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GHIMIRE, B., GIORGIONI, G. and LAWS, J.

2010

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Binam Ghimire*, Gianluigi Giorgioni and Jason Laws

June 2010

Liverpool Business School, Liverpool John Moores University, John Foster Building, 98 Mount Pleasant, Liverpool L3 5UZ, United Kingdom.

Abstract

This paper examines the relationship between banks and stock markets in developed and underdeveloped exchanges. Paper has constructed data on market capitalisation of banks and non-bank companies for eighteen years including data on age of exchanges. The simple Johansen (1988) cointegration technique applied to ten different stock markets find exchanges that rely less on banks are more developed. In addition, the hypothesis that under developed exchanges will have higher level of cointegration between banks and non bank-companies has been confirmed by high 95% confidence interval. The results of the investigations have been further verified with the performance of an exchange not included in the empirical investigation. The paper suggests listing of more non-bank companies important for the development of exchange.

JEL codes: C22 - Time-Series Models, G21 – Banks, O16 Financial Markets

Key words: Banks, Exchange, Co-integration

* Corresponding author, Tel. 0044 151 231 3592, E-mail: B.R.Ghimire@ljmu.ac.uk

I. Introduction

Many empirical works provided evidence that both banks and stock markets are important for growth (Chakraborty and Ray, 2006, Deidda and Fattouh, 2008, Levine, 2002, Levine and Zervos, 1998). Studies have also shown the complementary role between banks and stock markets (Demirgüç-Kunt and Levine, 1996, Garcia and Liu, 1999, Li, 2007).The understanding therefore was that these two large financial institutions should bear positive relationship upon economic growth. However, a growing number of recent literature has provided evidence of a negative relationship between banks development and economic growth although it is positive for stock market (Atje and Jovanovic, 1993, Beck and Levine, 2004, Saci et al., 2009, Shen and Lee, 2006).

On the above, it is important to note that banks are publicly owned and listed inside the exchange. Within an exchange as shown in this paper, banks may have a bigger or smaller share of the total market. This paper therefore aims to investigate the nature of relationship between banks and exchanges particularly when the size of banks inside the exchange is large and when it is small. It is important because it may not be very wise to conclude about the relationship of banks and markets upon economic growth without having adequate knowledge on the relationship between the natures of these two large financial institutions[1].

[1] It is interesting that these empirical works (that have found banks and markets important for growth, banks and markets as complement and banks unfavourable but market favourable) have used same variables to measure the stock market development, similar number of countries and period of investigations and a majority of the countries in the sample have an established stock market. (See Appendix table A1). In addition, banks and markets are considered as two separate independent/ explanatory variables in many of these empirical works without adequate investigation into the relationship between the two.

This paper is organized as follows. Section II reviews literature on banks and markets. Paper has identified new variables and constructed data that are discussed in section III. Paper applies common methods of testing cointegration namely Johansen (1988) procedure and Engle and Granger (1987) two step method. In addition, bootstrapping is carried out to check the significance of the correlation among variables. These methodological aspects are explained in section IV. Section V discusses the results and also confirms the findings on an exchange not included in the sample. Finally, section VI concludes.

II. Review of Literature

Studies about financial system involving both banks and markets are not very old and very few empirical works are available in this area.

Atje and Jovanovic (1993) carried out the first cross country growth analysis involving banks and stock markets and found a positive influence of stock markets but a negative for banks. The debate on comparative advantages of bank based and market based economies became more intense in the literature afterwards. Some of them included comparison of financial systems in different countries, particularly developed countries, while others investigated the nature of relationship between the banks and markets.

Allen (1993) recommends bank-based systems for traditional industries where there is consensus about policies, and market-based systems for dynamic industries where wide agreement is lacking. Allen and Gale (1995) expands over Allen (1993). The authors provide quantitative measure of the share of banks and markets for Germany and United States. For example,

they show the ownership of publicly listed banks during the period 1990-1991 was 8.9% in Germany compared to only 0.3% in the USA (Allen and Gale 1995, p.188, table 3).The authors continue to explore the bank and market based economies and in Allen and Gale (1997) they show theoretical model in which they find that bank based system may perform better than market based. The authors suggest German financial system with its reliance on financial intermediary market can minimize the risk (using the reserve held by the bank) better than the US financial system that relies more on financial markets. Levine (1997) compares the close bond between banks and industrialists in bank-based economies such as Germany and Japan, and greater liquidity and risk sharing opportunities in market-based countries such as United Kingdom and United States. The author finds bank-based financial structure of Japan superior to United States but raises concern over the available quantitative measure that differentiates an economy into bank-based and market-based. The author doubts if Japan is a bank-based economy as Japan has one of the best developed stock market in the world. The author therefore suggests the need for further research with new quantitative measures of financial structure and functioning of financial system (p. 719). Allen and Gale (2000) provided a more comprehensive explanation of five developed economies (France, Germany, and Japan as bank-based and United Kingdom and United States as market-based) and their effect in resource allocation and economic development. The authors find both banks and markets important for good financial system. Nevertheless, they stress the need for more research in the area to

understand the advantages and disadvantages of the different financial (Allen and Gale, (2001).

Some empirical works have suggested complementary role played by banks and markets. Boyd and Smith (1996) suggest that stock markets and banks may act as complements rather than as substitute sources of capital. Similar to Boyd and Smith (1996), Demirgüç-Kunt and Levine (1996) find that across countries the level of stock market development is positively correlated with development of financial intermediaries. Demirgüç-Kunt and Levine (1996) use data on 44 developed and emerging markets from 1986 to 1993 and find that large stock markets are more liquid, less volatile, and more internationally integrated than smaller markets. The authors find developed markets having developed intermediaries. Thus, they conclude that stock markets and financial intermediaries complement to each other and therefore they grow together when they develop.

Boot and Thakor (1997) explains the interaction between banks and markets. They make models of financial system based on three types of informational asymmetries. The first one is about imperfect knowledge on the quality of investment projects available to borrowers. This is better handled by financial markets as markets are better at pricing the value of the firms. The second is post-lending moral hazard and the third is uncertainty that borrower would be prone to moral hazard. The remaining two are better handled by banks as banks continue to retain information about the borrowers. The authors therefore present optimal combination of bank and markets as better financial system architecture. The authors also find that when the borrowers gain reputation (which is at the expense of bank), the capital market expands.

Garcia and Liu (1999) use seven countries in Latin America, six countries in East Asia, and two developed industrial countries (United States and Japan) in their empirical analysis regarding the macroeconomic determinants of stock market surge between the period 1980-1995. They argue that more developed banking sector in East Asian economies led to growth in the size of market in the region. The authors use stock market capitalization as a measure of stock market development. They find stock market as a complement rather than substitute for the banking sector. Similarly, Li (2007) finds development of financial intermediaries having positive association with the size of equity markets. The author uses 33 developed and developing countries. The author finds the stock market of less developed countries growing much faster in size than the developed countries in the sample whereas more developed countries enjoyed faster growth in trading activity than the developing countries.

Levine (2002) could not find support for any one (bank-based or market-based) financial system instead favoured for overall financial development importantly influenced by legal system. Chakraborty and Ray (2006) findings are similar to Levine (2002) as they were also unable to find one type of system superior to other although they suggested bank-based system more beneficial to industrial countries. Deidda and Fattouh (2008) in their model find both banks and stock markets important for growth. However, in their study, the growth impact of bank development (measured by domestic credit to private sector to GDP) is lower when the level of stock market development (measured by turnover ratio) is higher. Minier (2009) finds opening of exchange important for growth. The author finds higher growth

during the first 5 years of existence of the exchange. However, the longer-term results according to Minier (2009) are ambiguous.

III. Data

In line with the review of various studies made above that have recommended identification of relevant proxies for the better understanding of the financial system (Allen and Gale, 2001, Levine, 1997), this paper uses new and important variables to examine the nature of relationship between banks and exchanges. The data is constructed for exchanges in 10 countries namely Bangladesh, Hong Kong, Kenya, Korea, Indonesia, Malaysia, Pakistan, Sri Lanka, Singapore and Thailand. The motivation for selecting these countries is to include a variety of exchanges (well established, systematically more developed, less developed) in the investigations that are explained below.

1. Exchanges in Hong Kong and Singapore are some of the most developed ones in the world and in comparison to others in the sample they were established a long time ago.
2. Exchanges in countries such as Korea, Malaysia and Thailand are not very old but are regarded as systematically more developed exchanges than many (Australia, Canada and many in Europe) in the world (Demirgüç-Kunt and Levine, 1996).
3. Exchanges in Bangladesh, Pakistan, and Sri Lanka are not very new (for example Dhaka Stock Exchange was established two years before Korea stock exchange, Exchange in Pakistan was established before Korea) but they are not as developed as some others in the sample.

4. Exchange in Kenya is relatively new and has fewer (only 47 as of March 2010) numbers of listed companies.

The proxies used by this paper are market capitalisation and age of exchange. They are discussed next.

Market Capitalisation

Unlike in the existing empirical works that have used total market capitalisation, this paper has constructed market capitalisation separately for banks (hereinafter "BANKCAP") and for all companies other than banks (hereinafter "NONBANKCAP").

The data on market capitalisation are available at various sources such as the World Bank, World Federation of Exchange and International Monetary Fund. In the sources, the data is however only available for all listed companies (including banks) in total whereas the paper aims to obtain BANKCAP and NONBANKCAP separately. To achieve this, data on total market capitalisation has been downloaded using Datastream[2] and with manual intervention the data is separated for BANKCAP and NONBANKCAP.

Age of Exchange

The paper explores the history and collects the dates of establishment of exchanges to find the age of the exchange (hereinafter "AGEEXCHANGE"). The simple assumption made here is older exchanges in general are more

[2] Datastream is a time series data downloading software from Thomson Reuters. http://thomsonreuters.com. It may be noted that the data on BANKCAP and NONBANKCAP are from Datastream where market capitalisation for "composite" or "all share" index has been obtained. Details about selection of index, Datastream Mnemonic (code to obtain the data), and the establishment dates of exchanges are available in Appendix table 2. Data on BANKCAP and NONBANKCAP is new in the literature. Authors may be contacted for the necessary steps to be followed in Datastream to download data on BANKCAP and NONBANKCAP.

developed and therefore age of exchange (hereinafter “AGEEXCHANGE”) is a quantitative measure of size of exchange. While a new exchange may have grown up quickly in size (For example an exchange established in an emerging market) or a country may have an exchange established a long time ago but it may not have achieved expected development (such as due to political problems hindering the progress of the economy), in general, the assumption that older exchanges are more developed is true for most of the countries. In order to check upon this assumption, table 1 shows the age of exchange of major exchanges worldwide (58 exchanges) where the exchanges are ranked based on highest average market capitalization for the period 1991 to 2008.

Table 1. Major exchanges around the world, age of establishment in 2008 and ranking based on average market capitalization between 1991-2008

Exchange	Age in 2008	Ranking	Exchange	Age in 2008	Ranking
NYSE Euronext (US)	406	1	OMX Helsinki SE	96	30
Tokyo SE	130	2	Jasdaq	45	31
NASDAQ OMX	37	3	Oslo Børs	189	32
London SE	207	4	Thailand SE	33	33
NYSE Euronext (Europe)	406	5	Athens Exchange	132	34
Shanghai SE	18	6	Egyptian Exchange	125	35
Deutsche Börse	188	7	Santiago SE	115	36
NASDAQ OMX Nordic	37	8	Irish SE	35	37
TSX Group	147	9	Istanbul SE	23	38
Hong Kong Exchanges	117	10	OMX Copenhagen SE	89	39
Bombay SE	133	11	Tel Aviv SE	55	40
SIX Swiss Exchange	15	12	Wiener Börse	237	41
National Stock Exchange India	16	13	Indonesia SE	96	42
BME Spanish Exchanges	177	14	Colombia SE	7	43
Borsa Italiana	11	15	Warsaw SE	17	44
Australian SE	21	16	Luxembourg SE	81	45
MICEX	16	17	Philippine SE	16	46
Taiwan SE Corp.	47	18	Buenos Aires SE	154	47
Korea Exchange	52	19	Amman SE	9	48
BM&FBOVESPA	0	20	New Zealand Exchange	34	49
Johannesburg SE	121	21	Budapest SE	144	50
Saudi Stock Market - Tadawul	1	22	Tehran SE	41	51
Shenzhen SE	18	23	Lima SE	148	52
OMX Stockholm SE	145	24	Cyprus SE	12	53
Osaka SE	130	25	Ljubljana SE	19	54
Singapore Exchange	9	26	Mauritius SE	19	55
Mexican Exchange	114	27	Colombo SE	23	56
Bursa Malaysia	48	28	Bermuda SE	37	57
American SE	87	29	Malta SE	16	58

Note:
The age of exchange is derived by finding out the date of establishment of the exchange from the websites of the exchanges and subtracting it from 2008 to find the age in 2008. The ranking of the exchanges is made on the basis of their average market capitalisation for the period 1991-2008 i.e. the exchange with highest average market capitalisation is ranked no 1, second highest no. 2 and so on. For example, the highest average market capitalization (US Dollars 9.3 trillion) calculated comes from NYSE Euronext (US) and hence ranked 1. Data on market capitalisation of the exchanges annually for the period 1991-2008 and the year of establishment are available in Appendix table A2. Market capitalisation is the year end figure. Source of the data for market capitalization for the table above is World Federation of Exchanges (http://www.world-exchanges.org/).

Contrary to the assumption, some exchanges in the table are relatively new but have better rankings. For many of the exchanges, it is so because such exchanges have been formed by merging previously established exchanges. Some notes in this connection have been provided in table 2.

Table 2. Detail of some exchanges on date of establishment

NYSE Euronext NYSE was formed in 1924. Euronext is the consolidation of various exchanges in Europe including the oldest in the world - Amsterdam Stock Exchange. NYSE Euronext is another merger that launched from 4th April 2007. NYSE Euronext (US) and NYSE Euronext (Europe) have its origin from the oldest exchange in the world. According to NYSE EURONEXT website *"The founding of the Dutch East India Company (VOC) on 20 March 1602 marked the worldwide start of share trading."* http://www.euronext.com/editorial/wide/editorial-61218-EN.html
NASDAQ OMX, and NASDAQ OMX Nordic The current form of NASDAQ QMX and NASDAQ QMX Nordic have history that dates back to 1808 when Copenhagen Securities Exchange (non-profit organization) started trading. http://www.nasdaqomx.com/whoweare/milestones/milestonesomx/
Shanghai Stock Exchange Stock exchange in China has a very old history. Shanghai Stock Exchange is the oldest in China. Shanghai Securities and Commodities Exchange established in 1920; Shanghai Chinese Merchant Exchange established in 1921. Both were merged in 1929 to form the Shanghai Stock Exchange http://history.cultural-china.com/en/34History6633.html
SIX Swiss Exchange Switzerland's three stock exchanges in Geneva, Basle and Zurich are merged to form the SWX. The first Swiss stock exchange was the Société des agents de change réunis, founded in Geneva in 1850. http://www.six-swiss-exchange.com/about_us/company/review/history_en.html
National Stock Exchange India In India stock exchange has a long history. BSE is the oldest in Asia that was established in 1875. http://www.bseindia.com/about/introbse.asp
Borsa Italiana The exchange was founded in 1997 following the privatisation of the exchange. In 2008, Borsa Italiana celebrated 200 years of operation. http://www.borsaitaliana.it/borsaitaliana/chi-siamo/bicentenario/bicentenario.en.htm
Australian Stock Exchange Limited The Australian Stock Exchange Limited (now known as ASX Limited) was formed in 1987 by the amalgamation of six independent stock exchanges that formerly operated in the state capital cities. Each of those exchanges had a history of share trading dating back to the 19th century. http://www.asx.com.au/about/asx/index.htm
BM&FBOVESPA Exchange was created in 2008 with the integration between the Brazilian Mercantile & Futures Exchange (BM&F) and the São Paulo Stock Exchange (Bovespa). São Paulo Stock Exchange was established in 1890. http://www.bestbrazil.org.br/pages/publications/bovespa/Sao_Paulo_Stock_Exchange_and_the_Brazilian_Capital_Market.pdf

Continued

Singapore Exchange

SGX was inaugurated on 1 December 1999, following the merger of two established and well-respected financial institutions - the Stock Exchange of Singapore (SES) and the Singapore International Monetary Exchange (SIMEX).

http://www.sgx.com/wps/portal/corporate/cp-en/about_sgx

Singapore Stockbrokers' Association was established in 1930. Interchange of currency between Malaysia and Singapore ceased in 1973, and the exchange became and the Stock Exchange of Singapore. The Singapore International Monetary Exchange was a futures exchange that was established in 1984.

http://www.klse.com.my/website/bm/about_us/the_organisation/history.html

Nevertheless, there are still some exchanges in table 1 that do not agree on the assumption that older are more developed. For some of them there could be political and other reasons attached into it. For example MICEX is the Russian stock exchange. The exchange was only established after the fall of the former USSR but the ranking is comparatively higher. Here, it may be argued that some form of capital market was working in Russia and some other Eastern European countries even prior to establishment of the exchange. For example Warsaw Stock Exchange, Poland have mentioned in its website *"Traditions of the capital market in Poland dates back to 1817 when it was set up to act first in the Warsaw Stock Exchange Merchant"*. (http://www.gpw.pl/). Some other exceptions to the assumption include Saudi Stock Market – Tadawul. But according to the website of the exchange *"Saudi joint stock companies had their beginnings in the mid 1930's, when the "Arab Automobile" company was established as the first joint stock company."* (http://www.tadawul.com.sa/).

The paper now tests the assumption for the sample countries and the market capitalisation and age of exchange are reported in table next.

Table 3. Average market capitalization for the period 1991-2008 and age of exchange between 1991-2008 for sample countries.

Country	Market Capitalisation	Age of Exchange
Hong Kong	505,366	117
Korea	332,734	52
Malaysia	171,536	78
Singapore	170,331	78
Thailand	90,488	45
Indonesia	61,690	96
Pakistan	18,614	61
Kenya	3,784	20
Sri Lanka	2,990	23
Bangladesh	2,221	54

Note: Year of establishment is obtained from website of stock exchanges of the countries. Details available in Appendix table A.2. Age of exchange is calculated by subtracting from 2008 to find the age in 2008.
Market capitalisation above is from Standard & Poor's, Emerging Stock Markets Factbook and supplemental S&P data downloaded from ESDS International. The market capitalisation figures are in million US Dollars.

The table shows that Korea, Thailand, Indonesia and Bangladesh do not fully agree with the assumption that older exchanges are more developed. However, Korea and Thailand as stated above are systematically more developed market so they were able to grow quickly.

In Indonesia, although the exchange was established in 1912, it was closed for several years due to World War I and II. It was reactivated in 1952 by the Capital Markets Emergency Act 1952 but the exchange activity was almost dull until 1977. The company “PT Semen Cibinong” was the first issuer listed in the JSX in 1977. The exchange only had 24 issuers until 1987. People preferred community banking instruments compared to the capital market instruments (Indonesia Stock Exchange, history - http://www.idx.co.id/).

Bangladesh despite established more than five decades ago is not much developed in terms of size as compared to others in the sample. It may be noted that Bangladesh became independent from Pakistan only in 1971 after the war which must have led to big disruption in the progress of capital market.

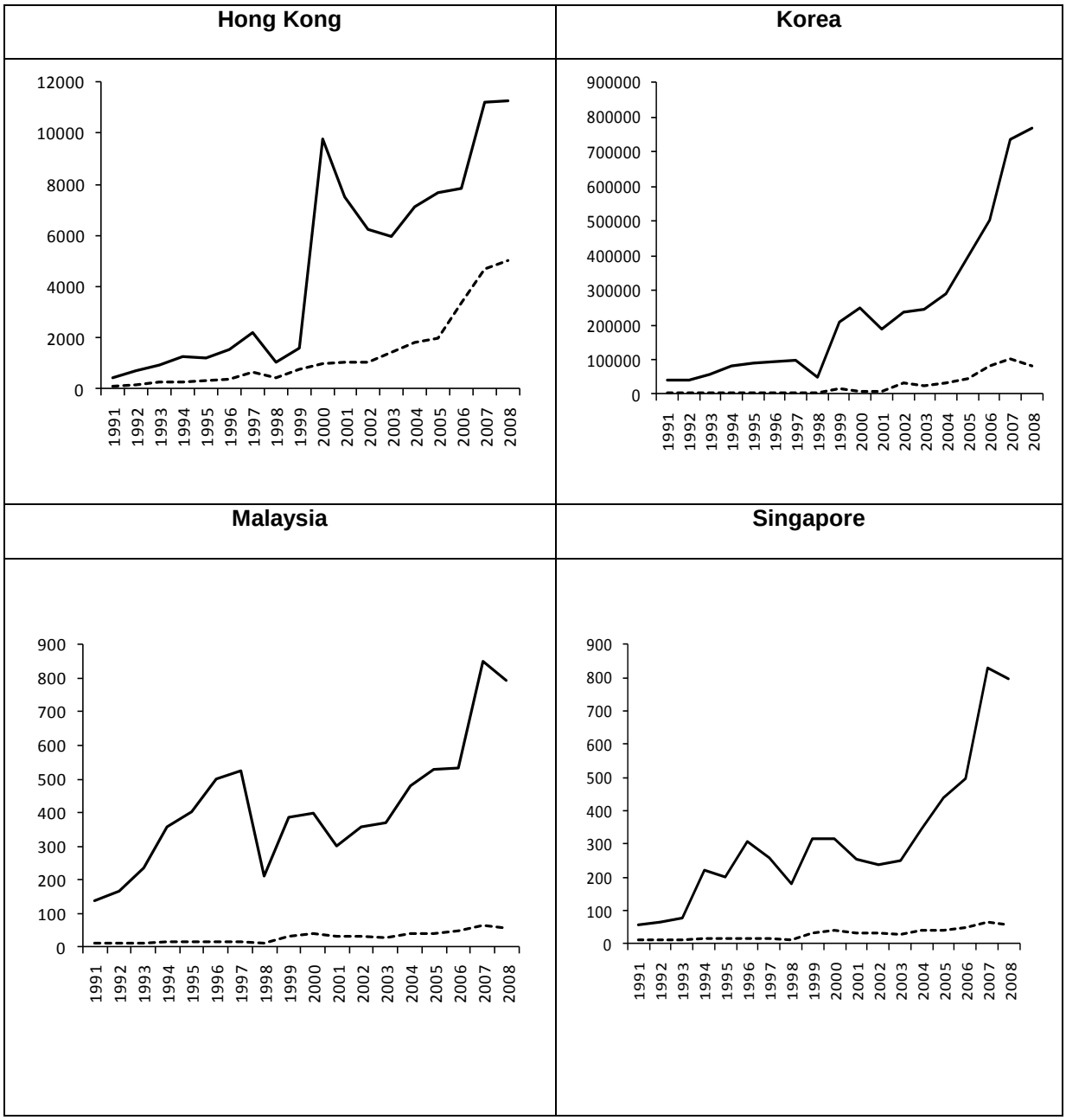
Nevertheless, the limitations of AGEEXCHANGE can not be fully ignored. Therefore, it will be applied as an additional test into the empirical investigation.

IV. Methodology

First, the nature of the relationship between BANKCAP and NONBANKCAP has been analysed by plotting the values in line charts for exchange of each country. The figures are in million local currencies.

As shown in Figure 1, Charts for Hong Kong, Korea, Malaysia, and Singapore do not present any kind of relationship on the movement among the series BANKCAP and NONBANKCAP.

Figure 1. Line chart for the variables BANKCAP (dashed line) and NONBANKCAP (solid line) for Hong Kong, Korea, Malaysia and Singapore.

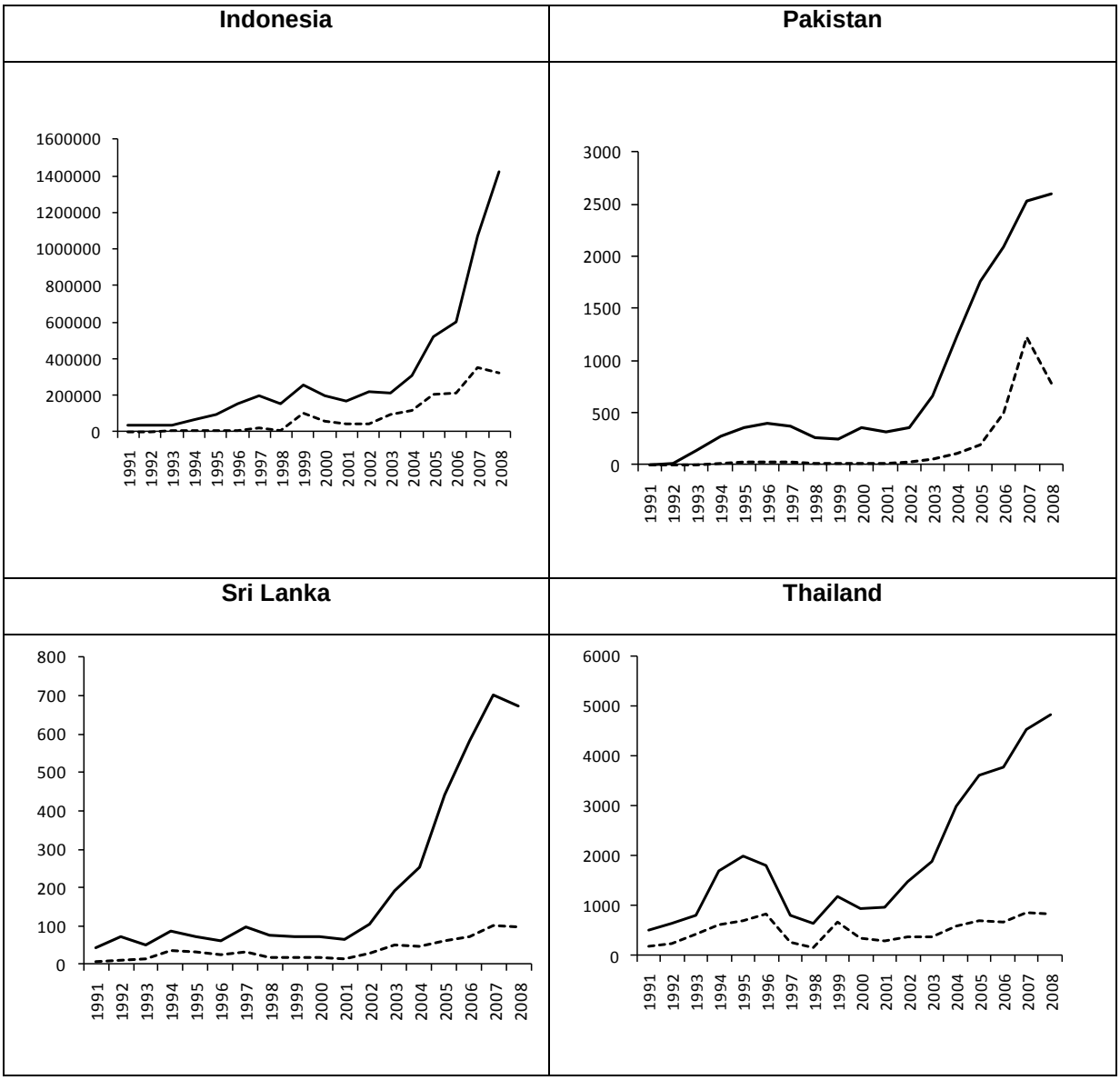


Next, the line chart for Indonesia, Pakistan, Sri Lanka and Thailand are presented in Figure 2.

Thailand shows some coherence in movement. However, the lines diverge after 2001. It is difficult to interpret Indonesia and Sri Lanka but market

capitalisation of both countries grew up significantly after about 2001(like Thailand). In the case of Pakistan again the pattern is not clear.

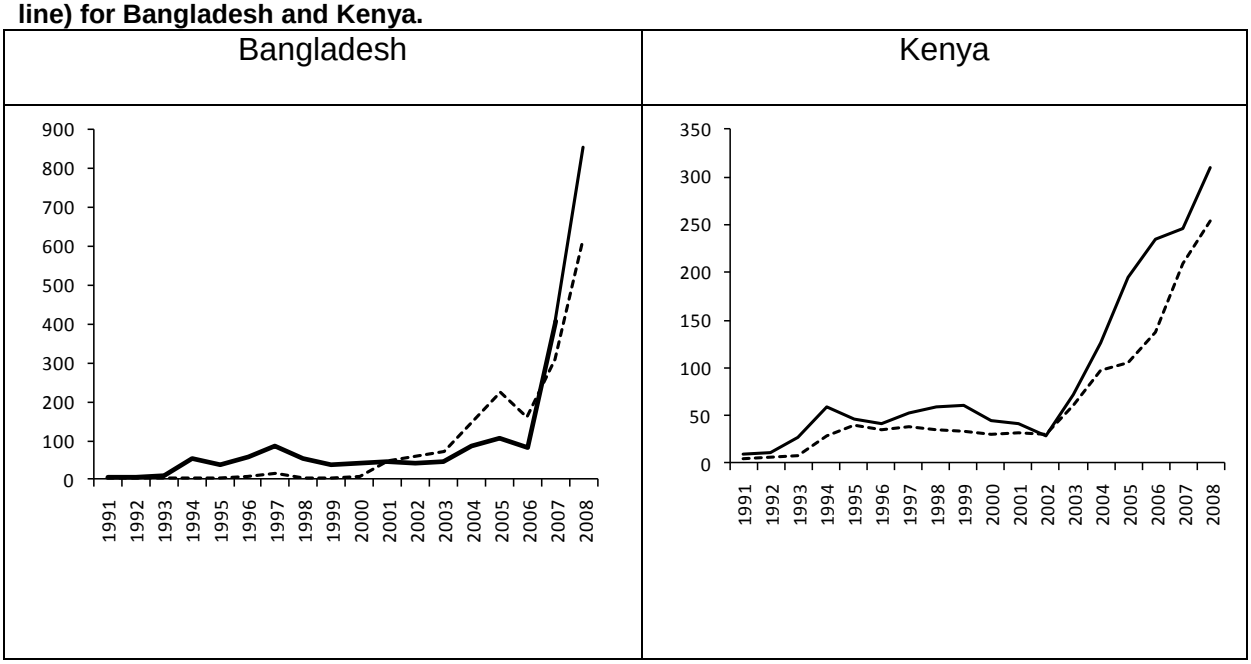
Figure 2. Line chart for the variable BANKCAP (dashed line) and NONBANKCAP (solid line) for Indonesia, Pakistan, Sri Lanka and Thailand.



Finally, an eye ball of the line graphs of Bangladesh and Kenya in Figure 3 shows that the two variables have moved in coherence. In the case of low developed or new exchange such as Kenya we believe that banks have very dominant role shaping the size of exchange as bank seems to have represented a significant portion of total market capitalisation. In the line

charts the movements of series for Bangladesh, Kenya, Thailand (until 2001) are evidencing the dominant role of banks in shaping the exchange. In fact for Bangladesh BANKCAP is higher than NONBANKCAP. In Kenya, in 2002, total market capitalisation is almost equal to BANKCAP. It may be noted that compared to other countries in the sample, these countries have less developed exchanges.

Figure 3. Line chart for the variable BANKCAP (dashed line) and NONBANKCAP (solid line) for Bangladesh and Kenya.



Next, average number of banks and companies other than banks have been shown along with the concentration of banks in the exchange[3] in table 4.

[3] The no of banks and non bank companies are manually counted for every year for the period 1991-2008.

Table 4. Average no of banks, and non banks companies (average 1991-2008) and percentage of banks in exchange

Country	No of Banks listed on the exchange	No of other companies listed on the exchange	Banks concentration (%)
Malaysia	3	592	0.51
Singapore	3	363	0.87
Hong Kong	6	569	1.09
Korea	12	553	2.08
Thailand	9	307	2.94
Sri Lanka	11	184	5.98
Pakistan	12	180	6.67
Indonesia	15	221	6.79
Bangladesh	19	160	12.19
Kenya	5	13	37.59

Note:
The countries are kept in order of bank concentration in the exchange in descending order.

The highest concentration of banks in the total number of listed companies is from Kenya followed by Bangladesh. Malaysia, Singapore, Hong Kong and Korea have very low numbers of bank in the exchange (less than 2.1%). They are some of the most developed and fastest growing exchanges in the world (Demirgüç-Kunt and Levine, 1996). Thailand, Sri Lanka, Pakistan and Indonesia range between 3 to 7 percent approximately with Thailand recording lowest at 2.94%. The stock exchange in Thailand is again systematically more developed than many developed in the world (Demirgüç-Kunt and Levine, 1996).

Since Malaysia, Singapore, Hong Kong, Korea and Thailand have more developed exchanges than others, the table above is also telling the story that an exchange with higher concentration of bank is less developed compared to one with lower concentration. The paper aims to establish this

relationship more closely and hence uses cointegration techniques as the empirical approach to investigate on the relationship.

Paper applies Johansen (1988) and the Engle-Granger (1987) two step method of cointegration. Johansen (1988) is applied as main test for the variable BANKCAP and NONBANKCAP. As an additional test, Engle-Granger (1987) carried out where the variable AGEEXCHANGE is used.

Two variables will be cointegrated to test if they have a long term, or equilibrium, relationship between them. So the test will help establish if there is cointegration between banks and exchanges, confirming evidence of any long-run relationship.

The idea of cointegration basically states that even though individual series may have a unit root, there may exist such a linear combination of variables which is stationary (Campbell and Perron, 1991). Technical note of Campbell and Perron (1991) is provided in Box 1.

Box 1. Technically explanation on co-integration, Campbell and Perron (1991, p. 164)

We start with an (n x 1) vector of variables Y_t. To keep the framework simple, we suppose that each element of this vector has a representation given by

$$Y_{it} = TD_{it} + Z_{it} \quad A_i(L)Z_{it} = B_i(L)e_{it} \qquad (i = 1, \ldots, n)$$

where

TD_{it} is the deterministic component of variable i

Z_i is its noise function modelled as an ARMA process, and

e_{it} the innovation is $N(O, \sigma_i^2)$.

Definition: A vector of variables defined by the equation is said to be cointegrated if there exists at least one non zero *n*-element vector B_i such that B_iY_t is trend-stationary.

First, Johansen cointegration test will be applied to find Trace/ Maximal Eigenvalue values. The hypotheses of the test are provided next.

H_0: r = 0 so there is no cointegration

H_1: r > 0 so there is cointegration

To support Johansen test, the two step cointegration using Engle and Granger (1987) procedure will also be performed. To achieve this, the residuals from the regression equation are calculated. On the residuals, unit

root tests (ADF[4]) is applied to find the t statistics. The cointegrating regression equation estimated on the residuals is

$$\Delta \varepsilon_{t-1} = \gamma \varepsilon_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \varepsilon_{t-1} + u_t$$

Where t-statistics is γ

The null hypothesis is γ = 0 i.e. there is no cointegration against the alternative hypothesis that γ < 0.

It is expected that if the t-statistics, is higher this will indicate closer association between the variables and vice versa. If the hypothesis is true then t-statistics for less developed stock exchanges will be higher. On the other hand, a developed stock exchange should have lower t- statistics value i.e. associated to a lesser extent.

The correlation coefficient is calculated between t-statistics and variables representing stock exchange development (AGEXCHANGE). If the correlation is negative then it would imply that in countries with highly developed stock exchanges, the banks and stock market will have less cointegration as compared to countries with less developed exchanges.

As a further robustness check, bootstrapping[5] of the variables (AGEXCCHANGE and ADF t-statistics) can be done to find the level confidence interval between the two[6].

[4] The unit root test is conducted for both intercept and trend. ADF is augmented Dickey-Fuller test.
[5] Bootstrapping with replacement
[6] Bootstrapping is done in MATLAB. MATLAB is a numerical computing environment maintained by The MathWorks (http://www.mathworks.com/).

Finally, if the difference is stationary (from cointegration test), this should imply that banks are dominant for the stock market (and the country does not have well developed exchange). Cointegration does not seek the causality. However, in the exchange banks are only one out of many industries in a country. So it should not be the only element responsible for the growth of a stock market. In other words, if the difference between total market capitalization and bank stock capitalization remains stationary, this practically means that banks' stock are the main element in the stock market contributing to its growth.

V. Results and discussion

The Johansen cointegration results are reported in Appendix table 4. The test shows that there is cointegration among BANKCAP and NONBANKCAP for countries namely Bangladesh, and Kenya (Trace test at 8%). The cointegration for Thailand can be established at 9% from Trace test and 8 % from Maximum Eigenvalue test.

The countries that have no cointegration are Hong Kong, Indonesia, Korea, Malaysia, Pakistan, Singapore, and Sri Lanka. Both the Trace and Maximum Eigenvalue tests support the results.

The results are similar to those predicted through the graph of the lines. This means stock exchanges that have larger share of banks are cointegrated.

The paper now runs the Engle and Granger (1987) two step method of calculating cointegration. The OLS equation is run and the series for residual is derived in which the ADF test is performed.

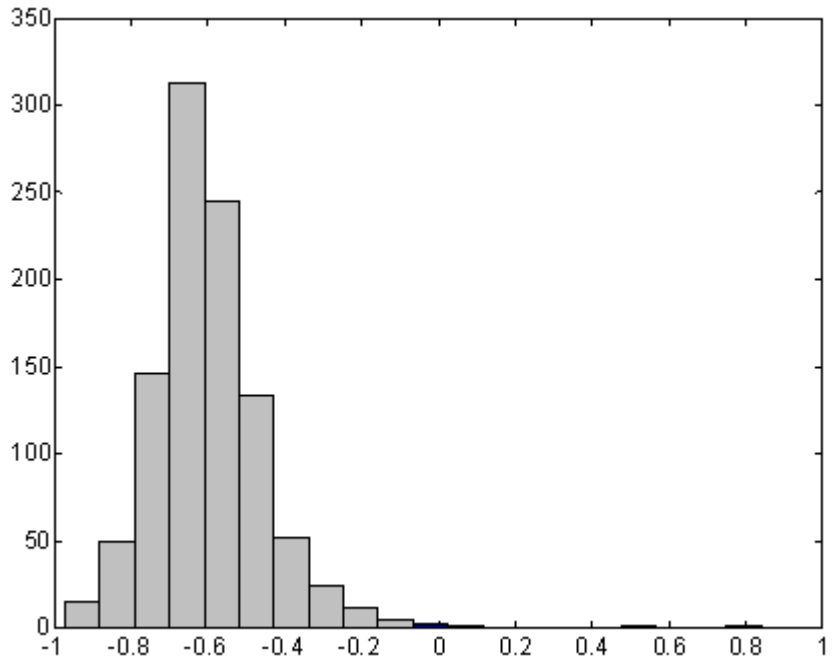
It is found that that the variables are not cointegrated for many countries. However, it is well established that the Engle and Granger (1987) method can be unreliable in case of small sample. Hence, the t-statistics computed from ADF tests of the residuals is taken. A higher t- statistics will mean the variables are more correlated and vice versa. The ADF t-statistics values of the unit root test on the residuals using Engle and Granger (1987) are made available in table 5.

Table 5. ADF t-statistics

Country	ADF t-statistics
Bangladesh	-1.403
Hong Kong	-1.491
Indonesia	-1.962
Kenya	-2.574
Korea	-2.719
Malaysia	-1.740
Pakistan	-3.085
Singapore	-1.279
Sri Lanka	-2.659
Thailand	-3.554

In addition, the re-sampling of the AGEXCHANGE and ADF t-statistics vectors a 1000 times is done to consider the variation in the resulting correlation coefficients. Correlation coefficient is computed on each sample and obtained the histogram that is shown in Figure next.

Figure 4. Histogram of correlation between the variables



The histogram shows that nearly all the estimates lie on the interval [-1 to -0.2].

Next bootstrapping is done for the pairs consisting of t-stats of ADF test and AGEXCHANGE (to construct a confidence interval). After bootstrapping the correlation coefficient 5,000 times (this also helps in minimising error bias in small time series data) at 95% confidence interval, lower/upper limit of -0.2103 and -0.8577 respectively are obtained.

The above implies an evidence for an inverted relation between t-stats of ADF test and AGEEXCHANGE. In other words when age of exchange is high the t-statistics is low and therefore no cointegration and vice versa.

This (evidence of negative correlation between t-statistics and AGEEXCHANGE) implies that in countries with highly developed stock exchanges, the banks and stock market will have less co-integration as

compared to countries with less efficient exchanges. The implication is that in less developed stock exchanges the variables BANKCAP and NONBANKCAP are more cointegrated suggesting stationarity of the relationship. In practical terms, this means that banks' stocks are the main element in the stock market contributing to its growth. Since bank is causing this (although there are many other industries in a country), in the stock exchange bank is the dominant player and the exchange may be less developed.

Confirming the result

The variables used are the first of its kind in the literature. In order to further support the findings (least developed exchanges have Banks as dominant player in the market) the paper has collected the market capitalisation of Nepal Stock Exchange (NEPSE[7]). Nepal is not the sample country of this empirical investigation. Hence the testing of the results obtained should be unbiased when tested for NEPSE.

The numbers of listed companies in the exchange (as of July 2009) after separation to financial and non-financial sectors are presented below.

[7] NEPSE is the only stock exchange of Nepal. It was established in 1983.

Table 6. Number of listed companies in NEPSE

Types	Total Number of Listed Companies	Category	Number listed
Financial Intermediaries	133	Commercial Banks	23
		Finance Companies	62
		Development Banks	32
		Insurance Companies	16
Non Financial	31	Hotels	4
		Manufacturing & Processing	17
		Others	2
		HydroPower	4
		Tradings	4

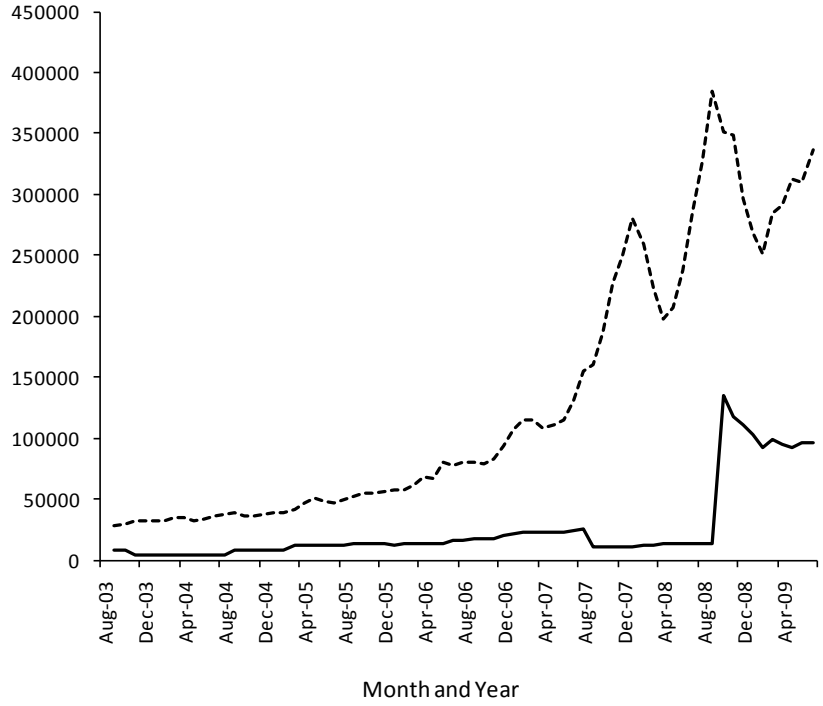
Data source: NEPSE

The paper has collected monthly data of the market capitalisation of all the industries listed in exchange for six years (from August 2003 to July 2009). The source of the data is the website of NEPSE. The data is constructed for banks and non bank companies separately.

Throughout the 6 years the contribution of banks in total market capitalisation has remained 82% on average.

The line graph of the data for BANKCAP and NONBANKCAP is provided in figure next.

Figure 5. BANKCAP (Dashed line) and NONBANKCAP (Solid line) – NEPSE. Amount in Million local currency[8].

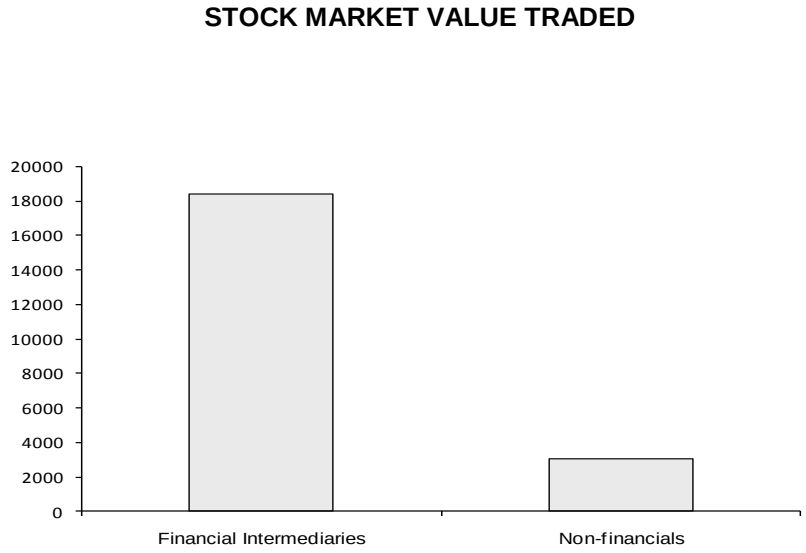


The paper has also collected data on Value traded and number of shares traded for one year on monthly basis (July 2007 to June 2009) for all companies listed in the exchange.

The result as shown by column graph next in figure 7.6 indicates that financial institution represented 85.84% of the total value traded in the period.

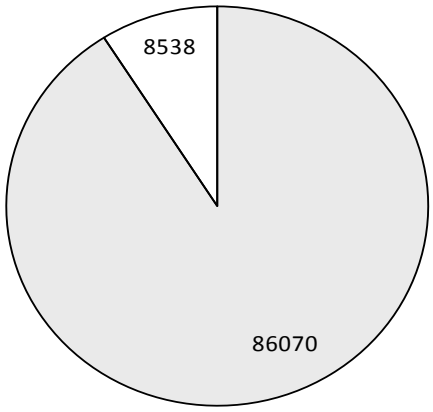
[8] Note: the sudden increase in the capitalization of non bank companies in August 2008 is due to listing of the telecommunication company (Nepal Doorsanchar Company Ltd.) into NEPSE. Nepal Doorsanchar Company Ltd. Was listed in the exchange on 25th August 2008 (The Himalayan Times, 26 August 2008, http://www.thehimalayantimes.com/)

Figure 6. Column chart on Stock market value traded during the period July 2007 to June 2008. (In Million Local Currency)



Similarly, almost 91% of the total numbers of shares were traded on account of financial institutions.

Figure 7. Pie chart on Number of Shares Traded in Financial and Non- Financial Sectors over July 2007 to June 2008.



Note: The gray area represents number of shares traded by all the financial intermediaries. The source of the data is NEPSE. The data is constructed by the author. In the original dataset, the data is available based on industry (Financial – Commercial Banks, Finance Companies, Insurance Companies and Development Banks and in Non-Financial sector – Manufacturing and Processing, Trading, Hotels, Hydro Powers, and Others)

Next, the Johansen co-integration test is carried out. The results show co-integration between the market capitalisation of financial and non-financial stocks (Appendix table 4).

VI. Conclusion

In sum, it is found that more developed exchanges have poor cointegration with banks' development. The hypothesis that under developed exchanges will have higher level of cointegration has been confirmed by high 95% confidence interval of correlation coefficient. This implies that the less developed exchanges are relying mainly upon banks and hence do not have a developed stock exchange. The results of the empirical investigation have been checked and confirmed using Nepal as a sample. The paper finds cointegration in the series and also a large dominance of banking sector in the exchange of Nepal. The paper sends the message that listing of more non bank companies inside the exchange can be important for the development of exchange.

APPENDIX

Table A1. Sample countries of empirical works on banks, stock markets and economic growth and on banks and markets.

#	Countries	A&J	D&L	L&Z	L	B&L	S et al.	S&L
1	Argentina	x	x	x	x		x	x
2	Australia	x	x	x	x	x		x
3	Austria	x	x	x	x	x		x
4	Bangladesh			x		x	x	
5	Belgium	x	x	x	x	x		x
6	Brazil	x	x	x	x	x	x	x
7	Canada	x	x	x	x	x		x
8	Chile	x	x	x	x	x	x	x
9	Colombia	x	x	x	x	x	x	x
10	Cote d' Ivoire			x			x	
11	Cyprus				x			
12	Denmark	x	x	x	x	x		x
13	Ecudor				x			
14	Egypt	x		x	x	x	x	x
15	Finland		x	x	x	x		x
16	France	x	x	x	x	x		x
17	Germany	x	x	x	x	x		x
18	Ghana				x			
19	Greece	x	x	x	x	x		x
20	Honduras				x			
21	Hong Kong		x	x				x
22	India	x	x	x	x	x	x	x
23	Indonesia	x	x	x		x	x	x
24	Ireland				x			x
25	Israel	x	x	x	x	x	x	x
26	Italy	x	x	x	x	x		x
27	Jamaica	x		x	x	x	x	
28	Japan	x	x	x	x	x		x
29	Jordan	x	x	x		x	x	x
30	Kenya				x		x	x

Continued

#	Countries	A&J	D&L	L&Z	L	B&L	S et al.	S&L
31	Korea	x	x	x		x	x	x
32	Luxembourg			x				
34	Malaysia	x	x	x	x	x	x	x
33	Mauritius						x	
35	Mexico	x	x	x	x	x	x	x
36	Morocco			x			x	
37	Netherlands	x	x	x	x	x		x
38	New Zealand		x	x	x	x		x
39	Nigeria	x	x	x			x	x
40	Norway	x	x	x	x	x		x
41	Pakistan		x	x	x	x	x	x
42	Panama				x			
43	Peru	x		x	x	x	x	x
44	Philippines	x	x	x	x	x	x	x
45	Portugal	x	x	x	x	x		x
46	Singapore	x	x	x				x
47	South Africa	x	x		x	x	x	x
48	Spain	x	x	x	x			x
49	Sri Lanka				x		x	x
50	Sweden	x	x	x	x	x		x
51	Switzerland		x		x			x
52	Taiwan	x		x	x	x		
53	Thailand	x	x	x	x	x	x	x
54	Trin. and Tob.				x		x	
55	Tunisia				x		x	
56	Turkey		x	x	x		x	
57	United Kingdom	x	x	x	x	x		x
58	United States	x	x	x	x	x		x
59	Uruguay	x				x		x
60	Venezuela	x	x	x		x	x	
61	Zimbawbe	x	x	x	x	x	x	x
	Total no. of countries	40	41	47	48	40	30	45

Note:

1. A&J : Atje and Jovanovic, 1993, D&L: Demirgüç-Kunt and Levine, 1996, L&Z: Levine and Zervos, 1998, B&L: L: Levine, 2002, Beck and Levine, 2004, S et al.: Saci et al. (2009)
2. Atje and Jovanovic, 1993, Beck and Levine, 2004, Saci et al., 2009, and Shen and Lee, 2006 have found a negative effect of banks' development upon economic growth but a positive with stock market. Paper by Demirgüç-Kunt and Levine, 1996, Levine and Zervos, 1998, Levine, 2002 are among those that have found both banks and markets important for growth.
3. The sample period of the papers are as follows: Atje and Jovan (1993): 1960-1985, Demirgüç-Kunt and Levine (1996): 1986-1993, Levine and Zervos (1998): 1976-1993, Levine, (2002): 1980-1995, Beck and Levine (2004): 1976-1998, Saci et al., (2009): 1988-2001, Shen and Lee (2006): 1976-2001.
4. All papers have used at least one or two or all of the following stock market measurement variables: market capitalisation/ GDP, Value traded/ GDP and Turnover ratio.
5. From the above, it shows that the papers have used similar countries, similar number of countries (Saci et al. have examined the relationship between financial development and economic growth among developing countries so they have excluded developed), same variables and similar years in their sample period.

Table A2. Name of the exchange, establishment date, and Datastream code used to download the data

Bangladesh Bangladesh has two stock exchanges namely Dhaka Stock Exchange (DSE) and Chattagong Stock Exchange (CSE). The former was established in 1954 as "East Pakistan Stock Exchange Ltd". The name was changed to Dhaka Stock Exchange in 1964. (http://www.dsebd.org/ilf.php**).** CSE was established in 1995 and has relatively fewer numbers of companies as compared to DSE. In order to download the data on capitalisation, Datastream provided market capitalisation for "all quoted shares" has been used to download the data. The mnemonic in Datastream is FBANG. Date of establishment of exchange: 1954.	**Hong Kong** Hong Kong is the most investor friendly place in the world. (Index of economic freedom has ranked Hong Kong as no 1 in many criteria[9] related with economic freedom for the last several years). As the first exchange, the Association of Stockbrokers in Hong Kong was established in 1891. At present the stock exchange is known as Hong Kong Exchanges and Clearing Limited (HKEx). It is a merger of The Stock Exchange of Hong Kong Limited (SEHK), Hong Kong Futures Exchange Limited (HKFE) and Hong Kong Securities Clearing Company Limited (HKSCC). (http://www.hkex.com.hk/eng/exchange/corpinfo/history/history.htm) In order to download the data on capitalisation, Datastream provided market capitalisation for "all domestic and foreign shares" has been used to download the data. The mnemonic in Datastream is FHKQ. Date of establishment of the exchange: 1891
Indonesia The first Stock Exchange in Indonesia was built in Batavia (currently known as Jakarta) by the Dutch East Indies in 1912. Later new stock exchanges were established in Semarang and Surabaya. Surabaya Stock Exchange was merged into Jakarta Stock Exchange (JSX). As a result, JSX changed its name into the Indonesia Stock Exchange. (http://www.idx.co.id/) The data for "Jakarta Composite Index" is downloaded using Datastream where the mnemonic is LJAKCOMP. Date of establishment of the exchange: 1912	**Kenya** In Kenya until 1963 the trading of shares was limited to European communities. In 1988, the first privatisation through Nairobi Stock Exchange took place when it sold the 20% of the share of the Kenya Commercial bank. So we take 1988 as the date of establishment of NSE. (http://www.nse.co.ke/newsite/inner.asp?cat=ahistory) The stock market capitalisation for "Nairobi Stock Exchange Index" is obtained using Datastream where the mnemonic is LNSEINDX. Date of establishment of the exchange: 1988
Korea The Daehan Stock Exchange, the predecessor of the Korea Stock Exchange (KSE), was established in 1956. In 1962, the KSE reorganized into a joint stock corporation. The Korea Exchange was established in 2005 as a merger of the Korea Stock Exchange, the KOSDAQ and the Korea Futures Exchange. The Korea Exchange is one of Asia's largest exchanges with around 1,800 listed companies. (http://eng.krx.co.kr/m9/m9_1/m9_1_3/UHPENG09001_03.html) The data for "KOSPI Composite Index constituents" is obtained using Datastream where the mnemonic is LKORCOMP.	**Malaysia** The first formal securities business organisation in Malaysia was the Singapore Stockbrokers' Association that was established in 1930. The Malayan Stock Exchange was established in 1960 and the public trading of shares commenced. Currency interchangeability between Malaysia and Singapore ceased in 1973, and the Stock Exchange of Malaysia became Kuala Lumpur Stock Exchange Berhad. On April 14, 2004, the name was changed to Bursa Malaysia Berhad. (http://www.klse.com.my/website/bm/about_us/the_organisation/history.html) The data for "Malaysia all quoted securities" is obtained using Datastream where the mnemonic is FMALQ.

[9] Criteria include Business Freedom, Trade Freedom, fiscal freedom, government spending, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption, labour freedom. We have discussed on index of economic freedom ranking here as it is believed that where economic opportunities are wider the stock market should perform better. http://www.heritage.org/Index/

Pakistan Karachi Stock Exchange is the premier stock exchange of the country. It was established in 1947 with 5 listed companies. Total no of companies listed is 651 as of March 2010. KSE has now 4 indices namely KSE 100, KSE 30, KSE All Share Index and KMI 30. (http://www.kse.com.pk/) "All stock Pakistan stocks" data is obtained from Datastream. The mnemonic is PAKALL.	**Singapore** Singapore Stockbrokers' Association was established in 1930. (http://www.klse.com.my/website/bm/about_us/the_organisation/history.html) Interchange of currency between Malaysia and Singapore ceased in 1973, and the exchange became the Stock Exchange of Singapore. The Singapore International Monetary Exchange was a futures exchange that was established in 1984. The Singapore Stock Exchange established on 1st December 1999 resulted from the merger of the two financial institutions - the Stock Exchange of Singapore and the Singapore International Monetary Exchange. (http://www.sgx.com/wps/portal/corporate/cp-en/about_sgx) In the Datastream "Singapore All Quoted Securities" is taken to download the data. The mnemonic is FSINQ.
Sri Lanka Exchange for some specific purpose (when British Planters needed funds to set up Tea Plantations in Sri Lanka in the 19th century) was established a long time ago; however formal exchange market, Colombo Stock Exchange, was established only in 1985. (http://www.cse.lk/welcome.htm) In order to download the data on capitalization, Datastream provided "Research Stocks" is used where the mnemonic is FSRILA.	**Thailand** The first stock exchange was established in 1962 privately. A more formal exchange was established in 1975 and the name given was The Securities exchange of Thailand. On January 1, 1991 its name was formally changed to "The Stock Exchange of Thailand", SET. (http://www.set.or.th/en/about/overview/history_p1.html) In the Datastream, "Stock Exchange of Thailand (S.E.T.)" is taken to download the data. The mnemonic is LBNGKSET

Table A3. Dates of Establishment and market capitalisation of exchanges around the world

Exchange	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average	Estb.
NYSE Euronext (US)	3,484.3	3,798.2	4,213.0	4,147.9	5,654.8	6,842.0	8,879.6	10,277.9	11,437.6	11,534.6	11,026.6	9,015.3	11,329.0	12,707.6	13,632.3	15,421.2	15,650.8	9,208.9	9,347.9	1792
Tokyo SE	3,117.3	2,318.9	2,906.3	3,592.2	3,545.3	3,011.2	2,160.6	2,439.5	4,463.3	3,157.2	2,264.5	2,069.3	2,953.1	3,557.7	4,572.9	4,614.1	4,330.9	3,115.8	3,232.8	1878
NASDAQ OMX	490.7	618.8	791.7	793.7	1,159.9	1,511.8	1,726.4	2,243.7	5,204.6	3,597.1	2,739.7	1,994.5	2,844.2	3,532.9	3,604.0	3,865.0	4,013.7	2,249.0	2,387.9	1971
London SE	986.1	928.4	1,150.6	1,145.3	1,346.6	1,642.6	1,996.2	2,372.7	2,855.4	2,612.2	2,164.7	1,856.2	2,460.1	2,865.2	3,058.2	3,794.3	3,851.7	1,868.2	2,164.1	1801
NYSE Euronext (Europe)	NA	NA	NA	761.0	906.5	1,105.7	1,322.7	1,903.3	2,444.3	2,271.7	1,889.5	1,538.7	2,076.4	2,441.3	2,706.8	3,712.7	4,222.7	2,101.7	2,093.7	1602
Shanghai SE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	306.4	360.1	314.3	286.2	917.5	3,694.3	1,425.4	1,043.5	1990
Deutsche Börse	392.5	346.9	460.8	499.3	577.4	664.9	825.2	1,086.7	1,432.2	1,270.2	1,071.7	686.0	1,079.0	1,194.5	1,221.1	1,637.6	2,105.2	1,110.6	981.2	1820
NASDAQ OMX Nordic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	728.8	802.6	1,122.7	1,242.6	563.1	891.9	1971
TSX Group	265.7	241.9	326.5	315.1	366.3	487.0	567.6	543.4	789.2	766.2	611.5	570.2	888.7	1,177.5	1,482.2	1,700.7	2,186.6	1,033.4	795.5	1861
Hong Kong Exchanges	121.9	172.0	385.0	269.5	303.7	449.2	413.3	343.6	609.1	623.4	506.1	463.1	714.6	861.5	1,055.0	1,715.0	2,654.4	1,328.8	721.6	1891
Bombay SE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	130.4	278.7	386.3	553.1	818.9	1,819.1	647.2	661.9	1875
SIX Swiss Exchange	173.8	189.1	270.9	284.7	398.1	400.3	575.3	701.6	693.1	792.3	625.9	547.0	727.1	826.0	935.4	1,212.3	1,271.0	880.3	639.1	1993
National Stock Exchange India	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	112.5	252.9	363.3	516.0	774.1	1,660.1	600.3	611.3	1992
BME Spanish Exchanges	127.3	98.8	118.9	123.6	150.9	241.0	290.4	399.8	431.6	504.2	468.2	461.6	726.2	940.7	959.9	1,322.9	1,781.1	948.4	560.9	1831
Borsa Italiana	158.8	123.7	145.3	186.0	209.5	256.6	344.7	566.0	728.2	768.4	527.5	477.1	614.8	789.6	798.1	1,026.5	1,072.5	522.1	517.5	1997
Australian SE	142.4	133.6	202.0	216.8	243.5	311.9	295.8	328.9	427.7	372.8	375.6	380.1	585.4	776.4	804.0	1,095.9	1,298.3	683.9	481.9	1987
MICEX	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	48.5	58.9	137.6	153.3	266.4	886.5	1,221.5	337.1	388.7	1992
Taiwan SE Corp.	123.5	100.2	193.3	247.3	187.2	273.8	287.8	260.5	376.5	247.6	292.9	261.3	379.1	441.4	476.0	594.7	663.7	356.7	320.2	1961
Korea Exchange	96.5	107.7	139.6	191.8	182.0	139.1	41.9	114.6	306.1	148.4	194.5	216.1	298.2	389.5	718.0	834.4	1,122.6	470.8	317.3	1956
BM&FBOVESPA	32.2	45.4	96.8	189.3	147.6	216.9	255.5	160.9	228.0	226.2	186.2	121.6	226.4	330.3	474.6	710.2	1,369.7	592.0	311.7	2008
Johannesburg SE	168.0	148.7	215.9	240.0	277.1	239.6	211.6	150.7	180.5	131.3	84.3	116.5	260.7	442.5	549.3	711.2	828.2	482.7	302.2	1887
Saudi Stock Market - Tadawul	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	73.2	74.9	157.3	306.2	646.1	326.9	518.9	246.3	293.7	2007
Shenzhen SE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	156.6	152.9	133.4	115.7	227.9	784.5	353.4	274.9	1990
OMX Stockholm SE	97.1	78.1	107.0	130.6	172.6	240.4	264.7	278.7	373.3	328.3	236.5	179.1	293.0	NA	NA	NA	NA	NA	213.8	1863
Osaka SE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	192.0	183.7	212.1	147.4	183.8	1878
Singapore Exchange	47.6	48.9	135.1	136.3	151.0	153.1	106.3	96.5	198.0	155.1	117.3	101.6	148.5	217.6	257.3	384.3	539.2	265.0	181.0	1999
Mexican Exchange	102.8	138.7	200.9	130.2	90.7	106.8	156.6	91.7	154.0	125.2	126.3	103.9	122.5	171.9	239.1	348.3	397.7	234.1	169.0	1894
Bursa Malaysia	56.7	91.5	219.8	190.2	213.8	306.2	93.2	95.6	139.9	113.2	119.0	122.9	161.0	181.6	180.5	235.6	325.3	189.2	168.6	1960
American SE	124.5	88.8	105.1	86.0	103.1	97.9	124.6	126.3	90.7	82.7	60.2	45.7	92.9	83.0	201.4	282.8	257.8	132.4	121.4	1921

Continued

Exchange	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average	Estb.
OMX Helsinki SE	14.2	12.2	23.6	38.3	44.1	62.6	73.3	153.8	349.4	293.6	190.5	138.8	170.3	NA	NA	NA	NA	NA	120.4	1912
Jasdaq	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	112.2	120.7	93.2	108.7	1963
Oslo Børs	22.0	17.8	27.5	36.5	44.6	56.9	66.5	46.3	63.7	65.3	69.4	68.1	95.9	141.6	191.0	279.9	353.4	145.9	99.6	1819
Thailand SE	37.5	57.3	127.5	125.6	135.8	95.9	22.8	34.1	57.2	29.2	36.0	45.4	119.0	115.4	123.9	140.2	197.1	103.1	89.1	1975
Athens Exchange	12.9	10.7	13.6	12.8	16.5	23.6	33.8	80.1	196.8	107.5	83.5	66.0	103.8	121.9	145.1	208.3	265.0	90.2	88.5	1876
Egyptian Exchange	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38.5	79.5	93.5	139.3	86.0	87.4	1883
Santiago SE	28.0	29.6	44.9	68.2	72.9	66.0	72.0	51.9	68.2	60.4	56.3	49.8	87.5	116.9	136.5	174.4	212.9	131.8	84.9	1893
Irish SE	NA	NA	NA	NA	25.8	34.7	49.4	66.6	68.8	81.9	75.3	59.9	85.1	114.1	114.1	163.3	143.9	49.5	80.9	1973
Istanbul SE	15.5	9.8	36.6	21.6	20.8	30.3	61.1	33.6	112.7	69.7	47.1	34.2	68.4	98.3	161.5	162.4	286.6	118.3	77.1	1985
OMX Copenhagen SE	44.8	30.1	41.7	48.8	57.7	71.1	93.8	98.9	105.3	107.7	85.1	76.7	118.2	NA	NA	NA	NA	NA	75.4	1919
Tel Aviv SE	13.2	27.9	47.5	31.1	35.1	34.5	44.4	39.2	63.5	65.3	58.2	40.8	68.9	90.2	122.6	161.7	235.1	107.7	71.5	1953
Wiener Börse	26.0	21.7	28.3	30.8	32.5	33.6	37.3	35.5	33.0	29.9	25.2	33.6	56.5	87.8	126.3	199.1	236.4	76.3	63.9	1771
Indonesia SE	6.8	12.0	32.8	47.2	66.5	90.9	29.1	22.1	64.0	26.8	23.0	30.1	54.7	73.3	81.4	138.9	211.7	98.8	61.7	1912
Colombia SE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.3	25.2	50.5	56.2	102.0	87.7	56.0	2001
Warsaw SE	0.1	0.2	2.7	3.1	4.6	8.4	12.1	20.5	29.6	31.4	26.2	28.8	37.4	71.5	93.6	151.8	211.6	90.8	45.8	1991
Luxembourg SE	11.3	11.9	19.3	28.5	30.4	32.4	33.9	37.9	35.9	34.0	23.8	24.6	37.3	50.1	51.2	79.5	166.1	66.6	43.1	1927
Philippine SE	10.8	15.3	40.1	56.6	58.8	80.5	31.2	34.9	41.5	25.3	20.6	18.2	23.2	28.6	39.8	68.3	102.9	52.0	41.6	1992
Buenos Aires SE	18.6	18.6	44.1	36.9	37.8	44.7	59.3	45.3	55.8	45.8	33.4	16.5	35.0	40.6	47.6	51.2	57.1	39.9	40.5	1854
Amman SE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	18.4	37.6	29.7	41.2	35.9	32.6	1999
New Zealand Exchange	14.3	14.7	24.6	27.1	31.9	36.9	29.9	24.5	27.8	18.5	17.7	21.7	33.0	43.7	40.6	44.8	47.5	24.2	29.1	1974
Budapest SE	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.9	10.4	13.0	18.9	28.3	32.6	41.9	46.2	18.5	24.6	1864
Tehran SE	NA	1.3	1.1	2.4	6.5	12.9	11.5	11.1	17.2	5.9	7.4	11.8	27.5	42.6	36.4	36.3	43.9	48.7	19.1	1967
Lima SE	1.1	2.6	5.1	8.2	10.9	12.6	15.5	9.9	12.1	9.7	9.8	11.4	14.1	18.0	24.1	40.0	69.4	37.9	17.4	1860
Cyprus SE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.9	6.6	16.2	29.5	8.0	13.0	1996
Ljubljana SE	NA	NA	NA	0.2	0.3	0.9	1.9	3.0	2.9	3.1	3.5	5.6	7.1	9.7	7.9	15.2	28.8	11.8	6.8	1989
Mauritius SE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.1	2.3	5.0	7.9	4.7	4.4	1989
Colombo SE	1.9	1.4	2.5	2.9	2.0	1.9	2.1	1.7	1.6	1.1	1.3	1.7	2.7	3.7	5.7	7.8	7.6	4.3	3.0	1985
Bermuda SE	NA	NA	NA	NA	NA	NA	NA	1.5	1.3	2.2	2.5	2.2	2.9	1.9	2.1	2.7	2.7	1.9	2.2	1971
Malta SE	NA	NA	0.0	0.0	0.4	0.4	0.4	0.8	3.9	2.0	1.4	1.4	1.8	2.8	4.1	4.5	5.6	3.6	2.1	1992

Note: The establishment date of the exchanges have been obtained by visiting the websites of the stock exchanges. For most of the exchanges the year of establishment is available inside the “About us”, “Overview” , “History” section of the exchange.

Table A4 Results of Johansen (1988) cointegration test

Country	Test Type and detail	P-values
Bangladesh	Unrestricted Cointegration Rank Test (Trace)	
	No. of CE(s)	
	None	0.00
	At most 1	0.34
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None	0.00
	At most 1	0.34
Kenya	Unrestricted Cointegration Rank Test (Trace)	
	No. of CE(s)	
	None *	0.08
	At most 1	0.77
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None *	0.04
	At most 1	0.77
Hongkong	Unrestricted Cointegration Rank Test (Trace)	
	No. of CE(s)	
	None	0.35
	At most 1	0.65
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None	0.31
	At most 1	0.65
Indonesia	No. of CE(s)	
	None	0.17
	At most 1	0.56
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None	0.15
	At most 1	0.56
Korea	Unrestricted Cointegration Rank Test (Trace)	
	No. of CE(s)	
	None	0.16
	At most 1	0.69
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None	0.11
	At most 1	0.69
Malaysia	Unrestricted Cointegration Rank Test (Trace)	
	No. of CE(s)	
	None	0.11
	At most 1	0.98
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None	0.03
	At most 1	0.98
Pakistan	Unrestricted Cointegration Rank Test (Trace)	
	No. of CE(s)	
	None *	0.28
	At most 1	0.54
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None *	0.28
	At most 1	0.54
Singapore	Unrestricted Cointegration Rank Test (Trace)	
	No. of CE(s)	
	None	0.82
	At most 1	0.98
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None	0.61
	At most 1	0.98
SriLanka	Unrestricted Cointegration Rank Test (Trace)	
	No. of CE(s)	
	None *	0.42
	At most 1	0.33
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None *	0.64
	At most 1	0.33
Thailand	Unrestricted Cointegration Rank Test (Trace)	
	No. of CE(s)	
	None *	0.09
	At most 1	0.49
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None *	0.08
	At most 1	0.49

Table A5. Results of Johansen Cointegration Test: Nepal

Country	Test Type and detail	P-values
Nepal	Unrestricted Cointegration Rank Test (Trace)	
	No. of CE(s)	
	None	0.0671
	At most 1	0.6196
	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)	
	No. of CE(s)	
	None *	0.0409
	At most 1	0.6196

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