Stock Exchange Mergers and Market
Amélie Charles, Olivier Darné, Jae H. Kim, Etienne Redor

To cite this version:

HAL Id: hal-01238707
https://audencia.hal.science/hal-01238707
Submitted on 6 Dec 2015

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
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

Étienne REDOR¶
Audencia Nantes, School of Management

---

*Olivier Darné gratefully acknowledge financial support from the Chaire Finance of the University of Nantes Research Foundation.
†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.
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 competitive1, 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

---

1See 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. 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
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 alternative to Hypothesis 4b, a higher level 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 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 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
\[ H_{0p1} : p_1 = 0.05 \text{ against } H_{1p1} : p_1 > 0.05 \text{ and } H_{0p2} : p_2 = 0.05 \text{ against } H_{1p2} : p_2 > 0.05. \]
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 \( H_{1p}^r : p_1 - p_2 > 0 \)) for the proportions and \( H_{1m} : m_1 - m_2 < 0 \) or \( H_{1m}^r : m_1 - m_2 > 0 \). 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 \( H_{1p}^r \) (\( p_1 - p_2 > 0 \)), 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.
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

---

4We 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


<table>
<thead>
<tr>
<th>Date Announced</th>
<th>Date Effective</th>
<th>Target Name</th>
<th>Acquiror Name</th>
<th>Target Nation</th>
<th>Acquiror Nation</th>
<th>Industry</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/21/2009</td>
<td>02/18/2010</td>
<td>Bataclan Ltd</td>
<td>Bataclan Ltd</td>
<td>United Kingdom</td>
<td>United Kingdom</td>
<td>Stock exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>01/17/2008</td>
<td>09/01/2008</td>
<td>Produce Exchange Inc</td>
<td>Produce Exchange Inc</td>
<td>United States</td>
<td>United States</td>
<td>Stock exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>01/07/2007</td>
<td>07/24/2008</td>
<td>Nyse Euronext Inc</td>
<td>Nyse Euronext Inc</td>
<td>United States</td>
<td>United States</td>
<td>Stock exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>12/21/2006</td>
<td>03/21/2007</td>
<td>Varazdinska burza dd</td>
<td>Varazdinska burza dd</td>
<td>Croatia</td>
<td>Croatia</td>
<td>Stock exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>06/23/2001</td>
<td>04/05/2001</td>
<td>Toronto Venture Exchange</td>
<td>Toronto Venture Exchange</td>
<td>Canada</td>
<td>Canada</td>
<td>Stock exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>06/26/1999</td>
<td>11/02/1999</td>
<td>Vancouver Stock Exchange</td>
<td>Vancouver Stock Exchange</td>
<td>Canada</td>
<td>Canada</td>
<td>Stock exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>03/23/2003</td>
<td>03/31/2003</td>
<td>Borsa Italiana</td>
<td>Borsa Italiana</td>
<td>Italy</td>
<td>Italy</td>
<td>Stock exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>03/20/2001</td>
<td>09/01/2001</td>
<td>Amsterdam Stock Exchange</td>
<td>Amsterdam Stock Exchange</td>
<td>Netherlands</td>
<td>Netherlands</td>
<td>Stock exchange</td>
<td>Stock exchange</td>
</tr>
</tbody>
</table>

Between domestic stock exchanges

Between cross-border stock exchanges
Table 2: List of mergers and acquisitions (continue).

<table>
<thead>
<tr>
<th>Date Announced</th>
<th>Date Effective</th>
<th>Target Name</th>
<th>Acquiror Name</th>
<th>Target Nation</th>
<th>Acquiror Nation</th>
<th>Target Industry</th>
<th>Acquiror Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between a stock exchanges and a commodity exchange (domestic)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/27/2008</td>
<td>07/01/2009</td>
<td>BESA</td>
<td>JSE Ltd</td>
<td>South Africa</td>
<td>South Africa</td>
<td>Commodity exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>08/22/2008</td>
<td>12/23/2008</td>
<td>ISE Stock Exchange LLC</td>
<td>Direct Edge Holdings LLC</td>
<td>United States</td>
<td>United States</td>
<td>Commodity exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>02/27/2008</td>
<td>07/01/2008</td>
<td>Singapore Commodity Exchange</td>
<td>Singapore Exchange Ltd</td>
<td>Singapore</td>
<td>Singapore</td>
<td>Commodity exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>12/10/2007</td>
<td>05/01/2008</td>
<td>Bourse de Montreal Inc</td>
<td>TSX Group Inc</td>
<td>Canada</td>
<td>Canada</td>
<td>Commodity exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>07/10/2007</td>
<td>10/22/2007</td>
<td>Waterexchange Pty Ltd</td>
<td>NSX Ltd</td>
<td>Australia</td>
<td>Australia</td>
<td>Commodity exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>03/27/2006</td>
<td>07/07/2006</td>
<td>SFE Corp Ltd</td>
<td>Australian Stock Exchange Ltd</td>
<td>Australia</td>
<td>Australia</td>
<td>Commodity exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>04/10/2002</td>
<td>05/28/2002</td>
<td>BVRJ</td>
<td>BBM</td>
<td>Brazil</td>
<td>Brazil</td>
<td>Stock exchange</td>
<td>Commodity exchange</td>
</tr>
<tr>
<td>03/04/1999</td>
<td>03/06/2000</td>
<td>Hong Kong Futures Exchange</td>
<td>Stock Exchange of Hongkong</td>
<td>Hong Kong</td>
<td>Hong Kong</td>
<td>Commodity exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>07/03/1998</td>
<td>01/06/1999</td>
<td>Kloffe Capital Sdn Bhd</td>
<td>Kuala Lumpur Stock Exchange</td>
<td>Malaysia</td>
<td>Malaysia</td>
<td>Commodity exchange</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>10/06/1995</td>
<td>01/20/1997</td>
<td>European Options Exchange</td>
<td>Amsterdam Stock Exchange</td>
<td>Netherlands</td>
<td>Netherlands</td>
<td>Commodities exchange</td>
<td>Stock exchange</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Date</th>
<th>Target Name</th>
<th>Acquiror Name</th>
<th>Target Nation</th>
<th>Acquiror Nation</th>
<th>Target Industry</th>
<th>Acquiror Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between a stock exchanges and a provider of services (cross-border)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06/01/2009</td>
<td>06/01/2009</td>
<td>BMIS Sdn Bhd</td>
<td>Bursa Malaysia Bhd</td>
<td>Malaysia</td>
<td>Malaysia</td>
<td>provider of stock exchange services</td>
<td>Stock exchange</td>
</tr>
<tr>
<td>04/20/2005</td>
<td>03/07/2006</td>
<td>New York Stock Exchange</td>
<td>Archipelago Holdings Inc</td>
<td>United States</td>
<td>United States</td>
<td>Stock exchange</td>
<td>provider of electronic communications network services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Date</th>
<th>Target Name</th>
<th>Acquiror Name</th>
<th>Target Nation</th>
<th>Acquiror Nation</th>
<th>Target Industry</th>
<th>Acquiror Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between a stock exchanges and a commodity exchange (cross-border)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12/07/2007</td>
<td>01/31/2008</td>
<td>Powernext SA-Powernext Carbon</td>
<td>NYSE Euronext Inc</td>
<td>France</td>
<td>United States</td>
<td>provider of risk management tools</td>
<td>Stock exchange</td>
</tr>
</tbody>
</table>
Table 3: Descriptive statistics.

<table>
<thead>
<tr>
<th>Merger</th>
<th>before</th>
<th>after</th>
<th>before</th>
<th>after</th>
<th>before</th>
<th>after</th>
<th>before</th>
<th>after</th>
<th>before</th>
<th>after</th>
<th>before</th>
<th>after</th>
<th>before</th>
<th>after</th>
<th>before</th>
<th>after</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domestic M&amp;As between stock exchanges</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.393</td>
<td>-0.582</td>
<td>-0.325</td>
<td>-0.091</td>
<td>-0.135</td>
<td>0.290</td>
<td>-0.455</td>
<td>-1.109</td>
<td>-0.153</td>
<td>0.100</td>
<td>0.650</td>
<td>0.046</td>
<td>0.057</td>
<td>-0.120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std.</td>
<td>1.792</td>
<td>3.020</td>
<td>1.202</td>
<td>1.035</td>
<td>0.722</td>
<td>3.563</td>
<td>5.328</td>
<td>1.343</td>
<td>1.406</td>
<td>0.728</td>
<td>1.142</td>
<td>0.450</td>
<td>0.500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>-0.008</td>
<td>-0.140</td>
<td>0.292</td>
<td>0.371</td>
<td>0.136</td>
<td>0.153</td>
<td>0.421</td>
<td>0.395</td>
<td>0.458</td>
<td>0.229</td>
<td>-0.353</td>
<td>0.190</td>
<td>-0.455</td>
<td>-1.109</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std.</td>
<td>0.950</td>
<td>0.881</td>
<td>2.846</td>
<td>1.894</td>
<td>0.888</td>
<td>1.069</td>
<td>0.758</td>
<td>1.231</td>
<td>1.354</td>
<td>0.945</td>
<td>1.382</td>
<td>1.271</td>
<td>3.563</td>
<td>5.328</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>-0.392</td>
<td>-0.035</td>
<td>0.198</td>
<td>0.212</td>
<td>0.097</td>
<td>-0.180</td>
<td>0.168</td>
<td>-0.179</td>
<td>0.226</td>
<td>-0.025</td>
<td>-0.152</td>
<td>-0.866</td>
<td>0.396</td>
<td>-0.250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std.</td>
<td>0.946</td>
<td>1.393</td>
<td>1.037</td>
<td>1.085</td>
<td>0.863</td>
<td>1.257</td>
<td>1.126</td>
<td>1.056</td>
<td>0.659</td>
<td>1.013</td>
<td>1.850</td>
<td>2.390</td>
<td>1.970</td>
<td>2.108</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KLCI</td>
<td>01/1999</td>
<td>AEX</td>
<td>10/1997</td>
<td>KLCI</td>
<td>06/2009</td>
<td>SP500</td>
<td>03/2006</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.529</td>
<td>-0.153</td>
<td>0.063</td>
<td>-0.170</td>
<td>??</td>
<td>??</td>
<td>0.052</td>
<td>0.116</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std.</td>
<td>1.592</td>
<td>1.121</td>
<td>1.558</td>
<td>2.304</td>
<td>??</td>
<td>??</td>
<td>0.584</td>
<td>0.479</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Domestic M&amp;As between stock exchange and commodity exchange</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>-0.392</td>
<td>-0.035</td>
<td>0.198</td>
<td>0.212</td>
<td>0.097</td>
<td>-0.180</td>
<td>0.168</td>
<td>-0.179</td>
<td>0.226</td>
<td>-0.025</td>
<td>-0.152</td>
<td>-0.866</td>
<td>0.396</td>
<td>-0.250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std.</td>
<td>0.946</td>
<td>1.393</td>
<td>1.037</td>
<td>1.085</td>
<td>0.863</td>
<td>1.257</td>
<td>1.126</td>
<td>1.056</td>
<td>0.659</td>
<td>1.013</td>
<td>1.850</td>
<td>2.390</td>
<td>1.970</td>
<td>2.108</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.529</td>
<td>-0.153</td>
<td>0.063</td>
<td>-0.170</td>
<td>??</td>
<td>??</td>
<td>0.052</td>
<td>0.116</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std.</td>
<td>1.592</td>
<td>1.121</td>
<td>1.558</td>
<td>2.304</td>
<td>??</td>
<td>??</td>
<td>0.584</td>
<td>0.479</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cross-border M&amp;As between stock exchanges</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>-0.016</td>
<td>-0.090</td>
<td>0.653</td>
<td>-0.594</td>
<td>0.027</td>
<td>-0.160</td>
<td>-0.037</td>
<td>-0.031</td>
<td>0.128</td>
<td>0.151</td>
<td>0.308</td>
<td>0.159</td>
<td>0.150</td>
<td>0.193</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std.</td>
<td>0.838</td>
<td>0.631</td>
<td>2.298</td>
<td>4.260</td>
<td>0.401</td>
<td>0.755</td>
<td>1.179</td>
<td>0.715</td>
<td>1.307</td>
<td>0.917</td>
<td>1.068</td>
<td>0.545</td>
<td>0.785</td>
<td>0.492</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>-0.203</td>
<td>0.309</td>
<td>-0.158</td>
<td>0.022</td>
<td>-0.297</td>
<td>0.024</td>
<td>-0.163</td>
<td>-0.088</td>
<td>-0.683</td>
<td>-0.964</td>
<td>-0.326</td>
<td>-0.040</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std.</td>
<td>1.204</td>
<td>1.094</td>
<td>0.953</td>
<td>0.952</td>
<td>0.667</td>
<td>1.088</td>
<td>1.387</td>
<td>1.420</td>
<td>2.992</td>
<td>5.255</td>
<td>1.483</td>
<td>1.152</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Subperiods</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
<th>9 months</th>
<th>12 months</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
<th>9 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significantly higher level of</td>
<td>32.43%</td>
<td>38.89%</td>
<td>30.30%</td>
<td>24.24%</td>
<td>21.21%</td>
<td>29.65%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>efficiency after than before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significantly lower level of</td>
<td>43.24%</td>
<td>33.33%</td>
<td>42.42%</td>
<td>42.42%</td>
<td>45.45%</td>
<td>41.28%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>efficiency after than before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No significant changes</td>
<td>24.32%</td>
<td>27.78%</td>
<td>27.27%</td>
<td>33.33%</td>
<td>33.33%</td>
<td>29.07%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing country</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significantly higher level of</td>
<td>50.00%</td>
<td>33.33%</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>25.93%</td>
<td>40.74%</td>
<td>37.04%</td>
<td>29.63%</td>
<td>25.93%</td>
</tr>
<tr>
<td>efficiency after than before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significantly lower level of</td>
<td>40.00%</td>
<td>44.44%</td>
<td>33.33%</td>
<td>83.33%</td>
<td>66.66%</td>
<td>44.44%</td>
<td>29.63%</td>
<td>44.44%</td>
<td>33.33%</td>
<td>40.74%</td>
</tr>
<tr>
<td>efficiency after than before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No significant changes</td>
<td>10.00%</td>
<td>22.22%</td>
<td>66.67%</td>
<td>16.67%</td>
<td>33.33%</td>
<td>29.63%</td>
<td>29.63%</td>
<td>18.52%</td>
<td>37.04%</td>
<td>33.33%</td>
</tr>
<tr>
<td>Developed country</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significantly higher level of</td>
<td>25.00%</td>
<td>50.00%</td>
<td>12.50%</td>
<td>–</td>
<td>–</td>
<td>62.50%</td>
<td>85.71%</td>
<td>71.43%</td>
<td>71.43%</td>
<td>57.14%</td>
</tr>
<tr>
<td>efficiency after than before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significantly lower level of</td>
<td>50.00%</td>
<td>50.00%</td>
<td>37.50%</td>
<td>50.00%</td>
<td>62.50%</td>
<td>12.50%</td>
<td>–</td>
<td>14.29%</td>
<td>14.29%</td>
<td>28.57%</td>
</tr>
<tr>
<td>efficiency after than before</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No significant changes</td>
<td>25.00%</td>
<td>–</td>
<td>50.00%</td>
<td>50.00%</td>
<td>37.50%</td>
<td>25.00%</td>
<td>14.29%</td>
<td>14.29%</td>
<td>14.29%</td>
<td>14.29%</td>
</tr>
</tbody>
</table>

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).

<table>
<thead>
<tr>
<th>Subperiods</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
<th>9 months</th>
<th>12 months</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
<th>9 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domestic merger</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significantly higher level of efficiency after than before</td>
<td>41.67%</td>
<td>27.27%</td>
<td>27.27%</td>
<td>18.18%</td>
<td>18.18%</td>
<td>18.18%</td>
<td>25.00%</td>
<td>25.00%</td>
<td>25.00%</td>
<td></td>
</tr>
<tr>
<td>Significantly lower level of efficiency after than before</td>
<td>41.67%</td>
<td>54.55%</td>
<td>36.36%</td>
<td>36.36%</td>
<td>54.55%</td>
<td>45.45%</td>
<td>18.18%</td>
<td>62.50%</td>
<td>62.50%</td>
<td>50.00%</td>
</tr>
<tr>
<td>No significant changes</td>
<td>16.67%</td>
<td>18.18%</td>
<td>36.36%</td>
<td>54.55%</td>
<td>27.27%</td>
<td>36.36%</td>
<td>63.64%</td>
<td>12.50%</td>
<td>12.50%</td>
<td>25.00%</td>
</tr>
</tbody>
</table>

| | **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% | 38.46% | 30.77% | 38.46% | 30.77% | 38.46% |
| Significantly lower level of efficiency after than before | 38.46% | 23.08% | 30.77% | 38.46% | 38.46% | 38.46% | 30.77% | 38.46% | 30.77% | 38.46% |
| No significant changes | 23.08% | 7.69% | 30.77% | 30.77% | 38.46% | 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 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.