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Financial liberalization and stock market efficiency: an empirical examination of nine emerging market countries

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Abstract

The efficient markets hypothesis in finance suggests that as equity markets are liberalized and made more open to the public, equity prices should reflect the increased availability of information and be more efficiently priced. In this paper, we examine whether emerging market equity prices have become more efficient after financial liberalization. Using two sets of financial liberalization dates, a battery of econometric tests, and data from nine different countries, we find that in spite of theory suggesting the opposite, liberalization does not seem to have improved the efficiency of emerging markets. In fact, most of our statistical tests indicate that the markets were already efficient prior to the actual liberalization.

JEL classification: F30; F36

Keywords: Efficiency; Financial liberalization; Emerging markets

1. Introduction

Since the late 1980s, many emerging market countries have amended their laws to allow foreigners to legally invest in their markets. Foreign investors can now directly invest in emerging stock market equity, buy closed-end country funds, and

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even use American Depository Receipts to enter emerging stock markets. This is in contrast to the early 1980s when there was no legal method for foreigners to invest in emerging market equity.

The results of the financial liberalization been quite dramatic. In 1985, the flows of foreign portfolio investment into emerging markets were only US$138 million. By 1993, however, the Dow had increased to a remarkable US$45 billion. The foreign inflow of capital also helped spark a boom in emerging stock prices. As Henry (1997) notes, the real dollar price of all emerging market equity increased by more than 300% from December 1984 to December 1994.

In this article we examine how the behavior of emerging market stock prices of nine countries have changed in the wake of the movement towards financial liberalization. The efficient markets hypothesis in finance suggests that as markets are made more open to the public, prices should come to reflect the increased availability of information and be more efficiently priced. That is, as domestic and international investors have increased access to the market and the information surrounding the market, the current price should come to reflect all available information. In this paper we examine whether financial liberalization has indeed caused emerging market stock prices to behave more efficiently.

A number of researchers have started investigating various aspects of the economics of emerging markets (Claessens et al., 1995; Urrutia, 1995; Bekaert and Harvey, 1997). However, only a few papers have directly focused on the effect of financial liberalization on stock market efficiency. Kim and Singal (1997), using the Lo and MacKinlay variance ratios tests, examine 11 countries and find that, in general, liberalization improves efficiency. Our paper differs from other attempts, such as Kim and Singal, in that we use a battery of econometric tests to examine whether efficiency has improved. In addition to the variance ratio test, these tests include the split sample structural change and permutation tests, the relatively efficient unit root tests proposed by Kwiatkowski et al. (1992), Elliott et al. (1996). The results for most of our tests and for most of the countries in our sample indicate that there is no significant difference in the behavior of emerging stock market prices before or after liberalization. Hence, in spite of theory suggesting the opposite, we find little evidence in the data that liberalization has changed the behavior of emerging stock market prices.

The rest of the paper is organized as follows. In the next section we address some important issues relevant to the analysis of emerging markets data. Section 3 reports the empirical results and Section 4 concludes the paper with some remarks.

2. Issues

In order to assess the effect of market liberalization on the efficiency of the market, two issues must be addressed: identification of the liberalization date and how to measure efficiency.

2.1. Opening dates

A number of studies, Bekaert (1995), Buckberg (1995), Bekaert and Harvey (1997), DeSantis and Imrohoroglu (1997), Henry (1997), Kim and Singal (1997), have examined the opening dates of emerging stock markets. Of these studies, Henry and Kim and Singal use the most sophisticated methods to come up with these opening dates. Kim and Singal first survey the previous literature, including Bekaert and Buckberg, and then identify the liberalization date as 'the most significant liberalization of the market' (1997). They use actual opening dates, not the announcement dates. Henry, (1997), page 10, in addition to the legal opening dates, uses the establishment of the first country fund or a 'sharp increase' in the investability ratio (ratio of the market capitalization of stocks that foreigners can legally hold to total market capitalization) to identify the first opening date.

Both Kim and Singal (1997) and Henry (1997) note the difficulties of identifying the opening dates. First, liberalization is often a gradual process where restrictions to foreign investors are removed gradually. Moreover, there is a possibility that a once open market may temporarily restrict foreign investment under unusual circumstances. Second, the announcement of the opening dates typically precede the actual opening dates. If investors have rational expectations, the effect of market liberalization may appear around the announcement dates rather than the actual opening dates.

In this paper, we take the opening dates identified by Kim and Singal (1997) and Henry (1997) as given. As an informal check of the appropriateness of these opening dates,. we plot the recursive estimates of the parameters of interest. As reported in Section 3, we do not find conclusive evidence to choose one set of dates over the other and use both sets of dates in our empirical analysis.

2.2. Market efficiency

We test market efficiency in the weak-form (Fama, 1970), or by the predictability of the future returns by past returns (Fama, 1991). Following the literature in emerging markets, we measure the return at period t by

$$r_t = (\log p_t - \log p_{t-1}) - i_t$$

where p_t is the market price index at period t in US dollars and i_t is the US risk free rate of return at period t. In other words, r_t is the excess dollar return at period t. Local excess returns are not used since they would require (local) risk free rates, which are not available for many emerging market countries that do not issue risk free debt. Moreover, excess dollar returns do not involve transformation of local returns and are appropriate for intracountry comparisons.[1]

We test market efficiency by examining the predictability of the excess dollar returns by the regression

[1] Kim and Singal (1997) also use the excess US dollar return for their analysis of emerging stock markets.

$$r_t = a_0 = a_1 r_{t-1} + \text{residual}. \tag{1}$$

If the null hypothesis of efficient market is true, we should not be able to reject the hypothesis $a_0 = a_1 = 0$. Note that this is a test for a necessary (but not sufficient) condition for weak-form market efficiency.

As a robustness check of our results, we also test market efficiency by examining the regression

$$\log p_t = b_0 + b_1 \log p_{t-1} + \text{residual} \tag{2}$$

Using this regression, we test whether the (log) market price follows a random walk: $b_1 = 1$. Note that the random walk condition is a sufficient (but not necessary) condition for market efficiency.

We note that the simple AR(1) process assumed in Eqs. (1) and (2) may not adequately describe the observed data for r_t or $\log p_t$. In our empirical analysis, we account for the possible serial correlation left in the residuals by either including additional lags or using robust standard errors.

3. Empirical analysis

3.1. Data and country selection criterion

To calculate the dollar returns we use the dollar denominated, monthly global stock price indexes available from the emerging markets database (EMDB) at the International Finance Corporation (IFC). As of the end of 1997, 31 countries were included in the EMDB. For some countries data coverage is quite long, with data beginning in January 1976, while for others the inception of the data is quite recent; countries like Russia and Egypt have IFC indexes beginning in January 1997. For all the countries included in the EMDB, the price indexes include dividends and capital gains, and are quoted at the end of each month. To calculate the excess dollar returns we used the 3-month US treasury bill rates from Citibase as the risk free rate of return.

There are several advantages to using the IFC data as compared to other local stock price indexes. The IFC indexes are computed as consistently as possible across countries so that they are ideal for cross country comparisons. Moreover, the IFC indexes are relatively broad in their coverage of the market; the indexes are designed to cover at least 60% of the local market capitalization and to include the most active stocks in the market.

To select the countries for our study we used the following selection process. First, in order to minimize survivorship bias, we took all the IFC indexes with inception dates before January 1997. This left 26 countries. We then examined the liberalization dates given by Henry and Kim and Singal, and the starting date and ending date of the data. If a country had excess dollar return data for at least 30 observations in both the preliberalization period and the postliberalization period (using both the Henry or the Kim and Singal liberalization dates), the country was

included in our sample. This left nine countries: Argentina, Brazil, Chile, Colombia, India, Korea, Mexico, Thailand and Venezuela. For each country we used the longest period of data coverage. All data end at November or December 1997 and most data start from January 1976.[2]

3.2. Opening dates and their consistency with the data

The opening dates identified by Henry (1997), Kim and Singal (1997) are shown in Tables 1 and 2, together with descriptive statistics in each subsample (before and after liberalization) for the excess return series r_t. In order to verify these opening dates we examine the stability of the excess return series r_t.

The first method used to examine the data is to check the stability of the excess return series rig. The assumed data generating process for r_t is the AR(1) model from Eq. (1). Figs. 1 and 2 show the recursive OLS estimates of the constant (intercept) and slope coefficients by estimating Eq. (1) for each country adding one observation at a time. The dashed lines are the two standard error bounds and the two vertical lines are the opening dates identified by Henry and Kim and Singal.

The recursive constant terms in Fig. 1 are remarkably stable for all countries and do not significantly deviate from the no-arbitrage value of zero. More striking are the recursive slope coefficients shown in Fig. 2. For the three countries Chile, Korea, and Venezuela, the slope coefficient is fairly stable throughout the sample and there is no noticeable break around either of the two opening dates. For Argentina, Colombia, and Thailand, there is a single shift in the slope coefficient very close to the date identified by Henry. Note that the *direction* of the shift is not the same among these three countries. The slope coefficient for Colombia jumps upward but those for Argentina and Thailand plummet downward. For India, there appears to be two breaks corresponding to the two dates identified by Henry and Kim and Singal. The slope coefficient for India becomes volatile starting at Henry's date and stabilizes again at the Kim-Singal date. For Brazil, the slope coefficient is very volatile until the date identified by Kim and Singal, after which it stabilizes. Both the Henry and Kim–Singal dates miss the shift for Mexico.[3]

Fig. 3 shows the recursive residuals from recursive OLS estimation of Eq. (1) for each country.[4] The recursive residuals exhibit the following general characteristics:

- There tends to be a large forecasting error around the opening dates. These large errors may reflect either the uncertainty regarding the newly opened market or noise trading by uninformed investors.

[2] Exceptions are Colombia and Venezuela whose data start only from January 1985.

[3] The break in the Mexican case may be due to the major change in the trade and industrial policy that took place in 1986, well before financial liberalization.

[4] The recursive residuals are the (standardized) one-step prediction errors using the recursive coefficient estimates obtained from the regression up to the previous period.

Table 1
Summary statistics of excess dollar returns r_t (Henry opening dates)

	Pre	Post
Argentina		
Sample	1976:02–1989:11	1989:12–1997:11
Mean	0.014062	0.010213
Median	−0.000128	0.020304
Standard deviation	0.271499	0.152418
Skewness	0.103984	−0.507437
Kurtosis	6.069837	12.73855
Obs	166	96
Brazil		
Sample	1976:02–1988:02	1988:03–1997:11
Mean	−0.007018	0.014558
Median	−0.032520	0.014131
Standard deviation	0.139016	0.183531
Skewness	0.311159	−0.876081
Kurtosis	3.185441	6.924010
Obs	145	117
Chile		
Sample	1976:02–1987:04	1987:05–1997:11
Mean	0.013625	0.017953
Median	0.001220	0.010683
Standard deviation	0.119777	0.076247
Skewness	0.479266	0.066573
Kurtosis	4.152383	2.999399
Obs	135	127
Colombia		
Sample	1985:02–1991:12	1992:01–1997:12
Mean	0.023883	0.013397
Median	0.007049	0.003063
Standard deviation	0.072362	0.086977
Skewness	1.592612	0.868913
Kurtosis	6.929841	4.7434s4
Obs	83	72
India		
Sample	1976:02–1986:05	1986:06–1997:11
Mean	0.011040	−0.000456
Median	0.008743	−0.007575
Standard deviation	0.057943	0.092161
Skewness	0.273786	0.341363
Kurtosis	3.972485	3.724413
Obs	124	138
Korea		
Sample	1976:02–1987:05	1987:06–1997:12
Mean	0.008871	−0.0068s9
Median	0.000068	−0.013049
Standard deviation	0.090005	0.088207
Skewness	0.738449	−0.514007
Kurtosis	4.250909	5.430239
Obs	136	127

Table 1 (Continued)

	Pre	Post
Mexico		
Sample	1976:02–1989:04	1989:05–1997:11
Mean	0.003236	0.012135
Median	0.013181	0.024705
Standard deviation	0.154232	0.101650
Skewness	−2.037148	−1.514455
Kurtosis	11.94854	7.361666
Obs	159	103
Thailand		
Sample	1976:02–1987:12	1988:01–1997:11
Mean	0.006369	−0.001614
Median	−0.000956	0.003680
Standard deviation	0.071738	0.100500
Skewness	−0.800845	−0.910362
Kurtosis	11.61833	5.926370
Obs	143	119
Venezuela		
Sample	1985:02–1990:03	1990:04–1997:12
Mean	−0.006320	0.018673
Median	0.007822	0.007674
Standard deviation	0.130939	0.145164
Skewness	−2.427749	−0.750s97
Kurtosis	13.90146	6.530854
Obs	62	93

- The large errors around the opening dates are temporary and quickly revert to the preopening level. The temporary nature of the large errors suggests that uncertainty is resolved by learning or that noise trading errors are quickly corrected in the market. Either of these factors indicate that the postopening market is efficient.

3.3. Split sample tests

To formally test whether there has been a structural change in Eq. (1) before and after the opening of the market, we carry out two tests of structural change: the Chow breakpoint test and a Wald test. The Chow test is valid provided that the error variances are the same in the two subsamples, while the Wald test allows different variances in the two subsamples (though the distribution of the error terms are assumed to be independent between the two subsamples).[5] The results of the structural change tests are shown in Table 3.

[5] See Greene (1993), (sections 7.3 and 7.4) for a discussion of these tests.

Table 2
Summary statistics of excess dollar returns rig (Kim and Singal opening dates)

	Pre	Post
Argentina		
Sample	1976:02–1989:10	1989:11–1997:11
Mean	0.014668	0.009222
Median	0.000436	0.020107
Standard deviation	0.272213	0.161936
Skewness	0.097402	−0.489896
Kurtosis	6.042255	12.75374
Obs	165	97
Brazil		
Sample	1976:02–1991:04	1991:05–1997:11
Mean	−0.005052	0.020382
Median	−0.024106	0.018179
Standard deviation	0.171377	0.131036
Skewness	−0.457900	0.135160
Kurtosis	5.911267	4.498075
Obs	183	79
Chile		
Sample	1976:02–1989:09	1989:10–1997:11
Mean	0.014765	0.017327
Median	0.004108	0.010098
Standard deviation	0.115273	0.071063
Skewness	0.409121	0.245113
Kurtosis	4.179162	2.57396s
Obs	164	98
Colombia		
Sample	1985:02–1991:01	1991:02–1997:12
Mean	0.017747	0.020110
Median	0.005096	0.004017
Standard deviation	0.060217	0.093252
Skewness	0.708799	1.126218
Kurtosis	3.710942	5.047254
Obs	72	83
India		
Sample	1976:02–1992:10	1992:11–1997:11
Mean	0.008889	−0.007882
Median	0.006476	−0.023092
Standard deviation	0.075499	0.084857
Skewness	0.301012	0.250539
Kurtosis	4.976684	2.947816
Obs	201	61
Korea		
Sample	1976:02–1991:12	1992:01–1997:12
Mean	0.008214	−0.017133
Median	−0.002557	−0.017210
Standard deviation	0.088281	0.090057
Skewness	0.593920	−0.911547
Kurtosis	3.968708	6.538359
Obs	191	72

Table 2 (Continued)

	Pre	Post
Mexico		
Sample	1976:02–1989:04	1989:05–1997:11
Mean	0.003236	0.012135
Median	0.013181	0.024705
Standard deviation	0.154232	0.101650
Skewness	−2.037148	−1.514455
Kurtosis	11.94854	7.361666
Obs	159	103
Thailand		
Sample	1976:02–1988:07	1988:08–1997:11
Mean	0.009029	−0.005675
Median	0.000542	−0.002082
Standard deviation	0.072054	0.101312
Skewness	−0.774109	−0.877502
Kurtosis	11.13136	5.886196
Obs	150	112
Venezuela		
Sample	1985:02–1989:12	1990:01–1997:12
Mean	−0.007115	0.018380
Median	0.008317	0.007549
Standard deviation	0.132157	0.144040
Skewness	−2.488237	−0.736022
Kurtosis	14.00297	6.527905
Obs	59	96

Neither test rejects the null hypothesis that there is no structural change for all countries in the sample, except for Korea using the Kim–Singal dates. Although the recursive coefficients show a jump around the opening dates, the changes are mostly not statistically significant. Therefore the split sample estimates of Eq. (1) do not provide evidence that the efficiency of the market has changed before and after stock market liberalization. However, it is possible that the market may have adapted to the opening well before the actual opening at the time the opening was announced.

We have also tested the joint hypothesis $a_0 = a_1 = 0$ in Eq. (1) which is a necessary condition for market efficiency before and after the opening of each market. We test the hypothesis by a Wald test using a heteroskedasticity and autocorrelation consistent (HAC) covariance matrix.[6] The results are reported in Table 4.

[6] We use the automatic bandwidth selection procedure suggested by Newey and West (1994) to obtain the HAC covariance estimate.

For most countries, the null hypothesis cannot be rejected at conventional significance levels both before and after the opening of the market. This suggests that most markets satisfied the necessary conditions for market efficiency prior to the opening of the market. This is also consistent with the possibility that the market may have adapted to the opening well before the actual opening at the time the opening was announced.

3.4. Permutation tests

To check whether there has been any change in the distribution of the excess return series before and after liberalization, we compare the first four sample moments of the series before and after liberalization. Since it is well known that financial series have distributions that depart from normality, we carry out a nonparametric procedure that does not require any distributional assumptions. The

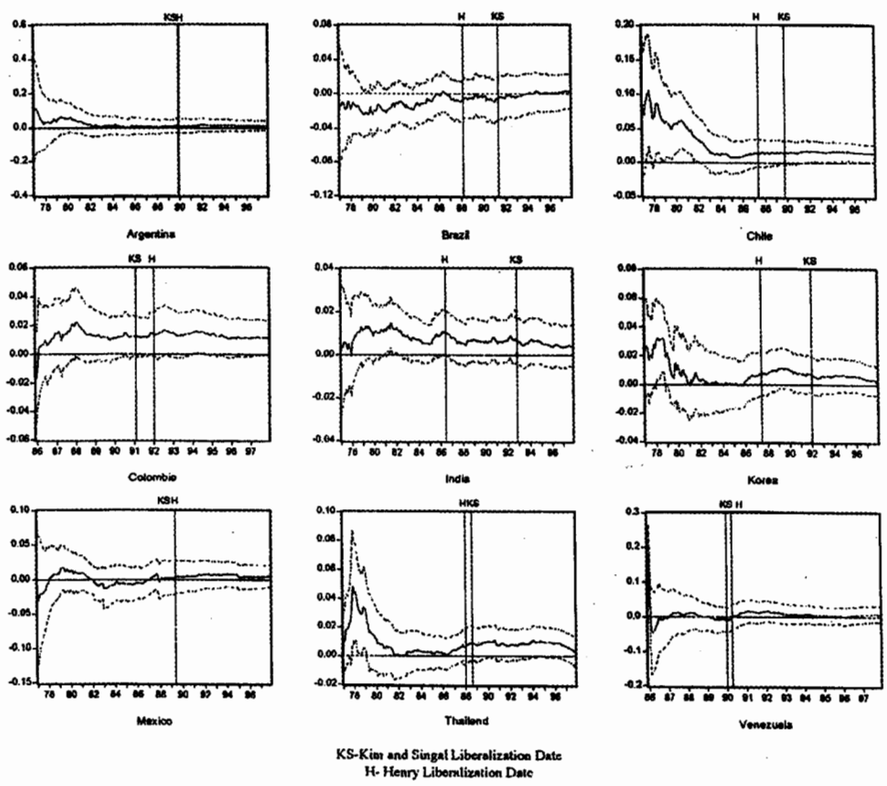

Fig. 1. Recursive coefficients (constant).

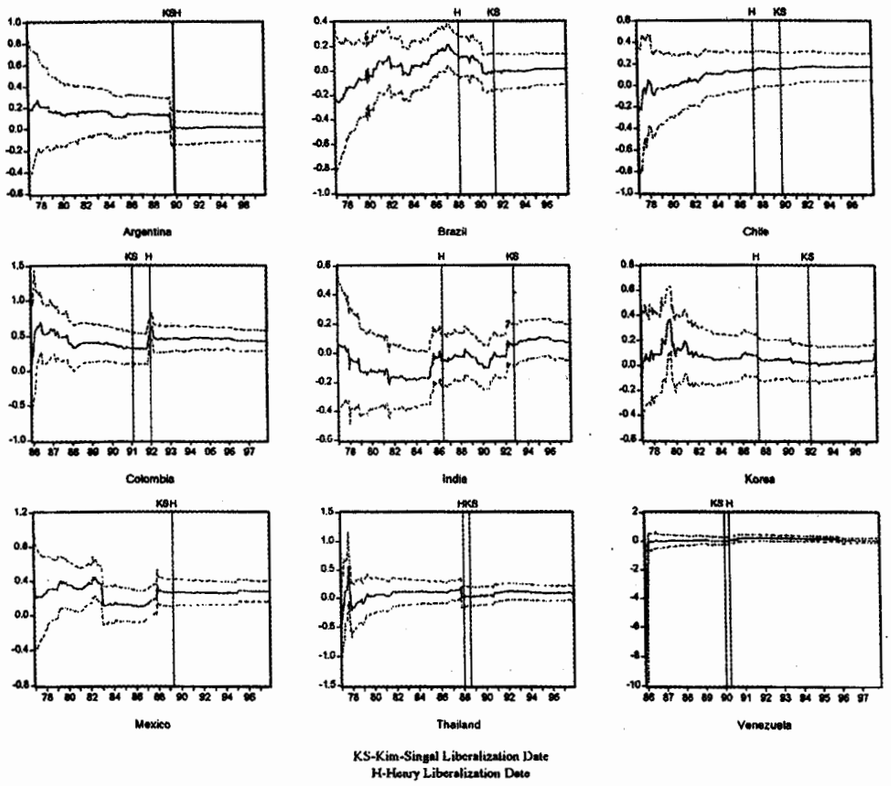

Fig. 2. Recursive coefficients (slope).

test we use is the two sample permutation test.[7] We pool the sample moments before liberalization from all countries in one group and the sample moments after liberalization in another group. We then compare the average moments within each group to those from the permutated groups. The results of the permutation tests are shown in Table 5.

The tests show no evidence of differences in the first four sample moments before and after liberalization. The recursive estimates and the permutation tests using the excess return series r_t show no indication of the change in the underlying distribution before and after liberalization.

[7] See Johnston and DiNardo (1997), (chapter 11) for an introduction to permutation tests.

3.5. Tests of random walks

We now turn to tests of market efficiency using the (log) market price index $\log p_t$. The hypothesis we test is whether $\log p_t$ follows a random walk, or contains a unit root. This is a sufficient condition for market efficiency (but not necessary) and is widely used as a test of market efficiency.[8]

There are several tests available for testing a unit root in a series. We present results from three tests. The first is the efficient unit root test proposed by Elliott et al. (1996), which, following Elliott et al. we call DF-GLS. The second is the test proposed by Kwiatkowski et al. (1992), which we call KPSS. While most of the unit root tests (including the DF-GLS test) take the unit root as the null hypothesis, the KPSS test tests the null hypothesis of a stationary root against the alternative of a

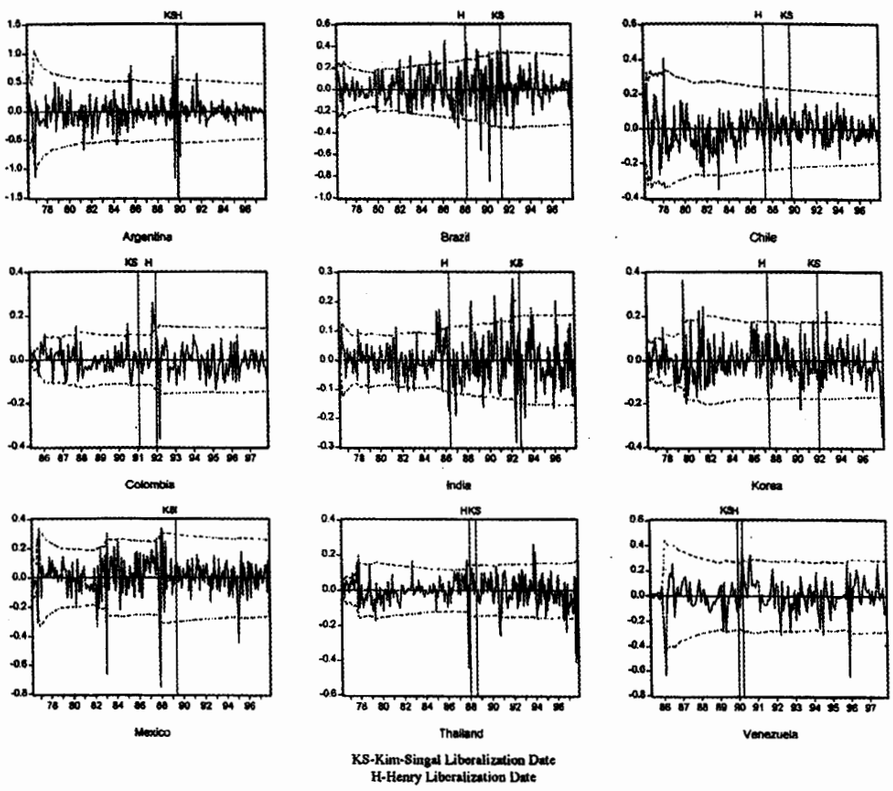

Fig. 3. Recursive coefficients (residuals).

[8] See Fama (1970) for references.

Table 3
Tests for structural change[a]

	Henry		Kim–Singal	
	Chow	Wald	Chow	Wald
Argentina	0.015	0.046	0.020	0.055
	(0.985)	(0.977)	(0.980)	(0.973)
Brazil	2.123	4.146	0.793	1.949
	(0.122)	(0.126)	(0.454)	(0.379)
Chile	0.568	1.424	0.284	0.899
	(0.568)	(0.491)	(0.753)	(0.638)
Colombia	0.544	1.082	0.402	0.984
	(0.581)	(0.582)	(0.670)	(0.612)
India	1.196	2.964	0.897	1.569
	(0.304)	(0.227)	(0.409)	(0.456)
Korea	1.004	2.008	4.749	9.700
	(0.368)	(0.366)	(0.009)*	(0.008)*
Mexico	0.090	0.224	0.090	0.224
	(0.914)	(0.894)	(0.914)	(0.894)
Thailand	0.465	0.919	0.930	1.722
	(0.629)	(0.632)	(0.396)	(0.423)
Venezuela	0.612	1.279	0.607	1.264
	(0.544)	(0.527)	(0.546)	(0.532)

[a] The null hypothesis is no structural change. Break points are those from Henry (1997) (Table 3) and Kim and Singal (1997), (Appendix). Numbers in ( ) are the *P*-values.
* Indicates significant at the 5% level.

Table 4
Wald tests for joint restriction $a_0 = a_1 = 0$ in Eq. (1)[a]

	Henry		Kim–Singal	
	Pre	Post	Pre	Post
Argentina	0.440	0.706	0.467	0.334
Brazil	2.906	2.031	0.222	3.784
Chile	4.038	21.739*	6.129*	12.590*
Colombia	14.344*	23.606*	17.785*	7.807*
India	7.147*	1.289	2.349	1.245
Korea	1.650	1.350	1.096	3.868
Mexico	5.024	7.487*	5.024	7.487*
Thailand	0.815	1.602	1.812	1.684
Venezuela	0.236	1.474	0.395	1.492

[a] χ^2 (2) 5% critical value, 5.99. Reported are χ^2 (Eq. (2)) statistics based on HAC covariance estimates obtained with the automatic bandwidth selection procedure of Newey and West (1994).
* indicates significant at the 5% level.

unit root. The third test is the variance ratio (VR) test proposed by Lo and MacKinlay (1988) and widely used in the finance literature.

Table 6 shows the results for the DF-GLS test. We include a constant and linear trend as exogenous regressors in the detrending regression. The DF-GLS test is a lower tail test and we reject the null hypothesis of a unit root in $\log p_t$ if the test statistic is to the left of the critical value. Most of the test statistics reject the hypothesis of a unit root in the (log) market price index both before and after

Table 5
Permutation tests[a]

	Henry	Kim–Singal
Mean	0.5902	0.5105
Median	0.8471	0.6937
Standard deviation	0.3729	0.2334
Skewness	0.3338	0.5831
Kurtosis	0.2655	0.2268

[a] The null hypothesis is no difference in moments before and after the breakpoints. Reported are one-sided P-values for 10 000 permutations.

Table 6
DF-GLS tests (nonstationary null hypothesis)

	Henry		Kim-Singal	
	Pre	Post	Pre	Post
DF-GLS (4 lags) 5% critical value: −2.89				
Argentina	−1.722	−1.590	−1.717	−1.458
Brazil	−1.813	−2.223	−2.018	−2.586
Chile	−0.979	−1.022	−1.011	−1.033
Colombia	−2.116	−1.962	−1.811	−1.285
India	−1.844	−2.142	−2.637	−2.059
Korea	−1.500	−0.498	−1.522	−0.338
Mexico	−1.619	−1.331	−1.619	−1.331
Thailand	−1.919	−0.041	−1.291	0.034
Venezuela	−1.595	−1.511	−1.504	−1.466
DF-GLS (12 lags) 5% critical value: −2.89				
Argentina	−1.726	−1.320	−1.736	−1.620
Brazil	−2.181	−2.271	−2.672	−3.104*
Chile	−1.641	−1.067	−1.820	−1.847
Colombia	−2.278	−1.765	−2.151	−2.214
India	−2.637	−1.662	−3.181*	−1.916
Korea	−1.893	−1.180	−2.116	−0.845
Mexico	−2.014	−1.444	−2.014	−1.444
Thailand	−2.403	−1.222	−2.181	−1.283
Venezuela	−2.598	−1.584	−2.515	−1.783

* Indicates significance at the 5% level.

Table 7
KPSS tests (stationary null hypothesis)

	Henry		Kim–Singal	
	Pre	Post	Pre	Post
KPSS (4 lags) 5% critical value: 0.146				
Argentina	0.242*	0.284*	0.243*	0.279*
Brazil	0.374*	0.216*	0.297*	0.130
Chile	0.510*	0.507*	0.395*	0.361*
Colombia	0.275*	0.193*	0.277*	0.303*
India	0.205*	0.330*	0.202*	0.154*
Korea	0.277*	0.171*	0.609*	0.356*
Mexico	0.347*	0.404*	0.347*	0.404*
Thailand	0.247*	0.329*	0.319*	0.325*
Venezuela	0.215*	0.207*	0.190*	0.201*
KPSS (12 lags) 5% critical value: 0.146				
Argentina	0.120	0.145	0.121	0.143
Brazil	0.175*	0.119	0.143	0.089
Chile	0.219*	0.228*	0.168*	0.175*
Colombia	0.137	0.108	0.137	0.165*
India	0.102	0.175*	0.102	0.102
Korea	0.131	0.087	0.252*	0.176*
Mexico	0.151*	0.187*	0.151*	0.187*
Thailand	0.117	0.165*	0.145	0.165*
Venezuela	0.121	0.114	0.114	0.110

* Indicates significance at the 5% level.

market liberalization, suggesting that the stock market has been efficient before actual market opening.[9]

The results for the KPSS tests are shown in Table 7. As in the DF-GLS tests, we include a constant and linear trend as exogenous regressors in the detrending regression. The KPSS test is an upper tail test and we reject the null hypothesis of stationarity in favor of the unit root alternative if the test statistic is to the right of the critical value. The results are sensitive to the lag truncation of the Newey–West HAC covariance estimate.[10] The results for lag truncation 4, which is the lag order selected by the automatic procedure suggested by Newey and West (1994) for most of our subsample sizes, all reject the stationary null in favor of the unit root alternative (except for one subsample in Brazil). These results are consistent with the DF-GLS results and provide further evidence that the markets were fairly efficient even before liberalization.

[9] The exceptions are Brazil and India for the Kim–Singal dates with 12 lags. Liberalization of the Brazilian market has changed the log price process from I(1) to I(0), while the liberalisation of the Indian market has the converse effect of changing the log price process from I(0) to I(1).

[10] The results of the KPSS tests are also sensitive to the assumption of a linear trend in the series. We retain the linear trend in the detrending regression on the grounds that including an irrelevant regressor is less harmful than omitting a relevant regressor. This is also the advice in Campbell and Perron (1991).

However, the results for lag truncation 12 are mixed. The only case that is consistent with the market becoming more efficient after liberalization (I(0) to I(1)) is Thailand (both Henry and Kim–Singal samples), India (Henry samples), and Colombia (Kim–Singal samples).

The results of the variance ratio tests are shown in Table 8. Most of the tests fail to reject the null hypothesis of a random walk both before and after liberalization. This is consistent with the results from the DF-GLS tests. Chile is the country that rejects the random walk null before liberalization but fails to reject after liberalization in four out of the six tests. This suggests that liberalization has made the market more efficient in Chile.

Chow and Denning (1993) have proposed a multiple variance ratio test that corrects the size of the test by taking into account the joint testing nature of the test. The joint test of the three multiple variance ratio statistics (for lags 2, 6, and 12) are shown in Table 9.[11] For most countries the random walk null cannot be rejected both before and after liberalization. This is again consistent with the hypothesis that markets were already efficient by the time of liberalization.

4. Concluding remarks

The battery of tests applied to emerging market price indices do not provide evidence that markets became efficient by their opening to foreign investors. We emphasize, however, that we do not take this as evidence that liberalization has no effect on market efficiency and that there is no need for liberalization. There are several points we wish to make.

First, the liberalization dates that we used for testing are the dates when the market was officially liberalized. Liberalization is a gradual process and the plans to liberalize are usually announced well in advance of the actual opening date. If investors are rational, then the simple announcement of liberalization (if it is believed credible) should suffice to alter the nature of the market.[12] In fact, most of our statistical results indicate that the markets were already efficient prior to the actual opening date, suggesting the effect of forward looking investors.

Second, we have analysed only aggregate financial market data. In practice, financial liberalization is part of an economic reform package that includes other policy changes. In particular, it would be interesting to investigate (both theoretically and empirically) the joint effect of trade and financial liberalization.

[11] We use the critical values from the asymptotic studentized maximum modulus distribution (which is Gaussian) with size $\alpha = 0.05$.

[12] An alternative to using outside information to determine the opening dates is to use data based methods to detect a break in the series. See Kawakatsu and Morey (1998) on the use of endogenous structural break techniques to find the date of announcement.

Table 8
Variance ratio tests (nonstationary null hypothesis)[a]

	2 Lags		6 Lags		12 Lags	
	Pre	Post	Pre	Post	Pre	Post
Henry subsamples						
Argentina	0.022	0.020	0.018	−0.071	−0.094	0.048
	(0.200)	(0.284)	(0.071)	(−0.337)	(−0.274)	(0.140)
Brazil	0.126	−0.089	0.212	−0.364	0.510	−0.507
	(1.416)	(−0.850)	(0.980)	(−1.439)	(1.552)	(−1.305)
Chile	0.139	0.269	0.904	−0.026	1.670	−0.020
	(1.661)	(2.679)*	(4.099)*	(−0.106)	(4.986)*	(−0.058)
Colombia	0.325	0.455	0.436	1.779	0.399	2.720
	(1.708)	(2.703)*	(1 251)	(5 249)*	(0.919)	(5.844)*
India	−0.071	0.112	−0.125	0.047	0.188	−0.080
	(−0.643)	(1.083)	(−0.479)	(0 184)	(0.500)	(−0.220)
Korea	0.039	0.124	0.242	0.037	0.414	0.285
	(0.489)	(0.864)	(1.065)	(0.136)	(1.169)	(0.822)
Mexico	0.274	0.263	0.356	0.460	0.584	0.433
	(1∼758)	(1.339)	(1.092)	(1.199)	(1.353)	(0.887)
Thailand	0.012	0.023	0.409	0.211	0.826	0.321
	(0∼087)	(0.303)	(1.451)	(0.789)	(2.247)*	(0.860)
Venezuela	0.016	0.089	0.134	0.517	0.142	0.923
	(0∼138)	(0.694)	(0.504)	(1.919)	(0-339)	(2.467)*
Kim-Singal subsamples						
Argentina	0.011	0.023	0.002	−0.044	−0.095	0.064
	(0∼098)	(0.330)	(0.008)	(−0.198)	(−0.275)	(0.183)
Brazil	−0.001	0.019	−0.137	−0.112	−0.005	−0.437
	(−0.008)	(0.154)	(−0.660)	(−0.414)	(−0.016)	(−1.031)
Chile	0.158	0.262	0.721	0.240	1.359	0.281
	(2.011)	(2.641)*	(3.524)*	(0.946)	(4.392)*	(0.742)
Colombia	0.355	0.459	1.018	0.899	1.246	1.163
	(3.579)*	(2.040)*	(3.624)*	(1.842)	(2.916)*	(1.868)
India	0.056	0.164	−0.126	0.416	−0.097	0.275
	(0.547)	(1.675)	(−0.508)	(1.365)	(−0.285)	(0.598)
Korea	0.004	0.227	0.180	−0.050	0.412	−0.001
	(0.053)	(1.080)	(0.940)	(−0.133)	(1.404)	(−0.003)
Mexico	0.274	0.263	0.356	0.460	0.584	0.433
	(1.758)	(1.339)	(1.092)	(1.199)	(1.353)	(0.887)
Thailand	0.029	0.002	0.423	0.174	0.812	0.302
	(0.230)	(0.032)	(1.512)	(0.631)	(2.119)*	(0.784)
Venezuela	0.034	0.064	0.180	0.384	0.138	0.788
	(0.287)	(0.535)	(0.661)	(1.504)	(0.322)	(2.156)*

[a] The first row reports the variance ratio estimates minus one. Numbers in ( ) are the heteroskedasticity robust z-statistics.

* Indicates significant at the 5% level.

Table 9
Multiple variance ratio tests (nonstationary null hypothesis)[a]

	Henry		Kim–Singal	
	Pre	Post	Pre	Post
Argentina	0.274	0.337	0.275	0.330
Brazil	1.552	1.439	0.660	1.031
Chile	4.986*	2.679*	4.392*	2.641*
Colombia	1.708	5.844*	3.624*	2.040
India	0.643	1.083	0.547	1.675
Korea	1.169	0.864	1.404	1.080
Mexico	1.758	1.339	1.758	1.339
Thailand	2.247	0.860	2.119	0.7c°4
Venezuela	0.504	2.467*	0.661	2.156

[a] Critical value, 2.388.
* Indicates significant at the 5% level.

References

Bekaert, G., 1995. Market integration and investment barriers in emerging equity markets. World Bank Econ. Rev. 9, 75–107.

Bekaert, G., Harvey, C.R., 1997. Emerging equity market volatility. J. Financial Econ. 43, 22–77.

Buckberg, E., 1995. Emerging stock markets and international asset pricing. World Bank Econ. Rev. 9, 51–74.

Campbell, J.Y., Perron, P., 1991. Pitfalls and opportunities: what macroeconomists should know about unit roots. In: Blanchard, O., Fischer, S. (Eds.), NBER Macroeconomics Annual, vol. 6. MIT Press, Cambridge, pp. 141–201.

Chow, V.K., Denning, K.C., 1993. A simple multiple variance ratio test. J. Econom. 58, 385–401.

Claessens, S., Dasgupta, S., Glen, J., 1995. Return behavior in emerging stock markets. World Bank Econ. Rev. 9, 131–151.

DeSantis, G., Imrohoroglu, S., 1997. Stock returns and volatility in emerging financial markets. J. Intl Money Finance 16, 561–579.

Elliott, G., Rothenberg, T.J., Stock, J.H., 1996. Efficient tests for an autoregressive unit root. Econometrica 64, 813–836.

Fama, E.F., 1970. Efficient capital markets: a review of theory and empirical work. J. Finance 25, 383–417.

Fama, E.F., 1991. Efficient capital markets: II. J. Finance 46, 1575–1617.

Greene, W.H., 1993. Econometric Analysis. Macmillan.

Henry, P.B., 1997. Do stock market liberalizations cause investment booms? Working Paper, Massachusetts Institute of Technology.

Johnston, J., DiNardo, J., 1997. Econometric Methods. McGraw-Hill.

Kawakatsu, H., Morey, M., 1998. Stock market opening and efficiency in emerging stock market prices: an empirical examination using endogenous structural break techniques. Working Paper, Fordham University.

Kim, E.H., Singal, V., 1997. Stock market openings: experience of emerging economies. Working Paper, University of Michigan School of Business Administration.

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P., Shin, Y., 1992. Testing the null hypothesis of stationary against the alternative of a unit root. J. Econ. 54, 159–178.

Lo, A.W., MacKinlay, A.C., 1988. Stock market prices do not follow random walks: evidence from a simple specification test. Rev. Financial Stud. 1, 41–66.

Newey, W., West, K., 1994. Automatic lag selection in covariance matrix estimation. Rev. Econ. Stud. 61, 631–653.

Urrutia, J., 1995. Test of random walk and market efficiency for Latin American emerging equity markets. J. Financial Res. 18, 299–309.