Stock Exchange Mergers and Market

Amélie Charles, Olivier Darné, Jae H. Kim, Etienne Redor

Stock Exchange Mergers and Market Efficiency[*]

Amélie CHARLES[†]

Audencia Nantes, School of Management

Olivier DARNÉ[‡]

LEMNA, University of Nantes

Jae H. KIM[§]

Department of Finance, La Trobe Business School, La Trobe University

Etienne REDOR[¶]

Audencia Nantes, School of Management

[†]Audencia Nantes, School of Management, 8 route de la Jonelire, 44312 Nantes Cedex 3. Email: acharles@audencia.com.

[‡]LEMNA, University of Nantes, IEMN–IAE, Chemin de la Censive du Tertre, BP 52231, 44322 Nantes, France. Email: olivier.darne@univ-nantes.fr.

[§]Department of Finance, La Trobe Business School, La Trobe University, VIC 3086, Australia. Email: J.Kim@latrobe.edu.au.

[¶]Audencia Nantes, School of Management, 8 route de la Jonelire, 44312 Nantes Cedex 3. Email: eredor@audencia.com.

0

Abstract

The aim of this paper is to examine the impact of stock exchange mergers on the degree of informational efficiency. For this purpose, we apply the generalized spectral shape test for the martingale difference hypothesis to the stock returns before and after the 31 domestic and cross-border mergers completed from 1997 to 2011. The test is conducted with moving sub-sample windows, allowing us to detect the periods of (in)efficiency, and thus to conduct a comparative analysis for pre-merger and post-merger periods. We find that higher levels of efficiency are less frequent than lower levels of efficiency after a stock exchange merger. We also find that the impact on the level of efficiency depends on a range of merger characteristics such as the level of development, size, geographical diversification and industrial diversification of stock exchange.

Keywords: Stock exchange mergers; Market efficiency; Martingale difference sequence.

JEL Classification: C12; C14; G14; G15.

1 Introduction

On February 2011, the NYSE Euronext Inc. and Deutsche Brse AG announced their intentions to merge. This deal would have created the world's largest stock exchange operator. Despite a competing hostile bid made by the NASDAQ and InterContinental Exchange in April 2011, the offer was approved by the shareholders of both firms in July 2011. In December 2011, the U.S. Justice Department blessed the tie-up of the NYSE Euronext and Deutsche Brse on the condition that the German exchange operators agreed to sell its 31.5% stake in Direct Edge Holdings LLC. However, in early February 2012, the European Commission decided to block the deal, with a concern that this merger would have led to create a near monopoly on the international market of European derivatives. As expected, NYSE Euronext Chairman, Jan-Michiel Hessels regretted that decision: "*Our merger would have created a high standard for transparency, stability and efficiency in the global capital markets, and we proposed significant and tangible remedies designed to address the European Commission's concerns with the transaction*" (Business Wire, 2012).

Since the end of the 1990s, a number of stock exchanges have merged following the trend towards demutualization – the process of converting exchanges from nonprofit, member-owned organizations to for-profit, investor-owned corporations (Aggarwal, 2002). Aggarwal and Dahiya (2006) give four factors driving the demutualization of stock exchanges: (i) deregulation of trading exchanges, (ii) growing conflicts of interest between existing owners, (iii) new developments in information technology and the rise of electronic communication networks (ECNs) or alternative trading system (ATSs), and (iv) shifting regulatory landscape. This process of demutualization has made securities trading more competitive[1], improved governance mechanisms, enhanced the effectiveness of cross-border capital flows, and lowered the cost of equity financing for listed firms (Hasan et al., 2012b). These mergers and acquisitions (M&As) can be viewed as the manifestation of consolidation of exchanges both geographically and across products. The existing literature on M&As has investigated the effects of stock exchange mergers from several perspectives such as liquidity (Lipson and Mortal, 2007; Nelsson, 2009) and exchange shareholders' value creation (Hasan et al., 2012a, 2012b). Some

---

[1]See Santos and Scheinkman (2001) and Amira and Muzere (2011) for discussion on competition among exchanges.

studies show that stock exchange M&As have increased the liquidity of the firms listed on them, attracted market share, and reduced the trading cost (Arnold et al., 1999; Nielsson, 2009). Further, M&As 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). Moreover, the M&As can have different effects according to some characteristics of the stock exchanges, such as stock exchange's level of development (Rossi and Volpin, 2004; Bris and Cabolis, 2008; Chari et al., 2010), size (Ben Slimane, 2012), geographical diversification (Kokkoris and Olivares-Caminal, 2008; Nielsson, 2009), and industrial diversification (Dessein, 2005; Gomes-Casseres et al., 2006). For these reasons, M&As among stock exchanges can have an impact on informational (weak-form) efficiency.

The objective of this paper is to examine whether the M&As between stock exchanges lead to a higher degree of informational efficiency. Departing from the dichotomous view of absolute market efficiency, we resort to the notion of relative efficiency (see Campbell et al., 1997), where a stock market shows a level of market efficiency higher or lower than the other. In addition, we assume that the level of efficiency changes over time, depending on the prevailing market conditions and the psychology of market participants, which is the main point of Lo's (2004) adaptive markets hypothesis. The evidence of time-changing relative level of market efficiency has been well-documented in the recent literature: see, for example, Lim and Brooks (2010) and Kim et al. (2011). To the best of our knowledge, Khan and Vieito (2012) is the only study that examines the impact of stock exchange merger between the Portuguese Stock exchange and Euronext in 2002 on informational market efficiency.[2] However, they employ the statistical tests that capture only linear dependence of stock returns and do not use time-varying measures to evaluate the level of market efficiency over time.

Given the importance of the stock exchange industry as a key component of the financial market, this paper is a step forward in understanding the stock exchange industry in relation to M&As. From a study of 31 domestic and cross-border mergers completed between 1997 and 2011, it makes an incremental contribution to the extant

---

[2]Pagano and Padilla (2005) examine Euronext, created in 2000, from the merger between the French, Dutch, Portuguese and Belgian stock exchanges, and find that integration of stock exchanges produces a number of significant direct and indirect efficiency gains (trading fees, bid-ask spreads, trading volume, and volatility), but they do not test the efficiency hypothesis directly.

literature by examining the positive and negative impacts of stock exchange mergers on the degree of informational efficiency. We also consider a range of factors in relation to the stock exchange merger, that can potentially affect market efficiency after a merger. These factors include the maturity of the markets being merged, the size of the markets, and different types of mergers (developed markets versus mergers under-developed markets; large stock exchange mergers versus small stock exchange mergers; and domestic stock exchange mergers versus cross-border stock exchange mergers). For this purpose, we evaluate time-varying return predictability using the generalized spectral shape test of Escansiano and Velasco (2006) for the martingale difference hypothesis (MDH), which can capture both linear and non-linear dependence of stock returns. We use moving sub-sample window of 3 months, which allows us to detect periods of (in)efficiency, and thus to conduct a comparative analysis for pre-merger and post-merger periods. Furthermore, to analyze the evolution of the merger effect across the time, we take different lengths of subperiods, i.e. one month, three months, six months, nine months, and twelve months.

We find that stock exchange mergers do have an impact on the degree of informational efficiency. Firstly, our results indicate a significant change in the level of efficiency after a stock exchange merger in most cases. Secondly, and more importantly, we find that there may be a ground for the concerns raised by the critics of stock exchange mergers. Indeed, in our full sample and in most of our sub-samples (domestic pure stock exchange mergers, cross border stock exchange mergers, domestic diversifying stock exchange mergers), higher levels of efficiency are less frequent than lower levels of efficiency after a stock exchange merger. Thirdly, we find that the positive impact of stock exchange mergers on the level of efficiency (gain of efficiency) tends to decline over time. That is, the positive impact of a stock exchange merger is more frequent in the short term than in the long term. Finally, we find that the impact on the level of efficiency depends on range of the characteristics of the merger: stock exchange's level of development, size, geographical diversification and industrial diversification.

The remainder of this paper is organized as follows: Section 2 outlines several hypotheses to be tested, followed by Section 3 which presents a brief discussion on testing return predictability. Section 4 reports the empirical results, and Section 5 concludes.

2   Hypotheses development

We focus on the mergers by stock exchanges where the bidders acquire 100% of the target's shares. This allows us to examine the effects of an unexpected merger on the efficiency of the stocks traded on this market. It is well-known that a prior ownership (a toehold) increases the bidder's probability of a successful full acquisition (see, for example, Goldman and Qian, 2005). Therefore, if a stock exchange already owns a stake in another stock exchange, the likelihood of a successful acquisition will be higher. Thus, the stock market response to the announcement of an acquisition might be different depending on whether the stock exchange has established a prior ownership or not and on the size of this toehold. Indeed, it is possible that the pre-merger efficiency of a stock exchange is impacted by this ownership if stock exchange mergers have an impact on efficiency. To avoid this bias in the evaluation of the pre-merger efficiency, it might be better to focus on unexpected mergers, that is mergers without prior ownership by the bidder. Our final sample is made of 31 mergers where the bidder or the target is a stock exchange which merged either with another stock exchange, a commodity exchange or a services provider. In a domestic merger, the bidder and the target come from the same country. Therefore, in a domestic merger, only the stocks listed in this country may be impacted by the merger. In a cross-border merger, the bidder and the target come from different countries. In that case, the merger could impact the efficiency of the stocks listed in the target's and in the bidder's home countries. Thus, we study the impact of our 31 mergers on the efficiency of 37 stock exchanges. Further details of theses mergers are listed in Tables 1 and 2 of the paper.

In this section, we formulate a number of hypotheses to be empirically tested in this paper. We consider a range of factors in relation to the stock exchange merger, that can potentially affect the level of market efficiency, after a merger. These factors include the maturity of the markets being merged, the size of the markets, and different types of mergers.

2.1   Mergers in developed vs. developing countries

The M&As can have some effects in the legal environment. When the stock exchange's partner is located in a country with a higher investor protection, its synergy gain from

the governance transfer will be greater (Rossi and Volpin, 2004; Bris and Cabolis, 2008; Chari et al., 2010). Further, the conventional wisdom is that emerging markets have a lower level of efficiency than developed markets (Griffin et al. 2010). If so, one might assume that the potential for improving the level of efficiency is greater for stock exchange mergers in developing than in developed ones. Shamsuddin and Kim (2010) find that the degree of efficiency of stock markets is negatively correlated with equity market development. Based on this, the first hypothesis of interest is:

> *Hypothesis 1: stock exchange mergers have the same impact on the level of efficiency in developing and developed countries.*

Under Hypothesis 1, the frequencies of higher level of efficiency in developing and developed countries should be statistically no different.

2.2 Stock exchange size

Ben Slimane (2012) studied the creation of Euronext and observed a beneficial impact of the merger on stock volatility only for the Portuguese market. She explains that this may be due to its lower size and level of development. This may suggest that the size of stock exchange impact stock exchange merger outcomes. Therefore, it is possible that the level of efficiency improves when the merger between small stock exchanges occurs, since the potential for improvement is greater in this case. On the other hand, the impact of a merger by small stock exchanges may not be substantial and may have little effect on the level of efficiency.

> *Hypothesis 2: The size of stock exchanges plays no role in the improvement of the degree of efficiency, after the merger.*

Under Hypothesis 2, the frequencies of higher level of efficiency should be statistically no different between the mergers of the small exchanges and large ones.

2.3 Domestic pure mergers

We define a pure stock exchange merger as a merger between two stock exchanges (in contrast to a merger between a stock exchange and a commodity exchange or

a services provider). Domestic pure stock exchanges mergers should (1) simplify trading, (2) increase liquidity and (3) consolidate the offer of domestic securities. The improved international reputation and the easier access to information may attract some institutional and foreign investors, with a potential to lure more companies into going public. In that case, a higher trading volume will drive down the trading fees and thus, may display a higher level of efficiency of the stocks traded on this exchange. By contrast, it is also possible that the stock exchange companies use their increased market power after a merger to raise trading fees which may lead to a lower level of efficiency of the stocks traded on this exchange.

> *Hypothesis 3: A domestic pure stock exchange merger brings no gain in the level of efficiency*

2.4   Domestic pure mergers vs. cross-border pure mergers

Cross-border business opportunities are an important driver of stock exchange consolidation activities (Nielsson, 2009). Technological breakthroughs, such as computerized trading, which has lowered fees per trade, have made cross-border trading easier and thus have created an international competition between stock exchanges to dominate trading globally. Consistent with this view, Kokkoris and Olivares-Caminal (2008) argue that cross-border pure stock exchange mergers aim at exploiting economies of scale in trading. Moreover, cross-border pure stock exchanges mergers may be a way for the stock market to improve its standing as a regional financial center. On the other hand, a higher level of efficiency may be harder or longer to achieve in cross-border pure stock exchange mergers than in domestic pure stock exchange mergers, because of differences in taxation treatments and in regulations in each country. For example, the three-way merger between the Peruvian, Colombian and Chilean stock exchanges has been disrupted by the existence of different tax rates on their profits in each country, which has slowed down the integration process.

> *Hypothesis 4a: A cross-border stock exchange merger has no impact on the level of efficiency.*

As an alternative to Hypothesis 4a, a higher level of efficiency may be displayed after a cross-border stock exchange merger due to economies of scale in trading.

Hypothesis 4b: A cross-border stock exchange merger and a domestic stock exchange merger have the same impact on the level of efficiency.

As an the alternative to Hypothesis 4b, a higher levels of efficiency may be achieved after a domestic stock exchange merger than after a cross-border stock exchange merger, due to difficulties in the integration process (for example, in the standardization of the exchange rules).

By nature, in a cross-border merger, the target firm and the bidding firm come from different countries. However, differences in stock market development, such as market integration (Hooy and Lim, 2013) or financial liberalization (Bae et al., 2012), as well as in corporate governance (Jin and Myers, 2006) may have an impact on stock market efficiency. If the bidder is characterized by a better market development and/or a better corporate governance, the potential for improvement of the level of efficiency may be larger for the target than for the bidder. Conversely, the target stock exchange may be acquired by the bidder stock exchange precisely because this acquisition will display a higher level of efficiency of the stocks listed on the bidder stock exchange. Therefore, the merger may have a different impact on the efficiency of the stocks listed on the target's stock exchange and on the bidder's stock exchange.

Hypothesis 5: Neither targets nor bidders will experience a significantly higher level of efficiency after a cross-border stock exchange merger.

When the Hypothesis 5 is rejected, there are three possible outcomes: (i) Both targets and bidders will experience a higher level of efficiency, after a cross-border stock exchange merger; (ii) only targets will experience a higher level of efficiency, after a cross-border stock exchange merger; and (iii) only bidders will experience a higher level of efficiency, after a cross-border stock exchange merger.

2.5   Domestic pure mergers vs. domestic diversifying mergers

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 (Hasan et al., 2012b). A large number of theoretical works has been

undertaken concerning whether or not diversifying mergers are in the best interests of the shareholders. The M&As between the same industry benefit stock exchanges more than those between different industry, because more knowledge and governance transfers will happen between two stock exchanges with the same business model (Dessein, 2005; Gomes-Casseres et al., 2006). According to Denis et al. (1997) and Serifsoy (2007) diversification costs outweigh the benefits. Indeed, it is often difficult to produce efficiency gains when the target and the bidder do not belong to the same industry. On the contrary, Kokkoris and Olivares-Caminal (2008) argue that the mergers combining different activities (for example, a merger between a broker or a services provider and a stock exchange) seek to provide a more comprehensive financial service to customers which could improve efficiency.

> *Hypothesis 6a: The level of efficiency becomes higher after a diversifying stock exchange merger.*

> *Hypothesis 6b: The level of efficiency becomes higher after a domestic stock exchange merger than after a diversifying stock exchange merger.*

3   Testing Return Predictability

The efficient market hypothesis (EMH) of Fama (1965) states that asset prices fully and instantaneously reflect all available and relevant information. Since price adjustment to a new piece of information is instantaneous and accurate, prices in an efficient market follow a random walk or a martingale process. Under the weak-form efficiency where the information set consists of past prices and returns, future prices and their returns are purely unpredictable based on past price information. Most of the studies for the EMH on financial markets have tested whether the returns follow a martingale difference sequence (MDS), where the returns are uncorrelated with the past values. For these reasons, the return predictability has been an important issue related to the market efficiency in the weak form.

In the literature of testing for market efficiency in the weak form, several alternative tests have been used to test for martingale-difference behavior of returns. They include autocorrelation-based tests (Ljung and Box, 1978) and variance ratio tests (Lo and

MacKinlay, 1988). However, these tests are are designed to capture the linear dependence of return on its own past. Given the evidence of non-linear dependence in asset returns, evaluation of linear dependence only may be restrictive. In this paper, we employ the generalized spectral shape (GSS) test of Escanciano and Velasco (2006), which is capable of detecting both linear and nonlinear dependence present in financial time series (Lim, 2007; Lim et al., 2008; Lim and Brooks, 2010). The GSS test is constructed based on the property that the spectral density of a MDS is flat. This test can capture a wide range of linear and non-linear dependence in mean, allowing for a general form of unknown conditional heteroscedasticity. In a recent Monte Carlo study, Charles et al. (2011) found that this test shows desirable size and power properties in small samples, under a wide range of martingale processes and non-martingale alternatives. To conserve the space, the details of the GSS test are are not given here: interested readers are pointed to Escanciano and Lobato (2006) and Charles et al. (2011) for detailed descriptions.

4   Empirical results

4.1   Data

We use daily closing spot prices from the following stock exchange markets: Amsterdam Stock Exchange (AEX), Australian Stock Exchange (ASX200), Bolsa de Valores de Colombia (COLCAP), Bolsa de Valores de Lima (IGBVL), Bolsa de Santiago de Chile (IPSA), Borsa Italiana (MIB20), Dubai Financial Market (DFM), Euronext (Euronext100), Johannesburg Stock Exchange (JSE), Kuala Lumpur Stock Exchange (KLCI), Lisbon Stock Exchange (PSI20), London Stock Exchange (FTSE100), Moscow Interbank Currency Exchange (MICEX), New York Stock Exchange (S&P500), Paris Stock Exchange (CAC40), Sao Paulo Stock Exchange (BOVESPA), Stock Exchange of Hong Kong (SEHK), Stock Exchange of Singapore (STI), Tokyo Stock Exchange (NIKKEI225), Toronto Stock Exchange (TSX), and Zagreb Stock Exchange (CROBEX).

We study the impact of 31 mergers on the efficiency of 37 stock exchanges. Tables 1 and 2 display the mergers between stock exchanges, between a stock exchange and a provider of services, and between a stock exchange and a commodity exchange, respectively. We give both the announced and effective dates of each merger, and the name, the country and the industry of the target and the acquirer.

We first present descriptive statistics (mean and standard deviation) for the return series calculated as the first logarithmic difference of the daily closing prices, which are obtained from Thomson Financial Datastream, before and after the date of merger ("Date effective") in Table 3. For the domestic M&As between stock exchanges or between stock exchange and commodity exchange the mean returns are higher before than after the merger in more than 50% of the mergers. For the cross-border M&As between stock exchanges the results are mixed. Note that when the merger implies a decrease of mean returns, there are some cases of higher volatility, in terms of standard deviation.

4.2   Details of testing procedure

The empirical analysis in this paper computes the GSS test statistic in a rolling window framework to detect the evolving nature of linear and nonlinear predictability, and hence changing degree of market efficiency over time. We evaluate time-varying return predictability by applying the GSS test with 3-months fixed-length moving sub-sample windows, which consists of around 66 daily observations. This length of the time window allows us to have a reasonable balance between analyzing the effect of the merger on the short term and desirable small-sample proprieties of the GSS test (Charles et al., 2011). For the post-merger (pre-merger) period, the first sub-sample window covers the period from the date of merger to three months after (before). After the GSS test is conducted for the first sub-sample, the window is moved one daily observations forward (backward), and the test statistic is recalculated. This process continues to the end of the data points. Given that the rolling window approach is able to detect periods of (in)efficiency, the relative efficiency of stock markets can be assessed by comparing the total time periods these markets exhibit significant linear or nonlinear serial dependence over time (see Lim, 2007; Lim et al., 2008; Lim and Brooks, 2010).

We also conduct a comparative analysis for pre-merger and post-merger sub-periods with an equal number of observations. To analyze the evolution of the merger effect across the time, we take different lengths of subperiods, i.e. one month, three months, six months, nine months, and twelve months. For each sub-period, we compute the proportions of the p-values less than 0.05 (p) and the mean of the p-values (m). Let p_1 and p_2 represent the sample proportions of the p-values less than 0.05 for pre- and post-merger sub-periods, respectively; and m_1 and m_2 represent the sample means of

the p-values for pre- and post-merger sub-periods, respectively. We can test individually $H_{0p1} : p_1 = 0.05$ against $H_{1p1} : p_1 > 0.05$ and $H_{0p2} : p_2 = 0.05$ against $H_{1p2} : p_2 > 0.05$. Rejection of H_{0p1} in favor of H_{1p1} is evidence against the MDH for the pre-merger period, and rejection of H_{0p2} in favor of H_{1p2} is evidence against the MDH for the post-merger period. We can also test the null hypothesis that the two population proportions and means are equal, i.e $H_{0p} : p_1 - p_2 = 0$ and $H_{0m} : m_1 - m_2 = 0$, respectively. The alternative hypothesis is $H_{1p} : p_1 - p_2 < 0$ (or $H_{1p}^* : p_1 - p_2 > 0$) for the proportions and $H_{1m} : m_1 - m_2 < 0$ or $H_{1m}^* : m_1 - m_2 > 0$). To test for these hypotheses, we use the nonparametric McNemar (1947) test for proportion comparison, and the nonparametric Wilcoxon (1945) test for mean comparison.

Given the information above, we apply the following testing strategies:

Step 1: Individual proportion tests

- If H_{0p1} and H_{0p2} are not rejected, then the MDH is accepted for the pre- and post-merger periods;

- If H_{0p1} is not rejected and H_{0p2} is rejected, then the MDH is accepted for the pre-merger period but rejected for the post-merger period;

- If H_{0p1} is rejected and H_{0p2} is not rejected, then the MDH is accepted for the post-merger period but rejected for the pre-merger period;

- If H_{0p1} and H_{0p2} are rejected, the MDH is rejected for the pre- and post-merger periods, and we go to step 2.

Step 2: Proportion comparison test

- If H_{0p} is rejected against H_{1p} ($p_1 - p_2 < 0$), then both sub-periods are inefficient and the pre-merger period has a lower level of inefficiency than the post-merger period. Therefore, the merger can imply a loss of efficiency;

- If H_{0p} is rejected against H_{1p}^* ($p_1 - p_2 > 0$), then both sub-periods are inefficient and the pre-merger period has a higher level of inefficiency than the post-merger period. Therefore, the merger can imply a gain of efficiency;

- If H_{0p} is not rejected ($p_1 - p_2 = 0$), then both sub-periods are efficient, and we go to step 3.

Step 3: Mean comparison test

- If H_{0m} is rejected against H_{1m} ($m_1 - m_2 < 0$), then the pre-merger period has a lower level of efficiency than the post-merger period. Therefore, the merger can imply a gain of efficiency;

- If H_{0m} is rejected against H_{1m}^* ($m_1 - m_2 > 0$), then the pre-merger period has a higher level of efficiency than the post-merger period. Therefore, the merger can imply a loss of efficiency.

4.3   Discussion of results

Table 4-5 summarize the results of the GSS test by displaying the proportion of the periods of efficiency according to the sub-periods (one month, three months, six months, nine months, and twelve months), and the characteristics of mergers (developed markets versus mergers under-developed markets; large stock exchange mergers versus small stock exchange mergers; and domestic stock exchange mergers versus cross-border stock exchange mergers), for all stock exchange mergers combined.[3]

4.3.1   General analysis

The overall analysis of the results reveals some interesting findings. Firstly, the GSS test shows, in most cases, a significant evolution of the efficiency of the stock prices (Panel A Table 4). According to the GSS test, in only 29.07% of cases, the stock market has experienced no significant changes in efficiency after a stock exchange merger. This means that, overall, a stock exchange merger has a significant impact on the level of efficiency. Secondly, taken globally, the result indicates that, following a stock exchange mergers, lower levels of efficiency (41.28% of the cases) are more common than higher levels (29.65% of the cases). This result is in contrast with that of Khan and Vieto (2012). Therefore these results cast doubt on the supposed benefits of stock exchange mergers on the efficiency, and tend to be fairly consistent with the market power theory. Thirdly, the results are conditional on the length of the subperiods since we observe a decrease in the frequency of efficiency improvements after a stock exchange merger in the

---

[3]The results for individual stock exchange mergers are available upon request.

long term.[4]

4.3.2   Mergers in developed vs. developing countries

We first test for the hypothesis that stock exchange mergers have the same impact on
the level of efficiency in developing and developed countries (Hypothesis 1). We follow
the definitions of the World Economic Forum to classify the countries into developed
and developing ones (see WEF, 2012). This allows us to construct a subsample of 10
deals where a developing country's stock exchange merges with another firm (another
stock/commodity exchange or a provider of services) and a subsample of 27 deals where a
developed country's stock exchange merges with another firm. Panel B1 in Table 4 shows
that in developing countries, even if the stock market may have a higher level of efficiency
in the short term after a stock exchange merger with another firm, it undoubtedly displays
a significantly lower level of efficiency in the long term.

A higher level of efficiency in stock markets are more frequently observed after a stock
exchange merger in a developing country than in developed countries only in the very
short term, namely less than 1 month (Panel B2, Table 4). In all the other cases, a
higher level of efficiency in stock markets are more prevalent in developed countries than
in developing countries.

To sum up, our results indicate the overall rejection of Hypothesis 1 that stock
exchange mergers have the same impact on the level of efficiency in the markets of
developing and developed countries. The evidence show that, in the medium and long
terms, the impact of stock exchange mergers results more frequently in improvements
of the level of efficiency in developed countries than in developing countries; while the
reverse is the case in the very short term.

4.3.3   Stock exchange size

To test for Hypothesis 2, we collect the information concerning the size of the merger
on Thompson One Banker Database. We focus only on domestic mergers and obtain

---

[4]We have tested the persistence of market reaction to analyze the potential effect that the length of
the subperiods could have on the frequency of events of varying levels of efficiency in the pre and post-
merger periods. We employ the Geweke and Porter-Hudak (1983) test, but we are unable do identify
any noticeable pattern from fractional parameter estimates. The results are available upon request.

information concerning 16 deals. We split our sample in two so that we had 8 small mergers (average size of $26.57 million with a minimum size of $5.37 million and a maximum size of $121 million) and 8 large mergers (average size of $934.88 with a minimum size of $140 million and a maximum size of $2,259.09 million). The results of Panel C1 in Table 4 display that small deals resulting in a significantly lower level of efficiency in stock market after the merger. This is particularly so in the long term since no small merger improves the level of efficiency for a subperiod of more than 9 months.

The comparison of the results associated with small mergers with those with large mergers offers some interesting insights (Panel C2, Table 4). Namely, large mergers tend to result in a higher level of efficiency in long term with high frequency. Our result shows strong evidence against Hypothesis 2 that the size of stock exchanges play no role in the improvement of the level of efficiency after the merger. We find that small stock exchange mergers may be too small to have a higher level of efficiency; while large stock exchange mergers show a strong tendency to display a higher level of efficiency.

4.3.4   Domestic pure mergers

In order to test for Hypotheses 3, we focus on the 11 domestic pure stock exchange mergers of our sample (Panel A1, Table 5). The results show that the stock market has a significantly lower level of efficiency after the merger than before. These results are particularly meaningful in the debate over the impact of stock exchange mergers. Although the results are mixed in the very short term (as many deals result in a higher level of efficiency than in a lower level of efficiency one month after the merger), a lower level of efficiency is evident after the merger in the medium to long term. Therefore, domestic mergers between two stock exchanges tend to have a negative impact on efficiency (loss of efficiency), which is an evidence against Hypothesis 3.

4.3.5   Domestic pure mergers vs. cross-border pure mergers

To test for Hypotheses 4a and 4b, we focus on the six cross-border stock exchange mergers of our sample. The results of Panel A2 in Table 5 indicate that the stocks listed on a stock exchange display a lower level of efficiency after a cross-border stock exchange merger which invalidates Hypothesis 4a. The comparison with the results given in Panel A1 indicates that for most length of subperiods, cross-border pure stock exchange mergers

result more frequently in a lower level of efficiency than domestic pure stock exchange mergers which contradicts Hypothesis 4b.

We have then split our sample between targets and bidders of a cross-border stock exchange merger in order to study whether there are differences in the changes of the level of efficiency of their stocks (Hypothesis 5). The results of Panel B in Table 5 tend to invalidate this hypothesis. Even if the number of observations is quite low, our evidence tends to indicate that, on the long term, both target's and bidder's stocks tend to have a lower level of efficiency after than before a cross border stock exchange.

This result is very interesting from a theoretical and policy point of view, because it calls into question the interest of cross-border stock exchange mergers since neither the acquirer nor the target seem to benefit from this kind of mergers in term of level of efficiency. Conversely, both stock exchanges exhibit a lower level of efficiency.

4.3.6 Domestic pure mergers vs. domestic diversifying mergers

Finally, we study the impact of diversifying stock exchange mergers on the level of efficiency (Panel C, Table 5). This is a test for the hypothesis that the level of efficiency will be higher after a diversifying stock exchange merger due to the creation of a more comprehensive financial service to customers (Hypothesis 6a). The results are somewhat mixed. In the short to medium term, they tend to indicate a higher level of efficiency; whereas, in the long term, the results tend to indicate a lower level of efficiency after a diversifying stock exchange merger. This means that Hypothesis 6a is validated in the short term but not in the long term.

Hypothesis 6b states that a higher level of efficiency is displayed after a domestic stock exchange merger than after a diversifying stock exchange merger due to diversification costs. The comparison between domestic focusing and domestic diversifying stock exchange mergers (Panel A1 and C Tables 5) seems to indicate that stock exchange's diversification might be a factor to in attaining a higher level of efficiency since improvements in the level of efficiency are more frequent after a diversifying merger than after a focusing merger - namely, when the target and the bidder belong to the same industry. This invalidates Hypothesis 6b.

5 Conclusion

Given the importance of the stock exchange industry as a key component of the financial market, this paper is a step forward in the understanding of stock exchange industry in the framework of M&As. This paper makes an incremental contribution to the existing literature by examining the positive and negative impacts of stock exchange mergers on the degree of informational efficiency for these markets, an issue that is still largely unexplored in previous academic studies. Indeed, there is currently an important debate among practitioners; among scholars; and between advocates and opponents of stock exchange mergers. The proponents of stock exchange mergers argue that integration of stock exchanges produces a number of significant direct and indirect efficiency gains such as decreases in the trading fees, in the bid-ask and the volatility of the securities as well as increases in the trading volumes. By contrast, the critics of stock exchange mergers generally refer to the market power theory to emphasize that the merged stock exchanges may try to exploit monopolistic rents by increasing the trading fees which would increase the transaction costs and thus stocks' illiquidity. Therefore, whether stock exchange mergers have a positive or a negative impact on the level of market efficiency is a controversial issue, which should be empirically examined.

In this paper, we have studied the impact of 31 mergers on the level of efficiency of 37 stock exchanges in order to fill this gap in the literature. Our results should be of interest not only to practitioners and scholars; but also to policymakers, because our approach allows us to compare different types of mergers and to study the circumstances under which a stock exchange merger improves or deteriorates the level of efficiency. Using the generalized spectral shape test for the martingale difference hypothesis, we find that stock exchange mergers do have an impact on the level of market efficiency. Firstly, our results indicate a significant change in the level of efficiency after a stock exchange merger in most cases. Secondly, and more importantly, we find that there may be a ground for the concerns raised by the critics of stock exchange mergers. Indeed, in our full sample and in most of our sub-samples (domestic pure stock exchange mergers, cross border stock exchange mergers, domestic diversifying stock exchange mergers), higher levels of efficiency are less frequent than lower levels of efficiency after a stock exchange merger. This suggests that supervisory authorities should carefully evaluate the impact of these mergers. Thirdly, we find that the positive impact of stock exchange mergers on

the level of efficiency tends to decline over time. That is, the positive impact of a stock exchange merger (gain of efficiency) is more frequent in the short term than in the long term. This effect has to be considered by those who would measure the impact of a stock exchange merger. Finally, we find that the impact of the merger on the level of efficiency depends on range of the characteristics of the merger, stock exchange's country's level of development, size, geographical diversification and industrial diversification.

References

[1] Aggarwal, R. (2002). Demutualization and corporate governance of stock Exchanges. Journal of Applied Corporate Finance, 18, 106-113.

[2] Aggarwal, R., Dahiya, S. (2006). Demutualization and public offering of financial exchange. Journal of Applied Corporate Finance, 18, 96-106.

[3] Amira, K., Muzere, M.L. (2011). Competition among stock exchanges for equity. Journal of Banking and Finance, 35, 2355-2373.

[4] Arnold, T., Hersch, P., Mulherin, H., Netter, J. (1999). Merging markets. Journal of Finance, 54, 1083-1107.

[5] Bae, K.H., Ozoguz, A., Tan, H., Wirjanto, T.S. (2012). Do foreigners facilitate information transmission in emerging markets? Journal of Financial Economics, 105, 209-227.

[6] Ben Slimane, F. (2012). Stock exchange consolidation and return volatility. Managerial Finance, 38, 606-627.

[7] Bris, A., Cabolis, C. (2008). The value of investor protection: Firm evidence from cross-border mergers. Review of Financial Studies, 21, 605-648.

[8] Business Wire (2012). NYSE Euronext Statement on EU Decision to Prohibit Merger.

[9] Campbell, J.Y., Lo, A.W., MacKinlay, A.C., 1997. The Econometrics of Financial Markets. Princeton University Press, Princeton.

[10] Chari, A., Ouimet, P.P., Tesar, L.L. (2010). The returns to developed-market acquirers in emerging market. Review of Financial Studies, 23, 1741-1770.

[11] Charles, A., Darné, O., Kim, J.H. (2011). Small sample properties of alternative tests for martingale difference hypothesis. Economics Letters, 110, 151-154.

[12] Denis, D., Denis, D., Sarin, A. (1997). Agency problems, equity ownership, and corporate diversification. Journal of Finance 52, 135-160.

19

[13] Dessein, W. (2005). Information and control in ventures and alliances. Journal of Finance, 65, 2513-2549.

[14] Escanciano, J.C., Velasco, C. (2006). Generalized spectral tests for the martingale difference hypothesis. Journal of Econometrics, 134, 151-185.

[15] Fama, E. (1965). The behaviour of stock market prices. Journal of Business, 38, 34-105.

[16] Geweke, J., Porter-Hudak, S. (1983). The estimation and application of long memory time series models. Journal of Time Series Analysis, 4, 221-238.

[17] Goldman, E., Qian, J. (2005). Optimal toeholds in takeover contests. Journal of Financial Economics, 77, 321-346.

[18] Gomes-Casseres, B., Hagedoorn, J., Jaffe, A.B. (2006). Do alliances promote knowledge flows? Journal of Financial Economics, 80, 5-33.

[19] Griffin, J.M., Kelly, P.J., Nardari, F. (2010). Do market efficiency measures yield correct inferences? A comparison of developed and emerging markets. Review of Financial Studies, 23, 3225-3277.

[20] Hasan, I., Schmiedel, H., Song, L. (2012a). How stock exchange mergers & acquisitions affect their competitors' shareholder value? Global evidence. In Poitras G. (eds) Handbook of Research on Stock Market Globalization, Edward Elgar Publishing.

[21] Hasan, I., Schmiedel, H., Song, L. (2012b). Growth strategies and value creation: What works best for stock exchanges? Financial Review, 47, 466-499.

[22] Hooy, C-W., Lim, K-P. (2013). Is market integration associated with informational efficiency of stock markets? Journal of Policy Modeling, 35, 29-44.

[23] Jin, L., Myers, S.C. (2006). R^2 around the world: New theory and new tests. Journal of Financial Economics, 79, 257-292.

[24] Khan W. and Vieito J.P. (2012). Stock exchange mergers and weak form of market efficiency: The case of Euronext Lisbon. International Review of Economics and Finance, 22, 173-189.

[25] Kim, J.H. (2009). Automatic variance ratio test under conditional heteroskedasticty. Fina

[26] Kokkoris, I., Olivares-Caminal, R. (2008). Lessons from the recent stock exchange merger activity. Journal of Competition Law and Economics, 4, 837-869.

[27] Lim, K-P. (2007). Ranking market efficiency for stock markets: A nonlinear perspective. Physica A, 376, 445-454.

[28] Lim, K-P., Brooks, R.D. (2010). The evolution of stock market efficiency over time: A survey of the empirical literature. Journal of Economic Surveys, 24, 1-40.

[29] Lim, K-P., Brooks, R.D., Kim, J.H. (2008). Financial crisis and stock market efficiency: Empirical evidence from Asian countries. International Review of Financial Analysis, 17, 571-591.

[30] Lipson, M.L., Mortal, S. (2007). Liquidity and firm characteristics: Evidence from mergers and acquisitions. Journal of Financial Markets, 10, 342-361.

[31] Ljung, G.M., Box, G.E.P. (1978). On a measure of lack of fit in time series models. Biometrika, 65, 297-303.

[32] Lo, A.W. (2004). The adaptive markets hypothesis: Market efficiency from an evolutionary perspective. Journal of Portfolio Management, 30, 15-29.

[33] Lo, A.W., MacKinlay, A.C. (1988). Stock market prices do not follow random walk: Evidence from a simple specification test. The Review of Financial Studies, 1, 41-66.

[34] McNemar, Q. (1947). Note on the sampling error of the difference between correlated proportions or percentages. Psychometrika, 12, 153-157.

[35] Nielsson, U. (2009). Stock exchange merger and liquidity: The case of Euronext. Journal of Financial Markets, 12, 229-267.

[36] Pagano, M., Padilla, A.J. (2005). Efficiency gains from the integration of exchanges: Lessons from the Euronext "natural experiment". Working Paper.

[37] Rossi, S., Volpin, P. (2004). Cross-country determinants of mergers and acquisitions. Journal of Financial Economics, 74, 277-304.

[38] Santos, T., Scheinkman, J.A. (2001). Competition among exchanges. Quarterly Journal of Economics, 116, 1027-1061.

[39] Serifsoy, B. (2007). Stock exchange business models and their operative performance. Journal of Banking and Finance, 31, 2978-3012.

[40] Shamsuddin, A., Kim, J.H. (2010). Short-horizon return predictability in international equity markets. The Financial Review, 45, 469-484.

[41] Wilcoxon, F. (1945). Individual comparisons by ranking methods. Biometrics Bulletin, 1, 80-83.

[42] World Economic Forum (2012). The Global Competitiveness Report 2012-2013. Report.

Table 1: List of mergers and acquisitions.

Date Announced	Date Effective	Target Name	Acquiror Name	Target Nation	Acquiror Nation	Target Industry	Acquiror Industry
Between domestic stock exchanges							
04/08/2010	09/09/2011	RTS	MICEX	Russian Fed	Russian Fed	Stock exchange	Stock exchange
12/22/2009	05/25/2010	Nasdaq Dubai Ltd	Dubai Financial Market PJSC	United Arab Emirates	United Arab Emirates	Stock exchange	Stock exchange
12/21/2009	02/18/2010	Turquoise Trading Ltd	Baikal Global Ltd	United Kingdom	United Kingdom	Stock exchange	Stock exchange
01/17/2008	10/01/2008	American Stock Exchange Inc	NYSE Euronext Inc	United States	United States	Stock exchange	Stock exchange
11/07/2007	07/24/2008	Philadelphia Stock Exchange	Nasdaq Stock Market Inc	United States	United States	Stock exchange	Stock exchange
12/21/2006	01/31/2007	Varazdinska burza dd	Zagrebacka burza dd	Croatia	Croatia	Stock exchange	Stock exchange
12/09/2004	04/12/2005	Bendigo Stock Exchange	Newcastle Stock Exchange	Australia	Australia	Stock exchange	Stock exchange
03/22/2001	08/01/2001	Canadian Venture Exchange	Toronto Stock Exchange	Canada	Canada	Stock exchange	Stock exchange
06/23/2000	03/31/2001	Kyoto Stock Exchange	Osaka Securities Exchange	Japan	Japan	Stock exchange	Stock exchange
04/26/1999	11/29/1999	Vancouver Stock Exchange	Alberta Stock Exchange	Canada	Canada	Stock exchange	Stock exchange
03/13/1998	11/02/1998	American Stock Exchange	Nasdaq Stock Market	United States	United States	Stock exchange	Stock exchange
Between cross-border stock exchanges							
03/04/2010	05/30/2011	Bolsa de Valores de Colombia	Bolsa de Comercio de Santiago	Colombia	Chile	Stock exchange	Stock exchange
03/04/2010	05/30/2011	Bolsa de Valores de Lima SA	Bolsa de Comercio de Santiago	Peru	Chile	Stock exchange	Stock exchange
06/20/2007	10/01/2007	Borsa Italiana SA	London Stock Exchange PLC	Italy	United Kingdom	Stock exchange	Stock exchange
05/22/2006	04/04/2007	Euronext NV	NYSE Group Inc	Europe	United States	Stock exchange	Stock exchange
06/14/2001	02/06/2002	Bolsa de Valores de Lisboa	Euronext NV	Portugal	Europe	Stock exchange	Stock exchange
03/20/2000	09/22/2000	Amsterdam Stock Exchange	Paris Stock Exchange	Netherlands	France	Stock exchange	Stock exchange

Table 2: List of mergers and acquisitions (continue).

Date Announced	Date Effective	Target Name	Acquiror Name	Target Nation	Acquiror Nation	Target Industry	Acquiror Industry
Between a stock exchanges and a commodity exchange (domestic)							
10/27/2008	07/01/2009	BESA	JSE Ltd	South Africa	South Africa	Commodity exchange	Stock exchange
08/22/2008	12/23/2008	ISE Stock Exchange LLC	Direct Edge Holdings LLC	United States	United States	Commodity exchange	Stock exchange
02/27/2008	07/01/2008	Singapore Commodity Exchange	Singapore Exchange Ltd	Singapore	Singapore	Commodity exchange	Stock exchange
12/10/2007	05/01/2008	Bourse de Montreal Inc	TSX Group Inc	Canada	Canada	Commodity exchange	Stock exchange
07/10/2007	10/22/2007	Waterexchange Pty Ltd	NSX Ltd	Australia	Australia	Commodity exchange	Stock exchange
03/27/2006	07/07/2006	SFE Corp Ltd	Australian Stock Exchange Ltd	Australia	Australia	Commodity exchange	Stock exchange
12/20/2005	11/24/2006	Athens Derivatives Exchange SA	Greek Stock Exchange Holdings	Greece	Greece	Commodity exchange	Stock exchange
04/10/2002	05/28/2002	BVRJ	BBM	Brazil	Brazil	Stock exchange	Commodity exchange
03/04/1999	03/06/2000	Hong Kong Futures Exchange	Stock Exchange of Hongkong	Hong Kong	Hong Kong	Commodity exchange	Stock exchange
07/03/1998	01/06/1999	Kloffe Capital Sdn Bhd	Kuala Lumpur Stock Exchange	Malaysia	Malaysia	Commodity exchange	Stock exchange
10/06/1995	01/20/1997	European Options Exchange	Amsterdam Stock Exchange	Netherlands	Netherlands	Commodities exchange	Stock exchange
Between a stock exchanges and a provider of services (cross-border)							
06/01/2009	06/01/2009	BMIS Sdn Bhd	Bursa Malaysia Bhd	Malaysia	Malaysia	provider of stock exchange services	Stock exchange
04/20/2005	03/07/2006	New York Stock Exchange	Archipelago Holdings Inc	United States	United States	Stock exchange	provider of electronic communications network services
Between a stock exchanges and a commodity exchange (cross-border)							
12/07/2007	01/31/2008	Powernext SA- Powernext Carbon	NYSE Euronext Inc	France	United States	provider of risk management tools	Stock exchange

Table 3: Descriptive statistics.

Merger	before	after	before	after	before	after	before	after	before	after
					Domestic M&As between stock exchanges					
	MICEX	09/2011	DFM	10/2010	FTSE	07/2008	CROBEX	01/2007	ASX200	04/2005
Mean	0.393	-0.582	-0.325	-0.091	-0.135	0.100	0.650	0.046	0.057	-0.120
Std.	1.792	3.020	1.202	1.380	1.035	1.406	0.728	1.142	0.450	0.500
	TSX	08/2001	NIKKEI	03/2001	NIKKEI	11/1999	JSE	07/2009	SP500	12/2008
Mean	-0.008	-0.140	0.292	0.371	0.136	0.153	-0.353	0.190	-0.455	-1.109
Std.	0.950	0.881	2.846	1.894	0.888	1.069	1.382	1.271	3.563	5.328
	SP500	02/2010			SP500	07/2008	SP500	11/1998		
Mean	-0.455	0.290			-0.153	0.100	0.458	0.229		
Std.	3.563	0.722			1.343	1.406	1.354	0.945		
					Domestic M&As between stock exchange and commodity exchange					
	STI	07/2008	ASX200	10/2007	SP500	03/2006	ATHEX	11/2006	HANGSENG	03/2000
Mean	-0.392	-0.035	0.097	-0.180	0.052	0.116	0.226	-0.025	0.396	-0.250
Std.	0.946	1.393	0.863	1.257	0.584	0.479	0.659	1.013	1.970	2.108
	TSX	05/2008	KLCI	06/2009	SP500	07/2006	BOVESPA	05/2002		
Mean	0.198	0.212	??	??	0.168	-0.179	-0.152	-0.866		
Std.	1.037	1.085	??	??	1.126	1.056	1.850	2.390		
	AEX	10/1997	KLCI	01/1999						
Mean	0.063	-0.170	0.529	-0.153						
Std.	1.558	2.304	1.592	1.121						
					Cross-border M&As between stock exchanges					
	COLCAP	05/2011	IGBVL	05/2011	IPSA	05/2011	MIB	10/2007	FTSE	10/2007
Mean	-0.016	-0.090	0.653	-0.594	0.027	-0.160	-0.037	-0.031	0.128	0.151
Std.	0.838	0.631	2.298	4.260	0.401	0.755	1.179	0.715	1.307	0.917
	EURONEXT	02/2002	PSI	02/2002	AEX	09/2000	CAC40	09/2000	EURONEXT	09/2000
Mean	-0.203	0.309	-0.158	0.022	-0.297	0.024	-0.163	-0.088	-0.683	-0.964
Std.	1.204	1.094	0.953	0.952	0.667	1.088	1.387	1.420	2.992	5.255
	EURONEXT	04/2007	SP500	04/2007			SP500	01/2008		
Mean	0.308	0.159	0.150	0.193			-0.326	-0.040		
Std.	1.068	0.545	0.785	0.492			1.483	1.152		

Notes: The mean and standard deviation are computed for a sample of one month and are given in percentage.

Table 4: Impact of stock exchange merger on the level of efficiency.

Subperiods	1 month	3 months	6 months	9 months	12 months
Overall					
Significantly higher level of efficiency after than before	32.43%	38.89%	30.30%	24.24%	21.21%
Significantly lower level of efficiency after than before	43.24%	33.33%	42.42%	42.42%	45.45%
No significant changes	24.32%	27.78%	27.27%	33.33%	29.07%
Developing country					
Significantly higher level of efficiency after than before	50.00%	33.33%	–	–	–
Significantly lower level of efficiency after than before	40.00%	44.44%	33.33%	83.33%	66.66%
No significant changes	10.00%	22.22%	66.67%	16.67%	33.33%
Small merger					
Significantly higher level of efficiency after than before	25.00%	50.00%	12.50%	–	–
Significantly lower level of efficiency after than before	50.00%	50.00%	37.50%	50.00%	62.50%
No significant changes	25.00%	–	50.00%	50.00%	37.50%

	1 month	3 months	6 months	9 months	12 months
Developed country					
Significantly higher level of efficiency after than before	25.93%	40.74%	37.04%	29.63%	25.93%
Significantly lower level of efficiency after than before	44.44%	29.63%	44.44%	33.33%	40.74%
No significant changes	29.63%	29.63%	18.52%	37.04%	33.33%
Large merger					
Significantly higher level of efficiency after than before	62.50%	85.71%	71.43%	71.43%	57.14%
Significantly lower level of efficiency after than before	12.50%	–	14.29%	14.29%	28.57%
No significant changes	25.00%	14.29%	14.29%	14.29%	14.29%

Note: Table summarizes the results of GSS tests by displaying the proportion of efficiency periods according to the sub-periods (one month, three months, six months, nine months, and twelve months), whatever the stock exchange mergers. Panel B tests Hypothesis 1 that stock exchange mergers have the same impact on the level of efficiency in developing and developed countries. Panel C tests Hypothesis 2 that the size of stock exchanges plays no role in the improvement of the degree of efficiency, after the merger.

Table 5: Impact of stock exchange mergers on the level of efficiency (continue).

Subperiods	Domestic merger					Cross-border merger				
	1 month	3 months	6 months	9 months	12 months	1 month	3 months	6 months	9 months	12 months
Domestic merger										
Significantly higher level oft efficiency after than before	41.67%	27.27%	27.27%	18.18%	18.18%	18.18%	18.18%	25.00%	25.00%	25.00%
Significantly lower level of efficiency after than before	41.67%	54.55%	36.36%	36.36%	54.55%	45.45%	18.18%	62.50%	62.50%	50.00%
No significant changes	16.67%	18.18%	36.36%	54.55%	27.27%	36.36%	63.64%	12.50%	12.50%	25.00%
Acquirers						*Targets*				
Significantly higher level of efficiency after than before	20.00%	20.00%	25.00%	25.00%	25.00%	16.67%	16.67%	25.00%	25.00%	25.00%
Significantly lower level of efficiency after than before	20.00%	–	75.00%	50.00%	50.00%	66.66%	33.33%	50.00%	75.00%	50.00%
No significant changes	60.00%	80.00%	–	25.00%	25.00%	16.67%	50.00%	25.00%	–	25.00%
Domestic diversifying										
Significantly higher level of efficiency after than before	38.46%	69.23%	38.46%	30.77%	23.08%					
Significantly lower level of efficiency after than before	38.46%	23.08%	30.77%	38.46%	38.46%					
No significant changes	23.08%	7.69%	30.77%	30.77%	38.46%					

Note: Table summarizes the results of GSS tests by displaying the proportion of efficiency periods according to the sub-periods (one month, three months, six months, nine months, and twelve months), whatever the stock exchange mergers. Panel A1 tests Hypothesis 3 that a domestic pure stock exchange merger brings no no gain in level of efficiency. Panel A2 tests both Hypothesis 4a that a cross-border stock exchange merger has no impact on level of efficiency, and Hypothesis 4b that a cross-border stock exchange merger and a domestic stock exchange merger have the same impact on the level of efficiency. Panel B tests Hypothesis 5 that neither targets nor bidders will experience a significant higher level of efficiency after a cross-border stock exchange merger. Panel C tests both Hypothesis 6a that level of efficiency will be higher after a diversifying stock exchange merger due to the creation of a more comprehensive financial service to customers, and Hypothesis 6b that higher level in efficiency is displayed after a domestic stock exchange merger than after a diversifying stock exchange merger due to diversification costs.