FINANCIAL LIBERALIZATION AND STOCK MARKET EFFICIENCY

Maria-Lenuța ULICI, PhD student
Lect. Ioan Alin NISTOR, PhD
"Babeş-Bolyai" University, Cluj Napoca

1. Introduction

Before implementing the policies of stock markets liberalization, emerging stock markets were characterized, primarily, as having low liquidity and thin trading. In addition, these markets are less attractive than developed markets, as public funds are more expensive than bank loans. In this context, financial liberalization, a market reform recommended by the World Bank and International Monetary Fund, is considered a solution for emerging countries to improve their national financial markets efficiency.

Since the liberalization of stock markets since the mid-1980s, there was the hope that the presence of foreign investors, leading to increased liquidity and transparency of the markets and provide price competition, will increase information efficiency. However, previous studies have not always been conclusive on the effect of stock market liberalization on the information efficiency of markets. In theory, there are two types of results often evoked.

First, financial liberalization would lead to an intensification of information efficiency due to the improved of three categories of economical and financial indicators:

- The quality of institutions, information and regulations: these factors make significant improvements because investors often require, as compensation for their capital contribution to emerging markets, greater transparency and higher quality financial reporting. Investment conditions and laws that protect shareholders should also be revised and improve them. All these things involve the application of international accounting standards and appropriate regulations relating to trading and the creation of new institutions to ensure the smooth functioning of financial markets. Together, these changes will help to reduce information asymmetry between foreign and domestic investors and to eliminate internal trading before disseminating relevant information on price movements.
- Market liquidity: as the contribution of foreign capital increases as a result of removing barriers from investment (capital controls, exchange rate and interest rates, restricting access, limiting foreign holdings), liquidity conditions in emerging markets are increasing considerably. Improving liquidity provides both categories of investors the posibility to exploit all opportunities for arbitrage that may exist. As soon as arbitrage opportunities disappear from the market, prices will return to their efficient levels. Note that increased liquidity will accelerate the speed of convergence market to efficiency since the ajustated price to new information will be instantaneous and complete.

[1] ***Investing in people!***
Ph.D. scholarship, Project co-financed by the SECTORAL OPERATIONAL PROGRAM FOR HUMAN RESOURCES DEVELOPMENT 2007 – 2013 Priority Axis 1. "Education and training in support for growth and development of a knowledge based society" Key area of intervention 1.5: Doctoral and post-doctoral programs in support of research. Contract nr.: POSDRU 6/1.5/S/4 – "DOCTORAL STUDIES, A MAJOR FACTOR IN THE DEVELOPMENT OF SOCIO-ECONOMIC AND HUMANISTIC STUDIES" Babeş-Bolyai University, Cluj-Napoca, Romania"

- The size and depth of the market: the increase in size (capitalization) and depth may also lead to a higher level of market efficiency. For example, the adoption of electronic trading and listing, which did not happen in many emerging markets before market liberalization, significantly reduces transaction costs and accelerates the full incorporation speed of new information into prices. Also, sources of markets inefficiency diminish as market players become more specialized.

Secondly, stock markets liberalization of may also lead to inefficiency information. Thus, many investors from a national market and a greater information asymmetry could amplify price deviations from their fundamental value. In addition, the high liquidity accompanied by free mobility of capital flows could be a barrier to market efficiency because it generates bubbles (ie positive correlated return at the begining and negative returns before the start of bursting bubble). Finally, increasing the irrational behavior of market participants (herd behaviour / group mentality, speculative transactions, etc.) during the post-liberalization period may also prevent or slow down the efficiency process of convergence [Arouri et al. (2010)].

The paper is structured as follows. Section 2 presents studies that have examined the link between stock markets liberalization and weak form efficiency hypothesis. Section 3 presents the research methodology used. Section 4 describes the data. Section 5 discusses the results of the estimation variances ratio test proposed by Lo-MacKinlay. Section 6 presents conclusions on the impact of liberalization on the efficiency of analyzed financial markets.

2. Literature review

In empirical studies, the authors`s attention is focused mainly on changes in weak form efficiency in the stock markets before and after liberalization. Date of financial liberalization is used to separate the two sub-periods. Null hypotheses that were tested included, among others, tests of autocorrelation and random walk of returns.

Groenewold and Ariff (1998) empirically tested the weak form efficiency hypothesis in a sample of four Asian emerging markets (Indonesia, South Korea, Malaysia and Taiwan). These authors attempt to explain changes that occur in the informational efficiency levels as a result of financial liberalization. Using a standard regression between present and past returns, autocorrelation tests and unit root test, they showed that they reject the hypothesis that emerging markets become more efficient after financial liberalization.

Kawakatsu and Morey (1999) examine whether stock prices of nine emerging markets behave better after liberalization. In fact, they try to see if past returns and risk rate have the power for predictability of future returns using a first order autoregressive model. It is worth mentioning that they used unit root tests to check the robustness of the results obtained from tests of serial correlation and data on financial liberalization of Henry (2000), Kim and Single (2000) as well as break points between ante and post liberalization periods. The authors found that their sample of emerging markets are already efficient, even before the liberalization process is implemented. This means that liberalization does not significantly affect the emerging markets efficiency.

In contrast, using the variance ratio test of Lo-MacKinlay (1988) to analyzed the weak form efficiency hypothesis, Kim and Single (2000) showed that market liberalization has led prices to behave more efficiency in emerging markets. In other words, evidence of reduced dependence between price movements during the most recent period suggests that market liberalization leads to more efficient markets.

Nguyen and Fontaine (2008) investigate whether stock market liberalization has led to improved weak form efficiency on emerging stock markets from eight countries (Argentina, Brazil, Chile, Colombia, Malaysia, Mexico, Thailand and Venezuela) by using monthly returns of indices. They used a dynamic model to measure predictability returns and found that stock markets in Mexico and Venezuela have been engaged in a process of gradual convergence towards weak form efficiency, after initially had short periods of inefficiency in the early period. By contrast, stock markets in Chile and Colombia have begun with several short periods of efficiency, but they have become ineffeciently by the end of the period under review. The other markets kept their efficiency, as they have been efficiente, even before the actual liberalization, the obtained results are consistent with the findings of Kawakatsu and Morey (1999). Using a dummy variable regression, they found significant links between market liberalization and information efficiency, but could not reach a clear conclusion on the impact of liberalization (positive / negative) as the empirical results tend to be specific to each country. These results do not change when control variables are taken into account.

Cajueiro et al. (2009) analyzes the impact of financial liberalization on weak form efficiency in the Greek stock market. In their research was used the generalized Hurst exponent (GHE) on the daily closing stock index for the period January 1987 to April 2005. They concluded that the implementation of liberalization process has a positive impact on the degree of stock market efficiency in Greece.

Overall, the empirical results illustrate the differences between economic expectations regarding the impact of financial liberalization.

3. Methodology research

In order to analyze the weak form efficiency hypothesis, we used the variance ratio test proposed by Lo and MacKinlay (1988, 1989). This test is based on the fact that, for a series that follows a random walk, variance differences of order *k* is k times the variance of its first differences [Belaire-Franchi and Contreras (2004)].

The hypothesis to be tested is:

H_0: series follows a random walk

H_1: the series does not follow a random walk.

Let $\{X_t\}$ be a time series, t = 1,2,3 ... T. The variance ratio statistic of *k* order difference is defined as:

$$VR(k) = \frac{\hat{\sigma}^2(k)}{\hat{\sigma}^2(1)}$$

where:

$$\hat{\sigma}^2(k) = \frac{1}{m}\sum_{t=k}^{T}(X_t - X_{t-k} - k\hat{\mu})^2$$

$$m = \frac{k(T-k+1)(T-k)}{T}$$

$$\hat{\mu} = \frac{1}{T}\sum_{t=1}^{T}(X_t - X_{t-1})$$

and:

$$\hat{\sigma}^2(1) = \frac{1}{T-1}\sum_{t=1}^{T}(X_t - X_{t-1} - \hat{\mu})^2$$

The statistical testof $M_1(k)$ is:

$$M_1(k) = \frac{VR(k)-1}{\phi(k)^{1/2}}$$

Under the assumption that the residues are independent and identically distributed following a normal law, statistics converge in probability to zero and has the asymptotic distribution:

$$\phi(k) = \frac{2(2k-1)(k-1)}{3kT}$$

In order to take account of the conditional heteroscedasticity displayed

by X_t series (ARCH-type variance), Lo-MacKinlay calculate a new statistic:

$$M_2(k) = \frac{VR(k) - 1}{\phi^*(k)^{1/2}}$$

where:

$$\phi^*(k) = \sum_{j=1}^{k-1} \left[\frac{2(k-j)}{k} \right]^2 \delta(j)$$

$$\delta(j) = \frac{\sum_{t=j+1}^{T} (X_t - X_{t-1} - \hat{\mu})^2 (X_{t-j} - X_{t-j-1} - \hat{\mu})^2}{\left[\sum_{t=1}^{T} (X_t - X_{t-1} - \hat{\mu})^2 \right]^2}.$$

4. Data

To test various aspects regarding the behavior of stock market indices, following the implementation of the capital markets liberalization, we used daily closing rates of the six indices from emerging capital markets of Europe: Hungary (BUX), Poland (WIG), Czech (PX), Slovenia (SIB), Slovakia (SAX) and Romania (BET) (table 1).

Analyzed time interval begins on the first day of listing of each index and ending on June 30, 2011 (except for the Slovenian stock exchange index). All of these indices closing values are collected from Datastream database and are denominated in local currency.

We analyzed the informational efficiency of stock markets ante-, respectively post- liberalization. We considered the breaking point the official date of capital markets liberalization (Table 1).

Table 1: The sample of analyzed stock exchange indices

Stock market indices	Analyzed period	Official date of stock market liberalization
BUX	2 jan. 1991 - 30 jun. 2011	jul. 2001
WIG	16 apr. 1991 - 30 jun. 2011	jan. 2001
PX	7 sept. 1993 - 30 jun. 2011	jan. 2001
SIB	3 jan. 1994 - 14 oct. 2010	jan. 2002
SAX	3 jul. 1995 - 30 jun. 2011	jan. 2001
BET	19 sept. 1997 - 30 jun. 2011	jan. 2006

Source: Author`s processing

Based on these data we calculated the logarithmic daily returns using closing prices of each trading day, as follow:

$$R_{i,t} = \ln\left(\frac{C_{i,t}}{C_{i,t-1}} \right);$$

where:

$R_{i,t}$ – return ratio of index *i* at moment *t*

$C_{i,t}$ – closing price of index *i* at moment *t*

$C_{i,\,t-1}$ - closing price of index *i* at moment *t-1*.

5. Empirical results

Lo-MacKinlay test was applied to both the initial data and on the corrected data, respectively before and after the implementation of financial liberalization. Data was processed by using the ***R*** program.

As for the test statistics: M1 and M2, it follows asymptotically standard normal-law. As a result the calculated values are compared with tabular values for 1% significance threshold, 5% and 10%: 2.576, 1.96, respectively 1.645. If it exceeds the interval for the critical values, then the statistic is significant. Random walk hypothesis is rejected only if there are more than 2 rejection to any of the three thresholds of significance (1%, 5% and 10%).

Overall, poor trading leads to the rejection of random walk hypothesis. The only stock market that accepts the null hypothesis is stock market in Slovakia (for all holding periods) (Annexe 1) in pre-liberalization period. In the following period more markets support the random walk hypothesis: Hungary and Czech Republic (both heteroscedastic and

homoscedastic series), respectivelly Romania (for heteroscedastic series) (Annexe 2).

Elimination of thin trading results in accepting the random walk hypothesis by all analyzed emerging markets, both before and after liberalization (except Polish and Slovenian stock markets that reject the null hypothesis only for periods of possession that k = 10,20,40, respectivelly k = 5,10,20).

6. Conclusion

Previous studies draw our attention to the fact that thin and infrequent trading, which characterized developing markets, also induce a series of errors among the results. Thus, the ratio variance test was applied to both the initial indices and on the corrected ones, respectively before and after the stock markets liberalization. There is a difference between the outcomes obtained for unadjusted data and corrected series, which confirm the fact that the six analyzed indices sufffer from the phenomenon of infrequent trading. However, following the finalization of liberalization process, all markets are weak form efficiency.

Test results are consistent with the findings obtained by Kim and Single (2000) and Cajueiro et al. (2009): there is a positive link between the emerging stocck markets liberalization and weak form efficiency hypothesis.

Acknowledgement

The authors wish to thank for the financial support provided from the program co-financed by THE SECTORAL OPERATIONAL PROGRAM FOR HUMAN RESOURCES DEVELOPMENT, Contract POSDRU 6/1.5/S/4 – "DOCTORAL STUDIES, A MAJOR FACTOR IN THE DEVELOPMENT OF SOCIO-ECONOMIC AND HUMANISTIC STUDIES.

REFERENCES

Arouri, M. El H., Jawadi, F. şi Nguyen, D.K.	The Dynamics of Emerging Stock Markets, *Physica-Verlag GmbH & Co, France*, 2010
Belaire-Franch, G. & Contreras, D	Ranks and signs-based multiple variance ratio tests, *Working paper*, University of Valencia, 2004
Cajueiro, D.O., Gogas, P. şi Tabak, B.M.	Does financial market liberalization increase the degree of market efficiency? The case of the Athens stock exchange, *International Review of Financial Analysis*, vol. 18, pp. 50-57, 2009
Groenewold, N., & Ariff, M.	The Effects of Deregulation on Share-Market Efficiency in the Asia-Pacific, International Economic Journal, vol. 12, issue 4: 23-47, 1998
Henry, P.B.	Stock market liberalization, economic reform and emerging market equity prices, *The Journal of Finance*, vol. 55, issue 2: 529-563, 2000
Kawakatsu, H. & Morey, M. R.	Financial Liberalization and Stock Market Efficiency: An Empirical Examination of Nine Emerging Market Countries, *Journal of Multinational Financial Management*, vol. 9: 353-371, 1999
Kim, E.H. & Singal, V.	Stock market openings: experience of emerging economies, Journal of Business, vol. 73, issue 1: 25-66, 2000
Lo, A. W. & MacKinlay, A. C.	Stock market prices do not follow random walks: Evidence from a simple specification test, *Review of Financial Studies*, vol. 1, no. 1: 41-66, 1988
Lo, A. W. & MacKinlay, A. C.	The size and power variance ratio test in finite samples: a Monte Carlo investigation, *Journal of Econometrics*, vol. 40, 203–238, 1989
Nguyen, D.K. & Fontaine, P.	Stock Market Liberalization and Informational Efficiency in Emerging Markets: New Consideration and Tests, *Bankers, Markets and Investors*, No. 84, pp. 6-17, 2006.
*****	http://banker.thomsonib.com/

Annex 1: Lo-MacKinlay[2] results for the pre-liberalization period

Indices	k-holding periods	Non-ajusted		Ajustated	
		M1	M2	M1	M2
BUX	k=2	5.618589***	2.252107**	0.5464333	0.537406636
	k=5	4.50958***	2.021095**	0.252117802	0.249178345
	k=10	3.71251***	1.821693*	0.004764678	0.004713562
	k=20	6.103888***	3.169406***	0.42093781	0.417295004
	k=40	6.084615***	3.382088***	0.935802616	0.931340347
WIG	k=2	13.852819***	7.165308***	-0.1724614	-0.1722087
	k=5	10.71431***	5.751827***	1.1418403	1.1514991
	k=10	9.241776***	5.175853***	1.7437568*	1.7571341*
	k=20	8.253301***	4.912525***	1.8430595*	1.8558298*
	k=40	8.321059***	5.295257***	1.9875527**	2.0005711**
PX	k=2	17.82189**8	4.811861***	-0.9831588	-0.9822719
	k=5	23.05236***	6.870465***	-0.3509877	-0.3563775
	k=10	17.862533***	6.135841***	0.1081969	0.1096637
	k=20	15.164464***	6.223247***	0.6461428	0.6535845
	k=40	8.654373***	4.068068***	0.6064716	0.6124957
SIB	k=2	13.30121***	5.95038***	-1.400536	-1.413645
	k=5	8.399723***	4.03698***	-1.803075*	-1.812332*
	k=10	7.68592***	4.092628***	-2.172412**	-2.180123**
	k=20	7.488273***	4.363111***	-2.176339**	-2.174801**
	k=40	4.985229***	3.188439***	-1.615033	-1.614104
SAX	k=2	-0.9439201	-0.8644533	-0.55322116	-0.55046791
	k=5	-1.3571119	-1.135753	-0.48604121	-0.48540766
	k=10	-0.1847177	-0.1505218	-0.03124514	-0.03110906
	k=20	0.8291464	0.6926745	0.80972115	0.80579696
	k=40	1.0230882	0.8983403	0.74547391	0.74252132
BET	k=2	12.209112***	6.583852***	1.2545895	1.2610692
	k=5	10.034807***	5.788856***	0.449978	0.4512526
	k=10	8.403961***	5.406973***	0.3067872	0.3064998
	k=20	6.51003***	4.590404***	-0.8432933	-0.8402971
	k=40	5.977235***	4.532826***	-0.9528784	-0.9528579

Source: Author`s calculations in R

Note: *, ** and *** represent the rejection of the null hypothesis for significance levels of 1%, 5%, 10%.

[2] Critical values for the test are: 2.576 (1%), 1.96 (5%) and 1.645 (10%).

Annex 2: Lo-MacKinlay[3] results for the post-liberalization period

Indices	k-holding periods	Non-ajusted		Ajustated	
		M1	M2	M1	M2
BUX	k=2	2.6829128***	1.341844	-0.618631	-0.610937
	k=5	0.3004593	0.1609022	-0.1425403	-0.1428163
	k=10	0.18705	0.1042748	0.3224549	0.3238465
	k=20	0.243412	0.1384195	0.3739772	0.3751059
	k=40	0.6974339	0.4193846	-0.1261193	-0.1262583
WIG	k=2	4.240089***	3.544441***	0.7679403	0.7736927
	k=5	3.792811***	3.029984***	1.6185774	1.6346631
	k=10	3.363023***	2.571203**	1.6101696	1.6227294
	k=20	3.248769***	2.463162**	0.8411395	0.8485389
	k=40	2.797418***	2.152899**	0.663562	0.6690024
PX	k=2	2.4980241**	0.9777516	1.3911611	1.3817529
	k=5	-0.6029526	-0.237831	0.310307	0.3108314
	k=10	-0.245471	-0.1011603	0.238951	0.2395358
	k=20	0.74358	0.3191304	0.1224523	0.1226228
	k=40	1.3495449	0.6201803	0.6007915	0.6005757
SIB	k=2	7.779851***	2.348655**	1.2297015	1.22377228
	k=5	4.761818***	1.663491*	1.1822785	1.19132098
	k=10	3.912489***	1.597015	0.7494467	0.75778493
	k=20	5.504576***	2.598671***	0.7733826	0.77948265
	k=40	7.478041***	3.942999***	0.0814634	0.08165163
SAX	k=2	-0.1914047	-0.1558617	0.1064444	0.1046685
	k=5	0.4935057	0.4011083	-0.1237885	-0.1227298
	k=10	0.7968712	0.6496265	0.4808352	0.4757251
	k=20	2.0548717**	1.6435238	0.5282784	0.5206736
	k=40	2.5417662**	2.0876808**	0.5518987	0.5440399
BET	k=2	2.045251**	1.0765969	1.86348485*	1.8805742*
	k=5	0.7322438	0.4112034	0.08692081	0.08698906
	k=10	0.6749544	0.4083349	-0.30091602	-0.3011327
	k=20	2.2630477**	1.4412958	-0.19679001	-0.1970229
	k=40	2.8729774***	1.9338302*	0.04920048	0.04943854

Source: Author`s calculations in R

Note: *, ** and *** represent the rejection of the null hypothesis for significance levels of 1%, 5%, 10%.

[3] Critical values for the test are: 2.576 (1%), 1.96 (5%) and 1.645 (10%).