolidation activities better as they observe and evaluate more of them.

Hypothesis 5: More value accrues when stock exchanges have undertaken more previous integration activities.

2.5. Differences in market development and governance

Existing research (e.g., Bris and Cabolis, 2008; Chari et al., 2010; Rossi and Volpin, 2004) shows that differences in the legal environment influence the intensity and the pattern of M&As worldwide. When the stock exchange's partner is located in a country with a more developed stock market, its liquidity will increase more after the integration activities. Similarly, when the stock exchange's partner is located in a country with higher investor protection, its synergy gain from the governance transfer will be greater. In the announcement of the alliance between the New York Stock Exchange and the Tokyo Stock Exchange, one potential collaboration area is regulation and governance (The New York Times, Feb. 1, 2007).

Hypothesis 6a: When the partnering stock exchange is located in a country with a more developed stock market, more value accrues to the sample stock exchange.

Hypothesis 6b: When the partnering stock exchange is located in a country with higher investor protection, more value accrues to the sample stock exchange.

3. Data

3.1. Sample description

Our sample includes 15 public stock exchanges for which stock price data are available in the Datastream database. Table 1 presents the distribution of these public stock exchange companies across countries.¹¹ As shown in Table 1, the public stock exchanges in our sample are located in 12 countries, such as the United States and the United Kingdom. We collected M&A and alliance announcement data on these stock exchanges during the period January 2000-August 2008 from a number of sources, such as the newsletters and press releases from the World Federation of Exchanges (WFE, 2000–2008) and the European Federation of Securities Exchanges (EFSE, 2000–2008). Other important data sources are the Internet, press archives and ad hoc announcements of the individual stock exchanges involved in the integration deals. For an event to be included in the analysis, the stock price data around the event for the involved public stock exchange must be available in the Datastream database. If one stock exchange in the sample announces the purchase of or an alliance with another stock exchange within six months of the previous announcement, we drop the subsequent one from the sample.¹² We also drop seven uncompleted M&A deals (six acquirers are publicly traded exchanges).

¹¹ The sample includes two derivative exchanges, the Chicago Board of Trade and the Chicago Mercantile Exchange, and 13 stock exchanges. We acknowledge that there are differences between stock and derivative exchanges. For example, compared with stock exchanges, derivative exchanges have not only a price discovery role, but also risk management and transaction costs reduction roles. Nonetheless, there are similarities between stock and derivative exchanges. Specifically, some stock exchanges have either merged with derivative exchanges or recently become more involved with derivative business. The differences in the function between stock exchanges and derivative exchanges are becoming smaller, and both face competitive pressure and technological innovation (Otchere, 2006). Thus, we believe that it is reasonable to include both stock and derivative exchanges in our sample.

¹² We choose the six-month window because our estimation window for the event study is from day -150 to day -31. This can ensure that the previous event does not happen in the middle of the estimation window of a certain event and bias our estimation.

Our search identified 111 announcements of M&As and alliances by these 15 public stock exchanges.¹³ In our sample, there are 30 M&A events. All are at least partially stock-financed and there are no hostile deals. Although we only focus on the acquirers' stock response and exclude the targets from our sample, we investigate the ownership structure of target exchanges. We find that only three target stock exchanges are publicly traded companies. This result suggests that only a small percentage of exchange M&As combined two publicly traded exchanges. Additionally, there are 16 stock exchange joint ventures and 65 non-equity alliances in our sample. The partners are both public stock exchanges in four joint ventures and seven non-equity alliances. We include each partner's announcement as one observation in our sample. Thus, in total, we have 20 observations for joint ventures (eight observations from four joint ventures for which the partners are both public stock exchanges and 12 observations from 12 joint ventures for which one partner is a public stock exchange and the other is a non-public stock exchange) and 72 event observations for non-equity alliances (14 observations from seven non-equity alliances for which the partners are both public stock exchanges and 58 observations from 58 non-equity alliances for which one partner is a public stock exchange and the other is a non-public stock exchange). Adding 30 observations for M&As, we have 122 observations in our sample. Each observation represents an integration event (M&A, joint venture, or non-equity alliance) by a single publicly traded exchange.

Panel A of Table 2 lists the sample events by year. An inspection of Table 2 shows that the largest number of announcements of M&As and strategic alliances in one

¹³ In total, 102 stock exchanges are involved in these deals. These account for roughly 72% of the total number of exchanges in the world. In terms of market capitalization, however, the stock exchanges in the sample represent more than 95% of the universe.

year is 28 in 2007. Panel B shows that there are 30 M&As, 16 joint ventures, and 65 non-equity alliances in our sample. Panel C classifies these integration activities: 83.78% of the total stock exchange integration events are horizontal and 89.19% are cross-border. These results suggest that stock exchanges prefer horizontal and cross-border consolidations. Panel D presents the sample events by the type of technological integration. The results imply that one type of technological integration does not dominate our sample.

We also check whether alliances represent experimental organizational forms and would eventually evolve into joint ventures or mergers as proposed by Mody (1993). Our result does not support this assertion. Within four years following the formation of an alliance, only four of our sample alliances evolved into a more permanent form of relationship (joint ventures or M&As). This result is consistent with the findings in the sample of U.S. business firms by Chan et al. (1997).¹⁴

3.2. Variable definition and summary statistics

In this subsection, we discuss the measurement of the variables used in our empirical test. A detailed description of the variable definitions also can be found in the appendix.

3.2.1 Exchange performance measures

Shareholder value creation, the outcome variable of interest, can be measured in various ways. We use the variable $CAR[-1,1]$ to represent the three-day announcement

¹⁴ They find that within four years of the formation of an alliance, only five of their sample alliances evolved into a more permanent form of relationship (joint ventures or M&As).

abnormal return calculated based on the extended market model.¹⁵ Our objective is to determine whether the consolidation of stock exchanges creates value for exchange shareholders. This is exactly what the three-day announcement abnormal return measures and what those hypotheses in Section 2 directly relate to. By examining the short-run stock price response instead of the long-run performance measures, we can save more observations in our sample when we focus on the recent stock exchange M&A and alliance activities. Nonetheless, to append to the overall shareholder value creation discussion, the three-year buy-and-hold abnormal return ($BHAR_{l, 36}$) is introduced in Section 4.2, which captures the long-term dimension of shareholder value creation. We also introduce other long-run performance variables such as the difference in industry-adjusted ROA, the difference in the industry-adjusted value of share trading scaled by the market capitalization of listed firms, and the difference in the industry-adjusted market capitalization of IPOs scaled by the market capitalization of listed firms between the year +2 and the year -2.

3.2.2. Deal characteristics

In our estimation, we control for several deal characteristics as follows. *InterType* is equal to 0 when the deal is an M&A, 1 when the deal is a joint venture, and 2 when the deal is a non-equity alliance. *CrossBorder* is a dummy variable, which is equal to 1 when the deal is a cross-border transaction and 0 otherwise. *Horizontal* is a dummy variable, which equals 1 when the deal is a horizontal integration and 0 otherwise. *Public* is a dummy variable, which equals 1 when the partner is a publicly traded exchange and 0 otherwise. *TechnologicalIntegration* is a series of dummy variables that equal 1 if a deal

¹⁵ A more detailed description of this measure can be found in Section 4.1.1.

employs a certain type of technological integration (outsourcing, common access, common systems, common operations, complete system integration, and other types of integration).^{16,17}

3.2.3. *Learning-by-doing variables*

Because one stock exchange might engage in several integration activities during our sample period, they can learn some lessons and draw some experience from them. We construct and include the variables that measure the number of stock exchange integration activities during the previous period to control for the potential effects of active, internal learning by doing. Specifically, *NoPreMA* is the number of previous M&A events experienced by a given exchange, *NoPreJV* is the number of previous joint venture events experienced by a given exchange, and *NoPreAL* is the number of previous non-equity alliance events experienced by a given exchange.

3.2.4. *Exchange characteristics*

The exchange traits that we control for are firm size, Tobin's q, leverage, and cash flow, all of which are measured at the fiscal year-end prior to the integration announcement and come from the Worldscope database. Specifically, we measure the exchange size using the log transformation of total assets (*FirmSize*). We define Tobin's q as the market value of assets scaled by the book value of assets (Q) and the market value of assets as the book value of assets minus the book value of equity plus the market value of equity. Leverage is defined as the ratio of total liabilities over total assets

¹⁶ Hasan et al. (2003) report increased cost and revenue efficiency of exchanges associated with investment in technology-related developments.

¹⁷ A more detailed definition of these types can be found in the appendix.

(*Leverage*), and cash flow equals operating income before depreciation minus interest expenses minus income taxes minus capital expenditures, divided by total assets (*CashFlow*).

3.2.5. Country-level variables

We obtain data from the World Development Indicator database and control for the logarithm of GDP per capita (*GDPPerCapita*) and the logarithm of GDP growth (*GDPGrowth*). If the two partnering stock exchanges are located in different countries, the difference in legal system and language might create some barriers to integration and reduce the synergy gain. To control for these effects, we construct two dummy variables: *SameLanguage*, which equals one when the countries, in which two partnering stock exchanges are located, share the same language reported in an atlas and zero otherwise, and *SameLegalSystem*, which equals one when the countries, in which the two partnering stock exchanges are located, share the same legal origin reported by La Porta et al. (1998) and zero otherwise. To gauge the difference in stock market development between the country in which the sample stock exchange is located and that in which the partnering stock exchange is located, we obtain data about the market capitalization of the listed stock scaled by GDP, the stock traded turnover ratio, and the total value of stock traded scaled by GDP from the World Development Indicator database. Then, we construct the three variables *DifMarketToGDP*, *DifTurnover*, and *DifStockTradeToGDP*, measured as the difference in these three variables between the country in which the sample stock exchange is located and the country in which the partnering stock exchange is located. To measure the potential governance transfer effect, we obtain the country-level indices on

shareholder rights and accounting standards and the efficiency of the legal system from La Porta et al. (1998) because the stock exchange governance mechanism can be regarded as a concrete manifestation of the country-level investor protection in the securities markets (Frost et al., 2006). Then, we calculate the shareholder protection index, which is the product of the shareholder rights index and the efficiency of the legal system. The variables *DifShareholderProtection* and *DifAccountingStandards* are measured as the difference in the corresponding indices (shareholder protection index and accounting standards) between the country in which the sample stock exchange is located and that in which the partnering stock exchange is located.

3.2.6. Summary statistics

Table 3 presents the summary statistics of our variables used in the empirical test. The exchange performance measures and exchange characteristics are winsorized at the first and 99th percentiles to eliminate the effect of outliers. The summary statistics of these variables are consistent with those reported in the existing research. In Panel C, we observe that some exchanges experience several M&A and alliance events in our sample period. For example, the maximum value of the previous M&A (*NoPreMA*), joint venture (*NoPreJV*), and alliance (*NoPreAL*) events are respectively 6, 3, and 11. As shown in Panels G and H, the mean values of the differences in capital market development and legal environment all are positive. These results suggest that most of the public stock exchanges are located in countries with relatively more developed capital markets and legal systems.

4. Tests and results

4.1. Short-run stock abnormal return and integration activities

4.1.1. Event study findings

We conduct an event study to gauge the stock price response associated with the announcement of stock exchange integration activities. Morck et al. (2000) argue that it is necessary to include the U.S. stock market return in the return estimation because most economies are at least partially open and influenced by the U.S. capital market. Thus, we extend the market model by adding a U.S. market return term to calculate the abnormal return. The model is:

$$r_{it} = \alpha_i + \beta_{1,i} r_{m,jt} + \beta_{2,i} [r_{US,t} + e_{jt}] + \varepsilon_{it} \quad (1)$$

where i represents the stock exchange index and t is a one-day period time index. We use the total return index from the Datastream database to calculate the daily return ($r_{i,t}$). j represents the market index of the country in which the stock exchange lists and $r_{m,jt}$ is a domestic market return. $r_{US,t}$ is the U.S. market return.^{18,19} The rate of change in the exchange rate per U.S. dollar is e_{jt} . When we calculate Equation (1) to estimate the abnormal returns for the U.S. sample, we set $\beta_{2,i}$ to zero. We define the announcement day as day zero and the estimation period as from day -150 to day -31.²⁰ When we calculate Equation (1) to estimate the abnormal returns for the U.S. sample, we set β_2 to zero to avoid the duplication of the two market returns. Figure 1 shows that establishing

¹⁸ The local market index data are the exchange stock associated market index reported in the Datastream database.

¹⁹ We use the S&P 500 index to calculate the U.S. market return. When we use the Dow Jones Index to calculate the U.S. market return, we obtain similar results.

²⁰ We set the cut-off at 30 days before the announcement date because one of the weakest points of event studies is information leakage, i.e., some inside information is known before the actual event announcement. However, this might not fully solve the problem if the mergers and acquisitions and strategic alliances had been in the making for a long time. Nonetheless, based on Figure 1, the cut-off at 30 days before the announcement date reasonably avoids the information leakage problem.

strategic relationships is considered good news and creates significant value for the shareholders of the partnering stock exchanges.²¹

Insert Figure 1 around here

The significance tests in our event study are based on a standardized parametric test statistic constructed to determine whether the mean abnormal return is significantly different from zero (Mackinlay, 1997). Campbell et al. (2009) find that a non-parametric test performs a better job than a parametric test in a multi-country event study. Thus, we also report the results of Wilcoxon signed-rank tests.

Panel A of Table 4 shows that the three-day cumulative abnormal return is a statistically significant 1.4% (Z-statistic = 2.24) for stock exchange M&As, 1.1% (Z-statistic = 2.51) for stock exchange joint ventures, and 0.94% (Z-statistic = 2.84) for stock exchange non-equity alliances. This evidence suggests that establishing strategic relationships creates significant value for shareholders of the partnering stock exchanges. The results based on the non-parametric tests are consistent.

We further classify our sample into different groups to examine the patterns in the subsamples. We acknowledge that these results reported in Tables 4 need to be interpreted with caution due to the small sample size. Panel B of Table 4 compares the cumulative abnormal return [-1, 1] among two of the three groups of the events: stock exchange M&As, joint ventures, and non-equity alliances. The mean value of the cumulative abnormal return [-1, 1] of stock exchange M&As is significantly higher than

²¹ We acknowledge that the sample acquisitions all appear to be partially stock-financed. This should put some negative downward pressure on bidder returns because negative information is revealed when stock is issued. This may cause a negative bias on the estimates of the value creation accruing to bidding shareholders from the M&A deal.

that of joint ventures (T-statistic = 4.42). Similarly, the mean value of the cumulative abnormal return [-1, 1] of stock exchange joint ventures is significantly higher than that of non-equity alliances (T-statistic = 4.51).

As shown in Panel C of Table 4, the three-day cumulative abnormal return is a statistically significant 2% (Z-statistic = 3.05) for cross-border stock exchange M&As, 1.13% (Z-statistic = 2.62) for cross-border stock exchange joint ventures, and 1.3% (Z-statistic = 3.92) for cross-border stock exchange alliances. In contrast, the three-day cumulative abnormal return is not statistically significant and has a lower mean value for domestic integration events. This evidence suggests that more value accrues to the shareholders of the partnering stock exchanges where cross-border strategic relationships are established. The non-parametric tests (sign tests) confirm these findings. Panel D of Table 4 shows similar results, suggesting that more value accrues to the shareholders of the partnering stock exchanges where horizontal strategic relationships are established.

Insert Table 4 around here

We also conduct several tests as discussed below. The results are available upon request, although not reported. Six acquirers are publicly traded exchanges in seven uncompleted M&A deals. We examine the stock price response for the acquirer stock exchanges when the deal failed. We observe that the merger failure announcement three-day cumulative abnormal return is a statistically significant -2.76% (Z-statistic = -3.78) for the acquirer stock exchanges. In contrast, the merger announcement three-day cumulative abnormal return is a statistically significant 1.35% (Z-statistic = 2.36) for the acquirer stock exchanges, which is lower than the merger failure announcement period

returns. These results suggest that failed M&As reduce the shareholder value of acquirer exchanges.

As indicated earlier, in our sample there are three M&As, four joint ventures, and seven non-equity alliances for which price data are available for the both partners. In this sub-sample, we examine whether there are wealth transfers between the larger and smaller partners in the alliance. We use the market value of each firm's common stock 31 trading days before the announcement of the integration to measure the relative size. In unreported results, we compare the average cumulative abnormal return [-1, 1], the average market value on event day - 31, and the change in wealth in the time interval [-1, 1] around the announcement day (market value on event day -31 multiplied by the average abnormal return [-1, 1]) for the sub-groups defined by the relative sizes of the alliance partner exchanges.

In three M&A deals, the average market value of the acquirers is \$4.02 million, which is on average more than three times that of the targets (\$1.06 million). Both acquirer and target exchanges experience a significant three-day cumulative abnormal return. These results also suggest that the target exchanges in the M&As receive a larger abnormal return than the acquirer exchanges. However, the wealth gains are almost equal.

In four joint ventures and seven non-equity alliances, the average market value of the larger partner is on average more than ten times that of the smaller ones. The smaller exchanges experience a significant three-day cumulative abnormal return. The larger exchanges experience an insignificant cumulative abnormal return. These results suggest that the smaller exchange in the alliance receives a larger abnormal return than the larger exchange. However, the wealth gains are almost equal. We also test the potential wealth

transfer between the larger and the smaller exchange. The evidence shows that the correlation between the wealth increases experienced by the paired larger and smaller exchanges is not significant. These results imply that the wealth is created by the formation of exchange joint venture and non-equity alliances, and there is no evidence of wealth transfer between the partners.

4.1.2. Cross-sectional analysis

In this section, we use multivariate analysis to analyze the cross-sectional differences in the short-run shareholder value creation for the M&A and alliance announcements. We acknowledge that these results need to be interpreted with caution due to a few degrees of freedom. The basic model specification is as below:

$$CAR[-1,1]=\alpha_i+\beta_1DealCharacteristics+\beta_2LearningByDoing+\beta_3ExchangeCharacteristics+\beta_4 MacroDevelopment +\beta_5 TechnologicalIntegration+\beta_6 DifLegalandLanguage +\varepsilon \quad (2)$$

where the dependent variable $CAR[-1, 1]$ is the three-day cumulative abnormal return calculated based on Equation (1). The independent variables include *DealCharacteristics* (*InterType*, *Crossborder*, and *Horizontal*) to control for deal characteristics, *LearningByDoing* (*NoPreMA*, *NoPreJV*, and *NoPreAL*) to measure learning-by-doing effects, *ExchangeCharacteristics* (*Firm_Size*, *Q*, *Leverage*, *CashFlow*) to control for exchange characteristics, *MacroDevelopment* (*GDPPerCapital* and *GDPGrowth*) to control for the countries' macroeconomic developments, *TechnologicalIntegration* to control for the type of technological integration, and the variables *Samelanguage* and *SameLegalSystem* to control for the differences in language and legal system

(*DifLegalandLanguage*). We also include country and year fixed effects to control for the variation across countries and years.

We uncover three important findings as shown in Column (1) of Table 5. First, more value accrues when the deal is a stock exchange M&A than when it is a joint venture or alliance. Second, horizontal stock exchange integration activities create more synergies than vertical ones. Finally, cross-border stock exchange integration activities create more synergies than vertical ones. These results are not only statistically significant, but also economically significant. On average, the three-day cumulative abnormal return of exchange M&As (joint ventures) is 0.597% higher than that of exchange joint ventures (non-equity alliances). The three-day cumulative abnormal return of horizontal integrations is 2.801% higher than that of vertical integrations. Cross-border consolidations generate abnormal returns 2.376% higher than domestic ones.²²

It is worth emphasizing that the coefficients of the learning-by-doing variables (*NoPreMA*, *NoPreJV*, and *NoPreAL*) are positive and statistically significant. For example, if the exchange experienced one more M&A, the three-day cumulative abnormal return of the next integration activity will increase by 0.012%.²³ Thus, we find evidence to suggest that exchanges engaging in integration activities tend to perform better once they have acquired some experience from previous integration activities. This finding most likely reflects the fact that the complicated and different regulations in

²² Our finding that horizontal stock exchange integration activities create more shareholder value than vertical ones is similar to the results reported in the existing research. For example, Kaplan and Weisbach (1992) show that only mergers between firms in related businesses are likely to generate operating synergies. Johnson and Houston (2000) reveal that only horizontal joint ventures create value for shareholders while vertical ones do not. Chan et al. (1997) find that when non-equity alliances involve a transfer or pooling of technology, the average stock price response is positive for horizontal alliances and there is no significant abnormal return for vertical ones.

²³ We acknowledge that the benefit from experience is not economically significant given the three-day cumulative abnormal returns of 1.4% for mergers.

various countries encountered by stock exchanges make previous experience valuable. As shown in Column (2), when we add exchange characteristics to the regression, we find that our main results are still robust. We also find that the exchange size (*FirmSize*) is inversely related to the abnormal return (the results are not reported for the sake of brevity). These results are robust when we control for macroeconomic variables as shown in Column (3).

Next, we examine how the difference in capital market development between the countries in which the partnering stock exchanges are located influences the abnormal return. As shown in Columns (4), (5), and (6), we add another term (*DifMarketToGDP*, *DifTurnover*, or *DifStockTradeToGDP*) to measure the difference in capital market development between the countries in which the participating stock exchanges are located, respectively. Our main results do not change. The coefficients of the variables *DifMarketToGDP*, *DifTurnover*, and *DifStockTradeToGDP* are significantly negative. Based on the results reported in Column (4), a 1% decrease in the difference in the capital market development between the country in which the sample stock exchange is located and the country in which the partnering exchange is located (i.e., a 1% increase in the capital market development of the country in which the partnering exchange is located) will lead to a 0.169% increase in the three-day cumulative abnormal return. These results suggest that when the partnering stock exchange is located in a country with a more developed stock market, more value accrues to the sample stock exchange.

Similarly, when the partnering stock exchange is located in a country with higher investor protection, there should be a greater synergy gain for our sample exchange from increased governance effects. As shown in Columns (7) and (8), we add another term

(*DifShareholderProtection* or *DifAccountingStandards*) to measure the difference in the legal environment between the countries in which the participating stock exchanges are located, respectively. As shown in Columns (7) and (8) of Table 5, our main results still hold.²⁴ The coefficients of the variables *DifShareholderProtection* and *DifAccountingStandards* are significantly negative. Based on the results shown in Column (7), a 1% decrease in the difference in the legal environment between the country in which the sample exchange is located and the country in which the partnering exchange is located (i.e., a 1% increase in investor protection in the country in which the partnering exchange is located) will increase the three-day cumulative abnormal return by 0.026%. These results suggest that when the partnering stock exchange is located in a country with better investor protection, more value accrues to the sample stock exchange. the more shareholder value accrues.

Insert Table 5 around here

4.2. Long-run performance and integration activities

From a stock exchange shareholder's viewpoint, the long-run stock return after the integration might be more important and valuable than the short-run stock return. By looking at the long-term patterns in stock returns, we are able to test whether the positive reaction to the exchange integration is a sign of temporary optimism by investors who newly gain remote access in equity trading, or whether the price reaction is permanent, implying an increase in the shareholders' wealth. Nonetheless, the long-run stock return is more likely to be contaminated by confounding events. This problem is more severe

²⁴ In the reported results, we only control for *DifTurnover*. Our results do not change when we control for *DifMarketToGDP* or *DifStockTradeToGDP*.

when our sample public stock exchange conducted more than one integration activity in our sample period.

To address this issue formally, first, we examine the three-year buy-and-hold abnormal return of the partnering exchange. The three-year period includes the following 36 months where months are defined as successive 21-trading-day periods relative to the announcement date. Thus, month 1 consists of event days 2–22; month 2 consists of event days 23–43, etc. The three-year buy-and-hold abnormal return $BHAR_{I, 36}$ is calculated as below:

$$BHAR_{1,36} = \prod_1^{36} (1 + R_{i,t}) - \prod_1^{36} (1 + R_{m,t}) \quad (3)$$

where $R_{i,t}$ is the monthly return and $R_{m,t}$ is the benchmark return, which is the value-weighted exchange industry return.²⁵ As shown in Columns (1) and (2) of Table 6, the patterns are consistent with the results when we examine the short-run abnormal return.

Then, we use accounting ratios (ROA) to measure the exchange performance because accounting ratios capture the actual financial performance over a period of time, while market returns are forward-looking measures of expected earnings. However, firms often take write-offs around major corporate control events. This makes it hard to compare the operating performance before and after the integration activities. As shown in Columns (3) and (4), the dependent variable is the difference in the industry-adjusted ROA between the year +2 and the year -2. We still find the same pattern as for the results when we examine the short-run abnormal return.

²⁵ Whether we use the market index return or equal-weighted industry average return as the bench return, we draw the same conclusion. The results are not reported, but are available upon request. When we calculate the value-weighted industry return for a sample exchange, we do not include that sample exchange.

The exchange accounting performance is mainly driven by the revenue from trading and IPOs. Thus, we examine the pattern in liquidity and IPO activities after the announcement of integration activities. We obtain the data from the website of the World Exchange Federation. The exchange liquidity is measured as the value of share trading divided by the market capitalization of listed stocks. The exchange IPO activities are measured as the market capitalization of IPOs divided by the market capitalization of listed stocks. As shown in Columns (5) and (6), the dependent variable is the difference in industry-adjusted exchange liquidity between the year +2 and the year -2. As shown in Columns (7) and (8), the dependent variable is the difference in industry-adjusted exchange IPO activities between the year +2 and the year -2. We obtain similar results to those we obtain when we examine the short-run abnormal return.

Insert Table 6 around here

4.3. Robustness tests

In this subsection, we conduct several robustness tests. These procedures do not qualitatively change our findings.²⁶

First, to make sure that our results are not driven by a specific model as shown in Equation (1), we examine another model based on Jin and Myers (2006) incorporating lagged market returns to avoid the influence of non-synchronous trading, the three-factor Fama-French model, and the three-factor Fama-French model plus Carhart's UMD momentum factor.²⁷ We also use different event windows, i.e. [-2, 2] and [-3, 3], to

²⁶ The results are available upon request, although not reported.

²⁷ Employing these multifactor models does not significantly change our results because the marginal explanatory power of additional factors is small (Mackinlay, 1997). For example, using the three-factor Fama-French model plus Carhart's UMD momentum factor, the three-day cumulative abnormal return is a

calculate the abnormal return. In addition, we calculate heteroskedasticity-robust t -statistics by regressing $CAR[-1,1]$ on an intercept.

Second, in most cases, we cannot find the data for the partnering stock exchange to combine the two parties into one observation for the sake of comparison because it is not a public stock exchange. For the three M&As, the four joint venture announcements, and the seven non-equity alliance announcements for which we have return data on multiple partners, we combine all the partners in the same deal to form a value-weighted portfolio using the market values of the partner firms on event day -31 as weights. We then treat the portfolio as a single observation when conducting our empirical study.

Third, to control for confounding events, we conduct a robustness check on the subsample excluding the observations in which there is an earnings announcement in the event window.

Finally, to deal with the endogeneity problem, we estimate a Heckman model where the probability of entering into an M&A deal is the dependent variable in a first-stage model. We model an exchange's decision to engage in an M&A activities as a function of its size (*FirmSize*), growth opportunities (*Q*), Leverage (*Leverage*), cash flow (*CashFlow*), market power (*Segmented*, which equals one if there is more than one stock exchange in a certain country and zero otherwise), GDP growth (*GDPGrowth*), and GDP per capita (*GDPPerCapita*). Then the Inverse Mills Ratio from this test is included in a

statistically significant 1.39% (Z-statistic = 2.26) for stock exchange M&As, 1.08% (Z-statistic = 2.55) for stock exchange joint ventures, and 0.92% (Z-statistic = 2.87) for stock exchange non-equity alliances.

second-stage model that resembles the models currently reported in Column (8) of Table 5.²⁸

5. Summary and conclusions

We provide evidence concerning the impact of M&As and strategic alliances on the wealth of partnering stock exchanges' shareholders. We find significant positive wealth effects, on average, from the formation of such M&As and alliances. These results support the conjecture that global exchange integration activities may promote the efficiency of cross-border capital flows and increase governance standards, and thus have the potential to create value for their shareholders. We acknowledge that the consolidation of exchanges may reduce competition and opportunities for cross-listings in the future. Thus, the loss to future consumers should be properly deducted from the benefit to current shareholders.

We also find that stock exchange alliances lead to the creation of less value than joint ventures. Similarly, less value accrues through stock exchange joint ventures than through M&As. By examining the types of stock exchange integration activities that have the greatest wealth impact on the partnering exchanges, we find that horizontal integration activities tend to produce larger wealth effects than vertical ones. In addition, cross-border integration activities tend to produce larger wealth effects than domestic ones. Additionally, there is evidence of learning-by-doing in stock exchange integration activities. Finally, we find that when the partnering exchange is located in a country with better shareholder protection, accounting standards, and capital market development,

²⁸ The coefficient of the Inverse Mills Ratio is significantly positive (0.167, p-value <0.1), suggesting that unobservable factors that increase the likelihood of M&As increase the three-day cumulative abnormal return.

the more value accrues to our sample exchange. These patterns are consistent when we examine long-run performance measures such as the three-year buy-and-hold abnormal return, the change in industry-adjusted ROA, liquidity, and market capitalization of IPOs between the year +2 and the year -2.

The results of our research have significant implications for managers of stock exchanges. In general, the use of M&As and alliances by stock exchanges creates value for their shareholders. Furthermore, expanding horizontally into international markets provides stock exchanges with the opportunity to capitalize on their domestic expertise and reap handsome profits. Our research also gives investors some guidance on how to value stock exchange shares after their integration activities.

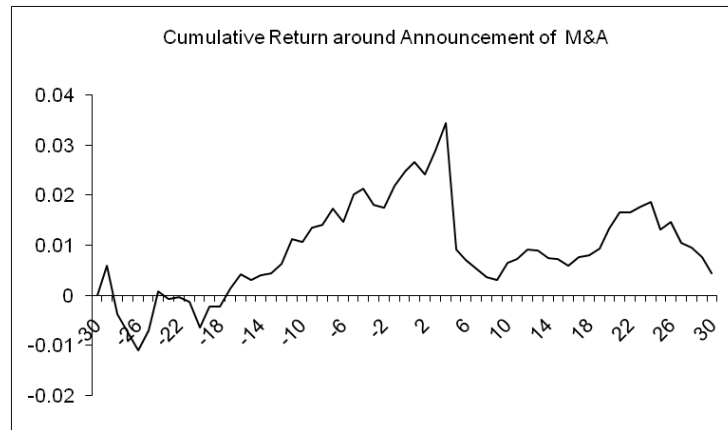
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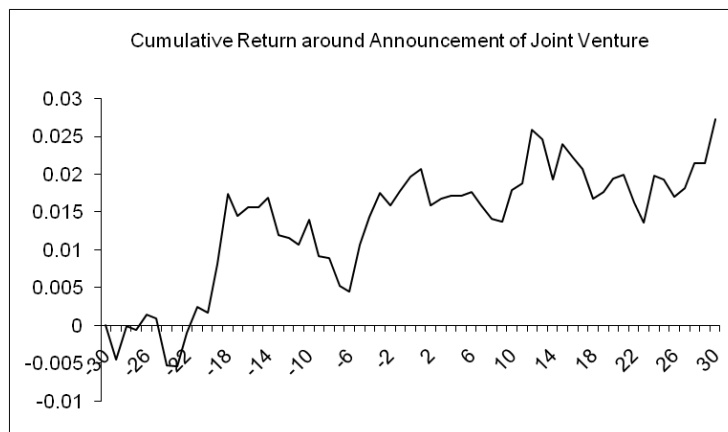
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Figure 1 Cumulative return around the announcement of stock exchange M&As, joint ventures and non-equity alliances

Panel A



Panel B



Panel C

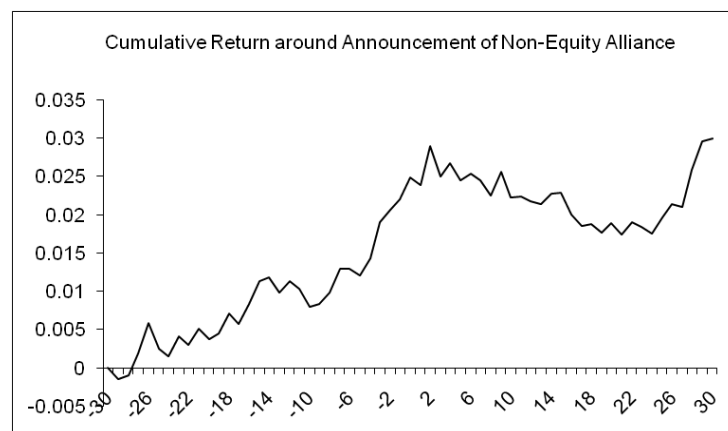


Table 1 Public stock exchanges in our sample

This table describes 15 public stock exchange companies in our sample, the countries in which their headquarters are located, and the stock exchanges in which they are listed.

No.	Public stock exchange company	Country in which its headquarter is located	Stock exchange in which it is listed
1	Australian securities exchange	Australia	Australian securities exchange
2	Athens Stock Exchange	Greece	Athens Stock Exchange
3	Chicago board of trade	United States	New York stock exchange
4	Chicago mercantile exchange	United States	Nasdaq
5	Deutsche Boerse	Germany	Frankfurt stock exchange
6	Euronext	France	Paris bourse
7	Hong Kong stock exchange	Hong Kong (China)	Hong Kong stock exchange
8	London stock exchange	United Kingdom	London stock exchange
9	Nasdaq	United States	Nasdaq
10	New York stock exchange	United States	New York stock exchange
11	OMX exchanges	Sweden	Stockholm exchange
12	Osaka securities exchange	Japan	Osaka securities exchange
13	Sao Paulo stock exchange	Brazil	Sao Paulo stock exchange
14	Singapore exchange	Singapore	Singapore exchange
15	TSX group	Canada	Toronto exchange

Table 2 Announcements of stock exchange M&As and alliances

This table presents the sample distributions by year and type of integrations.

<i>Panel A: Annual distribution of stock exchange integration activities</i>		
Year of announcement	Number of announcements	Percentage of total
2000	5	4.50
2001	8	7.21
2002	9	8.11
2003	12	10.81
2004	13	11.71
2005	14	12.61
2006	20	18.02
2007	28	25.23
2008	2	1.80
Total	111	100

<i>Panel B: Distribution of stock exchange integration activities by level</i>		
Type of integration activities	Number of announcements	Percentage of total
M&A	30	27.03
Joint venture	16	14.41
Non-equity alliance	65	58.56

<i>Panel C: Distribution of stock exchange integration activities by type</i>		
Type of integration activities	Number of announcements	Percentage of total
Horizontal	93	83.78
Vertical	18	16.22
Cross-border	99	89.19
Domestic	12	10.81

<i>Panel D: Distribution of stock exchange integration activities by type of technological integration</i>		
Type of technological integration	Number of announcements	Percentage of total
Outsourcing	17	15.32
Common access	10	9.01
Common systems	5	4.50
Common operation	6	5.41
Complete system integration	16	14.41
Other type of integration	55	49.55

Table 3 Summary statistics

This table presents the summary statistics. Performance measures and exchange characteristics are winsorized at the 1st and 99th percentiles. Variable definitions are given in the appendix.

<i>Panel A: Exchange performance measures</i>						
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
CAR [-1, 1] (%)	122	1.07	1.09	0.34	-5.96	6.48
BHAR _{1,36} (%)	71	97.33	101.22	26.46	-66.56	212.44
DifferenceInROA(%)	61	3.24	3.67	0.80	-2.47	8.01
DifferenceInLiquidity	59	0.12	0.15	0.04	-0.15	0.27
DifferenceInIPO	59	0.11	0.10	0.03	-0.13	0.28
<i>Panel B: Deal characteristics</i>						
InterType	122	1.37	2.00	0.86	0.00	3.00
Horizontal	122	0.82	1.00	0.38	0.00	1.00
CrossBorder	122	0.89	1.00	0.31	0.00	1.00
Public	122	0.12	0.00	0.32	0.00	1.00
<i>Panel C: Learning-by-doing variables</i>						
NoPreMA	122	1.21	2.00	1.72	0.00	6.00
NoPreJV	122	0.54	1.00	0.86	0.00	3.00
NoPreAL	122	3.08	3.00	2.75	0.00	11.00
<i>Panel D: Exchange characteristics</i>						
MarketValue (\$ millions)	122	4,045.94	10,024.43	5,841.89	12.86	34,753.22
Total Assets (\$ millions)	117	7,292.35	24,978.46	14,817.56	30.70	60,535.95
CashFlow	117	0.11	0.13	0.09	0.01	0.41
Leverage	113	0.60	0.51	0.17	0.39	0.79
Q	113	2.72	4.67	2.10	1.11	8.66
<i>Panel E: Macroeconomic development variables</i>						
GDP per capita (\$)	92	25,867.98	11,346.35	8,822.97	949.18	39,824.08
GDP growth (%)	92	2.98	6.56	2.42	-2.40	10.00
<i>Panel F: Difference in language and legal system</i>						
SameLanguage	122	0.55	1	0.23	0.00	1.00
SameLegalSystem	122	0.32	0	0.20	0.00	1.00
<i>Panel G: Difference in capital market development</i>						
DifMarketToGDP (%)	92	0.17	0.88	0.75	-2.62	2.43
DifTurnOver (%)	91	0.21	0.56	0.55	-1.54	1.59
DifStockTradeToGDP (%)	92	0.27	0.34	0.91	-2.52	1.91
<i>Panel H: Difference in governance</i>						
DifShareholderProtection	76	2.75	12	20.65	-41.00	50.00
DifAccountingStandards	72	4.63	10	13.47	-21.00	59.00

Table 4 Cumulative return [-1, 1] around announcement of stock exchange M&A, joint venture and non-equity alliance

This table presents the results of the event study in different subsamples. *, ** and *** stand for significance at the 10%, 5% and 1% levels.

<i>Panel A: Announcement period cumulative return [-1,1]</i>				
Event type	Number of observations	CAR [-1, 1] (%)	Z-statistic	Proportion of positive value (sign test)
M&A	30	1.40	2.24*	73.33%***
Joint venture	20	1.10	2.51*	70.00%*
Non-equity alliance	72	0.94	2.84**	69.41%**

<i>Panel B: Comparison of announcement period cumulative return [-1,1] among M&A, joint ventures, and non-equity alliances</i>				
Two group of events	Number of observations	Difference of CAR [-1, 1] (%)	T-statistic	P value (Wilcoxon rank-sum test)
M&A and joint venture	50	0.33	4.42***	0.01***
M&A and non-equity alliance	102	0.43	4.51***	0.03**
Joint venture and non-equity alliance	92	0.12	4.31***	0.01***

<i>Panel C: Comparison of announcement period cumulative return [-1,1] between cross-border and domestic deals</i>				
Event type	Number of observations	CAR [-1, 1] (%)	Z-statistic	Proportion of positive value (sign test)
Cross-border M&A	23	2.00	3.05***	78%**
Domestic M&A	7	-0.59	-0.37	57%
Cross-border joint venture	19	1.13	2.62***	74%*
Domestic joint venture	1	-0.23	-0.12	0%
Cross-border non-equity alliance	66	1.3	3.92***	71%***
Domestic non-equity alliance	6	-3.6	-2.20	39%

<i>Panel D: Comparison of announcement period cumulative return [-1,1] between horizontal and vertical deals</i>				
Event type	Number of observations	CAR [-1, 1] (%)	Z-statistic	Proportion of positive value (sign test)
Horizontal M&A	22	1.88	2.66***	77%**
Vertical M&A	8	0.05	0.04	63%
Horizontal joint venture	15	1.24	2.82***	73%*
Vertical joint venture	5	0.51	0.5	60%
Horizontal non-equity alliance	62	1.1	3.47***	69%***
Vertical non-equity alliance	10	-0.7	-0.52	65%

Table 5 Cross-sectional analysis of CARs upon announcement

The dependent variable is the three-day cumulative abnormal return (CAR) in percentage points. Variable definitions are given in the appendix. In brackets are *t*-statistics based on standard errors adjusted for heteroskedasticity and country clustering. *, ** and *** stand for significance at the 10%, 5% and 1% level respectively.

Dependent variable	CAR[-1, 1]							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Deal characteristics								
InterType	-0.597*** (-4.493)	-0.551*** (-4.389)	-1.101** (-2.016)	-1.135* (-1.995)	-1.136** (-2.014)	-1.092* (-1.974)	-0.941*** (-4.233)	-1.031*** (-4.450)
Horizontal	2.801** (2.227)	2.463* (1.801)	3.073* (1.930)	3.127* (1.938)	3.081* (1.893)	3.054* (1.902)	1.912*** (5.036)	2.422*** (4.445)
CrossBorder	2.376** (2.005)	2.028*** (3.498)	2.148*** (3.185)	2.098*** (4.134)	2.128*** (4.185)	2.174*** (4.193)	1.842*** (5.985)	2.102*** (4.215)
Public	0.006 (0.006)	0.003 (0.004)	0.004 (0.008)	0.002 (0.005)	0.002 (0.006)	0.003 (0.008)	0.003 (0.004)	0.004 (0.006)
Leaning-by-doing								
NoPreMA	0.012*** (4.687)	0.024*** (3.357)	0.018*** (3.258)	0.022*** (4.183)	0.015*** (5.201)	0.016*** (4.266)	0.021*** (4.600)	0.012*** (4.456)
NoPreJV	0.010*** (4.014)	0.017*** (4.497)	0.034*** (4.715)	0.017*** (4.733)	0.018*** (4.786)	0.016*** (4.701)	0.019*** (4.022)	0.021*** (4.056)
NoPreAL	0.014*** (5.555)	0.019*** (4.378)	0.025*** (4.626)	0.016*** (4.645)	0.022*** (4.632)	0.016*** (3.883)	0.014*** (4.682)	0.019*** (4.356)
Difference in capital market development								
DifMarketToGDP				-0.169*** (-4.267)				
DifTurnover					-0.160*** (-5.179)		-0.052*** (-4.245)	-0.043*** (-4.001)
DifStockTradeToGDP						-0.073*** (-4.135)		
Difference in governance								
DifShareholderProtection							-0.026*** (-3.922)	
DifAccountingStandards								-0.132*** (-2.792)
Control for								
Exchange characteristics	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic variables	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Technological dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Difference in language and legal environment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country and Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.12	0.16	0.19	0.19	0.20	0.20	0.21	0.22
No. of observations	122	113	84	84	82	84	55	52

Table 6 Cross-sectional analysis of long-run performance

The dependent variable is the three-year buy-and-hold abnormal return (BHAR), DifferenceInROA, DifferenceInLiquidity, and DifferenceInIPO. Variable definitions are given in the appendix. In brackets are *t*-statistics based on standard errors adjusted for heteroskedasticity and country clustering. *, ** and *** stand for significance at the 10%, 5% and 1% level respectively.

Dependent variable	BHAR _(1, 36)		DifferenceInROA		DifferenceInLiquidity		DifferenceInIPO	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Deal characteristics								
InterType	-3.821*	-3.315***	-0.650***	-0.256***	-0.030***	-0.025***	-0.023***	-0.025***
	(-1.990)	(-5.853)	(-5.379)	(-4.694)	(-4.232)	(-4.494)	(-4.362)	(-4.811)
Horizontal	8.143***	16.675***	1.912*	3.451***	0.191***	0.328***	0.703***	0.242***
	(4.172)	(5.134)	(1.899)	(6.214)	(4.892)	(6.005)	(4.685)	(5.061)
CrossBorder	3.833***	3.463***	0.524***	0.213***	0.046***	0.028***	0.034***	0.013***
	(4.387)	(4.287)	(5.272)	(6.417)	(4.143)	(5.249)	(4.653)	(5.114)
Public	0.012	0.014	0.007	0.008	0.006	0.007	0.005	0.003
	(0.004)	(0.008)	(0.004)	(0.003)	(0.002)	(0.006)	(0.003)	(0.009)
Leaning-by-doing variables								
NoPreMA	1.183***	1.434***	0.065***	0.215***	0.008***	0.027***	0.002***	0.013***
	(4.689)	(5.453)	(3.345)	(4.201)	(4.399)	(4.688)	(4.641)	(4.215)
NoPreJV	1.101***	1.135***	0.082***	0.013***	0.008***	0.004***	0.002***	0.003***
	(4.295)	(4.358)	(5.874)	(4.822)	(5.142)	(4.242)	(5.872)	(4.157)
NoPreAL	1.165***	1.178***	0.046***	0.038***	0.005***	0.007***	0.004***	0.006***
	(4.274)	(5.159)	(5.952)	(4.552)	(5.101)	(4.774)	(5.431)	(4.136)
Difference in capital market development								
DifTurnover		-1.207***		-0.083***		-0.015***		-0.008***
		(-4.193)		(-4.194)		(-4.668)		(-4.102)
Difference in governance								
DifShareholderProtection		-1.144***		-0.027***		-0.007***		-0.005***
		(-4.552)		(-4.515)		(-4.354)		(-4.122)
Control for								
Exchange characteristics	No	Yes	No	Yes	No	Yes	No	Yes
Macroeconomic variables	No	Yes	No	Yes	No	Yes	No	Yes
Technological dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Difference in language and legal environment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country and year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.19	0.42	0.19	0.47	0.24	0.41	0.17	0.34
No. of observations	71	41	61	35	59	37	59	36

Appendix Brief descriptions of all the variables

Variables	Description
Exchange performance measures	
CAR [-1, 1]	The three-day cumulative abnormal return (in percentage points) calculated using the extended market model. The extended market model parameters are estimated over the period (-150, -31).
BHAR _{1,36}	The three-year buy-and-hold abnormal return (in percentage points). The benchmark is the value-weighted exchange industry return.
DifferenceIn ROA	The difference in the industry-adjusted ROA between +2 and -2 year. The industry-adjusted ROA is defined as ROA minus asset-weighted industry ROA (in percentage points).
DifferenceInLiquidity	The difference in industry-adjusted exchange liquidity between +2 and -2 year. The industry-adjusted exchange liquidity is defined as the exchange liquidity minus the asset-weighted industry exchange liquidity. The exchange liquidity is measured as the value of share trading divided by market capitalization of listed stocks.
DifferenceInIPO	The difference in industry-adjusted exchange IPO activities between +2 and -2 year. The industry-adjusted exchange IPO is measured as the exchange IPO activities minus the asset-weighted industry exchange IPO activities. The exchange IPO activities are measured as the market capitalization of IPOs divided by market capitalization of listed stocks.
Deal characteristics	
InterType	It is equal to 0 when the deal is an M&A, 1 when the deal is a joint venture, and 2 when the deal is a non-equity alliance.
Horizontal	It equals 1 when the deal is a horizontal transaction, otherwise 0.
CrossBorder	It is equal to 1 when the deal is a cross-border transaction, otherwise 0.
TechnologicalIntegration	Dummy variables to indicate the type of technological integration (outsourcing, common access, common systems, common operations, complete system integration, and other type of integration).
Outsourcing	Outsourcing of trading systems.
Common access	Common access to previously separate trading platforms or often involve so called cross membership agreements, cross-trading or common front-end, but systems of partners continue to operate independently from one another.
Common systems	Implementation of a jointly used system or products are traded on this joint system, but the partners independently operate the system, i.e. processes such as risk control, market supervision, post-trade processes, etc. are handled separately by each of the partners.
Common operation	Besides using a common system as technical platform, partners also integrate the operation of the trading, i.e. risk control, market supervision, etc. are integrated, only post-trade processes are handled separately.
Complete system integration	Complete integration of value chain, i.e. trading and post-trading.
Other types of integration	Cooperation agreement focuses on products, i.e. cross-listings, joint product development, information sharing, but doesn't include sophisticated forms of technical integration.
Public	It is equal to 1 when the target exchange is a publicly traded exchange in an M&A or the partner is a publicly traded exchange in a joint venture (non-equity alliance),

	otherwise 0.
Learning-by-doing variables	
NoPreMA	The number of previous M&A events experienced by a given exchange.
NoPreJV	The number of previous joint venture events experienced by a given exchange.
NoPreAL	The number of previous non-equity alliance events experienced by a given exchange.
Exchange characteristics	
MarketValue	The market value of equity on the 31st trading day prior to the announcement date.
FirmSize	The logarithm of total assets.
CashFlow	Operating income before depreciation minus interest expenses minus income taxes minus capital expenditures, scaled by total assets.
Leverage	Total liabilities scaled by total assets.
Q	The market value of assets over the book value of assets. The market value of assets is calculated as the book value of assets minus the book value of equity plus the market value of equity.
Segmented	It equals 1 if there is more than one stock exchange in a certain country and 0 otherwise.
Macroeconomic development variables	
GDPPerCapita	The logarithm of GDP per capita.
GDPGrowth	The logarithm of GDP growth.
Difference in language and legal environment	
SameLanguage,	It equals 1 when the two partnering stock exchanges' countries share the same language and 0 otherwise.
SameLegalSystem,	It equals 1 when the two partnering stock exchanges' countries share the same legal origin and 0 otherwise.
Difference in capital market development	
DifMarketToGDP	The difference in the market capitalization of listed stock scaled by GDP between the country in which the sample stock exchange is located and the country in which the partnering stock exchange is located.
DifTurnover	The difference in the stock traded turnover ratio between the country in which the sample stock exchange is located and the country in which the partnering stock exchange is located.
DifStockTradeToGDP	The difference in the total value of stock traded scaled by GDP between the country in which the sample stock exchange is located and the country in which the partnering stock exchange is located.
Difference in governance	
DifShareHolderProtection	The difference in the shareholder protection index (the product of the shareholder rights index and the efficiency of the legal system) between the country in which the sample stock exchange is located and the country in which the partnering stock exchange is located.
DifAccountingStandard	The difference in accounting standard index between the country in which the sample stock exchange is located and the country in which the partnering stock exchange is located.