The Journal of Financial Research • Vol. XXII, No. 4 • Pages 385–411 • Winter 1999

AN EMPIRICAL EXAMINATION OF FINANCIAL LIBERALIZATION AND THE EFFICIENCY OF EMERGING MARKET STOCK PRICES

Hiroyuki Kawakatsu
University of California, Irvine

Matthew R. Morey
Smith College

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 sixteen countries and three composite portfolios, 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 before the actual liberalization.

I. Introduction

Over the last decade, most emerging market countries have changed their laws to allow foreigners to invest legally in their markets. Foreign investors can now directly invest in emerging stock market equity, buy closed-end country funds, and 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 have been dramatic. In 1985, the flow of foreign portfolio investment into emerging markets was only $138 million. By 1993, however, the flow had increased to $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 percent from December 1984 to December 1994.

We wish to thank the referee for helpful comments.

In this article we examine how the behavior of emerging market stock prices has changed in the wake of the movement toward financial liberalization. The efficient markets hypothesis suggests that as markets are made more open to the public, prices should 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 reflect all available information. In this paper we examine whether financial liberalization has indeed caused emerging market stock prices to behave more efficiently.

Several researchers investigate the economics of emerging markets (Claessens, Dasgupta, and Glen (1995), Bekaert and Harvey (1997), Urrutia (1995)). However, only a few authors focus on the effect of financial liberalization on stock market efficiency. Kim and Singal (1997), using the Lo and MacKinlay (1988) variance ratios tests, examine eleven 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, we use the split-sample structural change and permutation tests and the relatively efficient unit root tests proposed by Elliott, Rothenberg, and Stock (1996) and Kwiatkowski, Phillips, Schmidt, and Shin (1992). The results for most of our tests and for most of the countries and composite portfolios in our sample indicate 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 that liberalization has changed the behavior of emerging stock market prices.

II. Issues

To assess the effect of market liberalization on market efficiency, we address two issues: identification of the liberalization date and how to measure efficiency.

Opening Dates

Several studies examine the opening dates of emerging stock markets. Of these, Henry (1997) and Kim and Singal (1997) use the most sophisticated methods to determine these opening dates. Kim and Singal first survey the previous literature including Bekaert (1995) and Buckberg (1995) and then identify the liberalization date as the most significant liberalization of the market. They use actual opening dates, not the announcement dates. Henry, in addition to using 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 in identifying the opening dates. First, liberalization is often a gradual process where restrictions to foreign investors are removed gradually. Moreover, 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.

Our approach to identifying the opening dates is to combine the dates identified by official documents with data-based methods. More specifically, we check whether the two sets of opening dates identified by Kim and Singal (1997) and Henry (1997) are consistent with the data. As reported in section III, 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.

Market Efficiency

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

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

where p_t is the market price index at period t in U.S. dollars and i_t is the U.S. 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 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

$$r_t = a_0 + a_1 r_{t-1} + \text{residual} \qquad (2)$$

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

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

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

$$\log p_t = b_0 + b_1 \log p_{t-1} + \text{residual} \quad (3)$$

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

III. Empirical Analysis

Data- and Country-Selection Criteria

To calculate the dollar returns, we use the dollar-denominated, monthly global stock price indexes available from the Emerging Markets Major Database (EMDB) at the International Finance Corporation (IFC). As of the end of 1997, thirty-one countries were included in the EMDB. For some countries data coverage is long, with data beginning in January 1976. For other countries data coverage is short, with IFC indexes beginning in January 1997 for countries such as Russia and Egypt. 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 use the three-month U.S. Treasury bill rates from Citibase as the risk-free rate of return.

Using the IFC data offers several advantages over using 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 market coverage; the indexes are designed to cover at least 60 percent of the local market capitalization and to include the most active stocks in the market.

We use sixteen countries in our analysis: Argentina, Brazil, Chile, Colombia, Greece, India, Korea, Malaysia, Mexico, Pakistan, Philippines, Taiwan, Thailand, Turkey, Venezuela, and Zimbabwe. We choose these countries because: (1) Henry (1997) and/or Kim and Singal (1997) provide opening dates for the country's stock market; and 2) each country had more than twelve observations of stock price data on each side of the opening date.[2] Table 1 presents all of the countries that were available from the IFC major emerging market index, the stock price sample availability (as of the end of December 1997), the Henry (1997) and Kim and Singal (1997) opening dates, and the reason we excluded a country from

[2]Portugal was the only country that was excluded on this second criterion.

TABLE 1. Stock Price Sample Availability, Opening Dates, and Reasons For Exclusion.

		Opening Dates		
Country	Sample	Henry (H)	Kim-Singal (KS)	Reason for Exclusion
Argentina	1976.01–1997.12	89.12	89.11	Included.
Brazil	1976.01–1997.12	88.03	91.05	Included.
Chile	1976.01–1997.12	87.05	89.10	Included.
China	1993.11–1997.12	NA	NA	No opening dates provided by H or KS.
Colombia	1985.01–1997.12	92.01	91.02	Included.
Czechoslovakia	1994.01–1997.12	NA	NA	No opening dates provided by H or KS.
Egypt	1997.02–1997.12	NA	NA	No opening dates provided by H or KS.
Greece	1976.01–1997.12	NA	86.08	Included. Only use KS opening date; no opening date provided by H.
Hungary	1994.01–1997.12	NA	NA	No opening dates provided by H or KS.
India	1976.01–1997.12	86.06	92.11	Included.
Indonesia	1990.01–1997.12	NA	89.09	KS opening date before availability of stock price data; no opening date provided by H.
Jordan	1978.02–1997.12	NA	78.01	KS opening date before availability of stock price data; no opening date provided by H.
Korea	1976.01–1997.12	87.06	92.01	Included.
Malaysia	1985.01–1997.12	87.02	Before 85.01	Included. Only use H opening date; KS opening date is before stock price data.
Mexico	1976.01–1997.12	89.05	89.05	Included.
Morocco	1997.02–1997.12	NA	NA	No opening dates provided by H or KS.
Nigeria	1985.01–1997.12	NA	Not open	No opening date provided by H; consider to be not open according to KS.
Pakistan	1985.01–1997.12	NA	91.02	Included. Only use KS opening date; no opening date provided by H.
Peru	1993.10–1997.12	NA	NA	No opening dates provided by H or KS.
Philippines	1985.01–1997.12	86.05	86.03	Included.

(Continued)

TABLE 1. Continued.

Country	Sample	Opening Dates		Reason for Exclusion
		Henry (H)	Kim-Singal (KS)	
Poland	1994.01–1997.12	NA	NA	No opening dates provided by H or KS.
Portugal	1986.02–1997.12	NA	86.07	No opening date provided by H. The opening date provided by KS is too close to the beginningof the stock price data (five months) to test the period before the opening date.
Russia	1997.02–1997.12	NA	NA	No opening dates provided by H or KS.
Slovakia	1997.02–1997.12	NA	NA	No opening dates provided by H or KS.
South Africa	1994.02–1997.12	NA	NA	No opening dates provided by H or KS.
Sri Lanka	1993.10–1997.12	NA	NA	No opening dates provided by H or KS.
Taiwan	1985.01–1997.12	NA	91.01	Included. Only use KS opening date: no opening dates provided by H.
Thailand	1976.01–1997.12	88.01	88.08	Included.
Turkey	1987.01–1997.12	NA	89.08	Included. Only use KS opening date; no opening dates provided by H.
Venezuela	1985.01–1997.12	90.04	90.01	Included.
Zimbabwe	1976.01–1997.12	NA	93.01	Included. Only use KS opening date; no opening dates provided by H.

the analysis. Not all countries have opening dates identified by both Henry (1997) and Kim and Singal (1997). Also, for some countries in our sample, data availability before the opening date is short. For tests that require long lags, these countries were dropped if there were not enough observations to perform the test.[3]

Opening Dates and Breakpoints in the Data

The pre-opening and post-opening samples using the dates identified by Henry (1997) and Kim and Singal (1997) are shown in Table 2, together with descriptive statistics in each subsample (before and after liberalization) for the excess return series r_t. 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 a check on the stability of the excess return series r_t. The assumed data-generating process for r_t is the AR(1) model from equation (1). Figures I and II show the recursive ordinary least squares (OLS) estimates of the constant (intercept) and slope coefficients by estimating (1) for each country adding one observation at a time. The dashed lines are the two standard error bounds and the vertical lines are the opening dates identified by Henry (H) and Kim and Singal (KS).

The recursive constant terms in Figure I are stable for most countries and do not significantly deviate from the no-arbitrage value of zero. Possible exceptions are Chile and Taiwan, where the constant term drops from a positive value to zero after the opening date. This drop is consistent with the view that market efficiency increased after the opening date in these two countries.

More striking are the recursive slope coefficients shown in Figure II. For Chile, Greece, Korea, Turkey, Venezuela, and Zimbabwe, the slope coefficient is fairly stable throughout the sample and no noticeable break occurs around either of the two opening dates. For Argentina, Colombia, Pakistan, and Thailand, a single shift in the slope coefficient occurs near the opening date. The direction of the shift is not the same among these countries. The slope coefficients for Colombia and Pakistan jump upward, but those for Argentina and Thailand plummet downward. For Brazil, India, Mexico, and Taiwan, the slope coefficients move around before the opening date but stabilize thereafter. This pattern is consistent with the view that liberalization increases market efficiency. For the remaining two countries, Malaysia and Philippines, there are too few observations before the opening date to make any comparison before and after the opening date. The behavior of the slope coefficient for these two countries after the opening date is fairly stable, consistent with the view that liberalization has increased efficiency in these two countries.

---

[3]Countries that are excluded in certain tests are Malaysia, Philippines, and Turkey.

TABLE 2. Summary Statistics of Excess Dollar Returns.[a]

Country	Statistic	Before Henry	After Henry	Before Kim-Singal	After Kim-Singal
Argentina	Sample	76:02–89:11	89:12–97:11	76:02–89:10	89:11–97:11
	Mean	0.014	0.01	0.015	0.009
	Median	0	0.02	0	0.02
	Std. dev.	0.271	0.152	0.272	0.152
	Skewness	0.104	−0.507	0.097	−0.49
	Kurtosis	6.07	12.739	6.042	12.754
	No. of obs.	166	96	165	97
Brazil	Sample	76:02–88:02	88:03–97:11	76:02–91:04	91:05–97:11
	Mean	−0.007	0.015	−0.005	0.02
	Median	−0.033	0.014	−0.024	0.018
	Std. dev.	0.139	0.184	0.171	0.131
	Skewness	0.311	−0.876	−0.458	0.135
	Kurtosis	3.185	6.924	5.911	4.498
	No. of obs.	145	117	183	79
Chile	Sample	76:02–87:04	87:05–97:11	76:02–89:09	89:10–97:11
	Mean	0.014	0.018	0.015	0.017
	Median	0.001	0.011	0.004	0.01
	Std. dev.	0.12	0.076	0.115	0.071
	Skewness	0.479	0.067	0.409	0.245
	Kurtosis	4.152	2.999	4.179	2.574
	No. of obs.	135	127	164	98
Colombia	Sample	85:02–91:12	92:01–97:12	85:02–91:01	91:02–97:12
	Mean	0.024	0.013	0.018	0.02
	Median	0.007	0.003	0.005	0.004
	Std. dev.	0.072	0.087	0.06	0.093
	Skewness	1.593	0.869	0.709	1.126
	Kurtosis	6.93	4.743	3.711	5.047
	No. of obs.	83	72	72	83
Greece	Sample			76:02–86:07	86:08–97:11
	Mean			−0.017	0.012
	Median			−0.014	0.004
	Std. dev.			0.064	0.11
	Skewness			−0.322	0.821
	Kurtosis			3.458	6.205
	No. of obs.			126	136
India	Sample	76:02–86:05	86:06–97:11	76:02–92:10	92:11–97:11
	Mean	0.011	0	0.009	−0.008
	Median	0.009	−0.008	0.006	−0.023
	Std. dev.	0.058	0.092	0.075	0.085
	Skewness	0.274	0.341	0.301	0.251
	Kurtosis	3.972	3.724	4.977	2.948
	No. of obs	124	138	201	61
Korea	Sample	76:02–87:05	87:06–97:12	76:02–91:12	92:01–97:12
	Mean	0.009	−0.007	0.008	−0.017
	Median	0	−0.013	−0.003	−0.017
	Std. dev.	0.09	0.088	0.088	0.09
	Skewness	0.738	−0.514	0.594	−0.912
	Kurtosis	4.251	5.43	3.969	6.538
	No. of obs.	136	127	191	72

(Continued)

TABLE 2. Continued.

Country	Statistic	Before Henry	After Henry	Before Kim-Singal	After Kim-Singal
Malaysia	Sample	85:02–87:01	87:02–97:12		
	Mean	-0.007	-0.001		
	Median	-0.019	0.008		
	Std. dev.	0.08	0.088		
	Skewness	0.738	-1.546		
	Kurtosis	2.887	7.217		
	No. of obs.	24	131		
Mexico	Sample	76:02–89:04	89:05–97:11	76:02–89:04	89:05–97:11
	Mean	0.003	0.012	0.003	0.012
	Median	0.013	0.025	0.013	0.025
	Std. dev.	0.154	0.102	0.154	0.102
	Skewness	-2.037	-1.514	-2.037	-1.514
	Kurtosis	11.949	7.362	11.949	7.362
	No. of obs.	159	103	159	103
Pakistan	Sample			85:02–91:01	91:02–97:12
	Mean			0.004	0.006
	Median			0	-0.005
	Std. dev.			0.03	0.096
	Skewness			0.143	0.648
	Kurtosis			2.442	3.873
	No. of obs.			72	83
Philippines	Sample	85:02–86:04	86:05–97:12	85:02–86:02	86:03–97:12
	Mean	0.053	0.011	0.029	0.014
	Median	0.028	0.011	0.027	0.013
	Std. dev.	0.083	0.103	0.051	0.106
	Skewness	1.136	-0.092	0.187	-0.045
	Kurtosis	3.98	5.095	1.926	4.891
	No. of obs.	15	140	13	142
Taiwan	Sample			85:02–90:12	91:01–97:12
	Mean			0.021	0.001
	Median			0.045	-0.001
	Std. dev.			0.167	0.099
	Skewness			-0.566	1.098
	Kurtosis			3.742	5.815
	No. of obs.			71	84
Thailand	Sample	76:02–87:12	88:01–97:11	76:02–88:07	88:08–97:11
	Mean	0.006	-0.002	0.009	-0.006
	Median	-0.001	0.004	0.001	-0.002
	Std. dev.	0.072	0.1	0.072	0.101
	Skewness	-0.801	-0.91	-0.774	-0.878
	Kurtosis	11.618	5.926	11.131	5.886
	No. of obs.	143	119	150	112
Turkey	Sample			87:02–89:07	89:08–97:11
	Mean			0.034	0.008
	Median			0.008	-0.006
	Std. dev.			0.209	0.175
	Skewness			0.274	0.409
	Kurtosis			2.25	3.472
	No. of obs.			30	100

(Continued)

TABLE 2. Continued.

Country	Statistic	Before Henry	After Henry	Before Kim-Singal	After Kim-Singal
Venezuela	Sample	85:02–90:03	90:04–97:12	85:02–89:12	90:01–97:12
	Mean	−0.006	0.019	−0.007	0.018
	Median	0.008	0.008	0.008	0.008
	Std. dev.	0.131	0.145	0.132	0.144
	Skewness	−2.428	−0.751	−2.488	−0.736
	Kurtosis	13.901	6.531	14.003	6.528
	No. of obs.	62	93	59	96
Zimbabwe	Sample			76:02–92:12	93:01–97:11
	Mean			−0.004	0.026
	Median			−0.004	0.018
	Std. dev.			0.099	0.086
	Skewness			−0.249	0.234
	Kurtosis			4.396	3.403
	No. of obs.			203	59

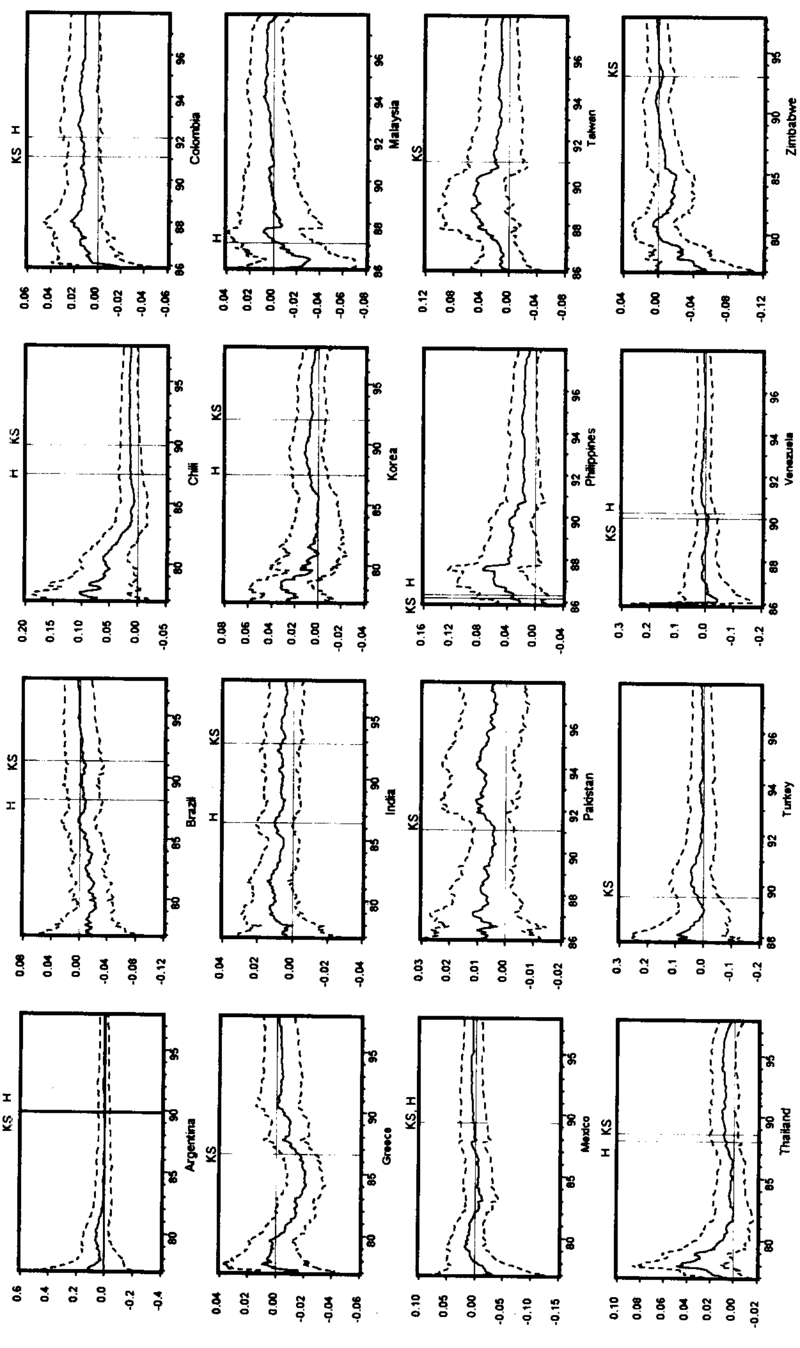
[a]A blank indicates the country was not included in the sample of Henry (1997) or Kim and Singal (1997).

Figure III shows the recursive residuals from recursive OLS estimation of equation (2) for each country.[4] For Argentina, Brazil, Colombia, Malaysia, and Thailand, the recursive residuals exhibit a large temporary spike around the opening date. This temporary spike may reflect noise that arises from uncertainty regarding the new regime. Indeed, inference from statistical tests may be clouded by this noise. In the next subsection we perform tests removing the noisy period surrounding the opening dates. For Greece, India, and Pakistan, the recursive residuals become more volatile after the opening date than before. This may simply reflect the increase in trading volume after the opening date and does not necessarily contradict the view that market efficiency increases after the opening date. Of the remaining countries, Mexico and Taiwan exhibit a few large spikes before the opening date but become less susceptible to "market-crash-like" shocks. Overall, the recursive coefficients and residuals exhibit a (visual) change in the generating process around the opening dates for many emerging markets. To access the significance of these changes, we resort to formal statistical tests.

Split-Sample Tests

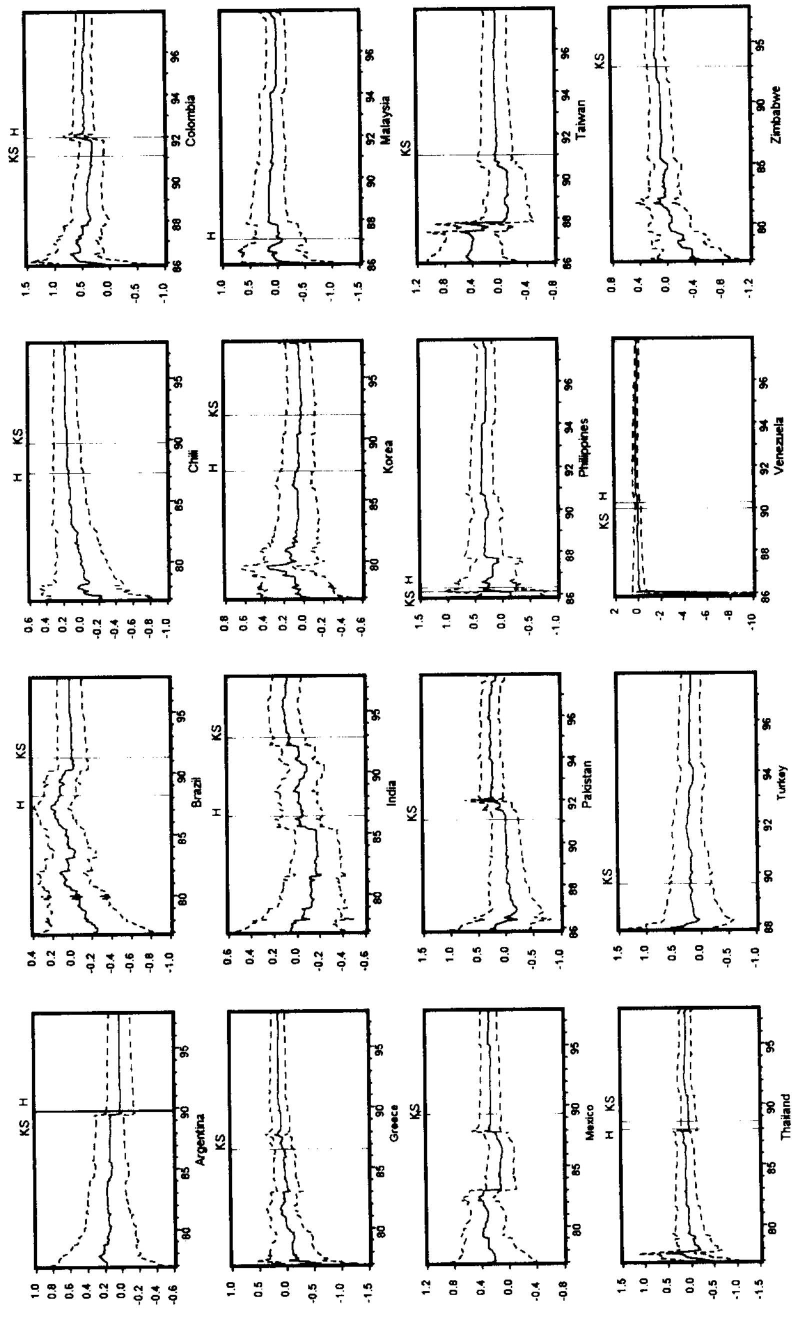
To test formally whether equation (2) undergoes a structural change before and after the opening of the market, we carry out two tests of structural change: the Chow breakpoint test and a Wald test (see Greene (1993) for a discussion of these

[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.



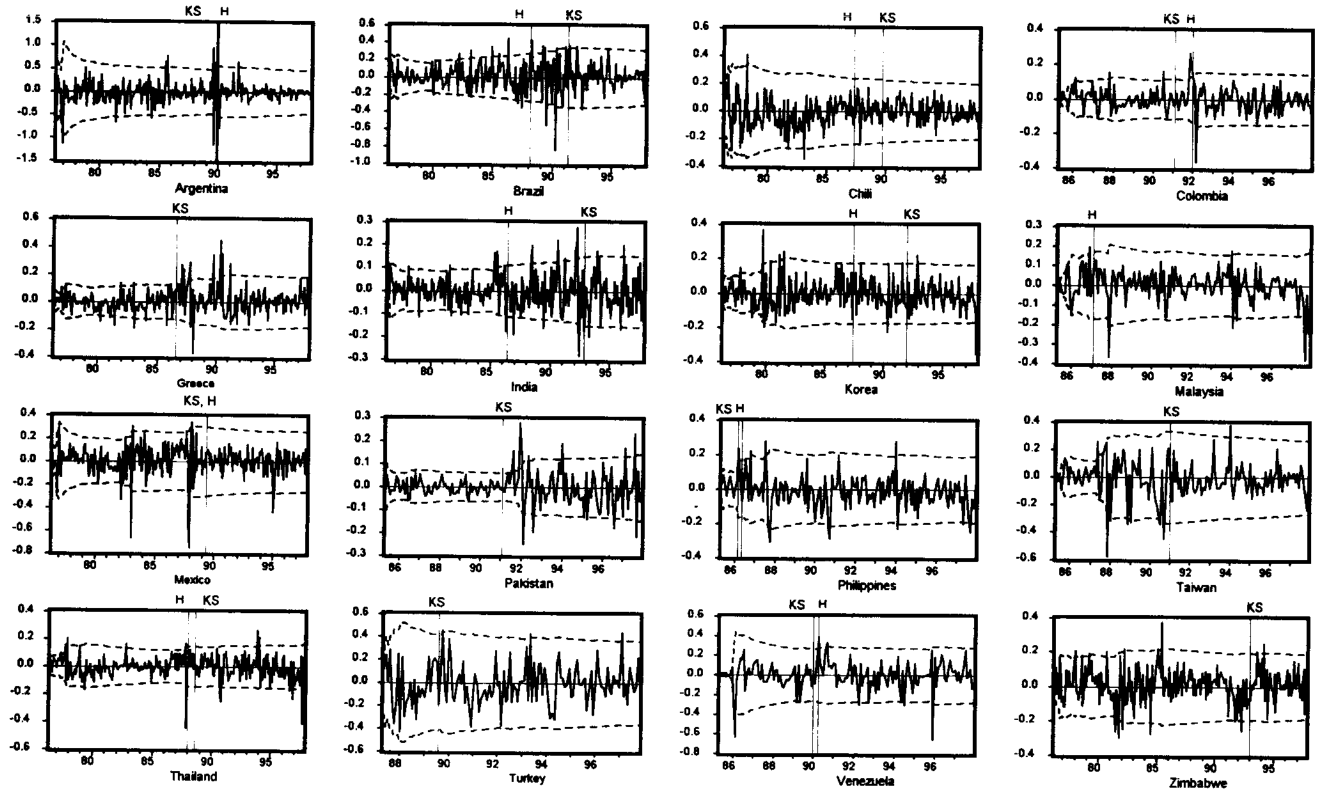
Note: The dashed lines are the two standard error bounds, and the vertical lines are the opening dates identified by Henry (H) (1997) and Kim and Singal (KS) (1997).

Figure 1. Recursive Coefficients (Constant).



Note: The dashed lines are the two standard error bounds, and the vertical lines are the opening dates identified by Henry (H) (1997) and Kim and Singal (KS) (1997).

Figure II. Recursive Coefficients (Slope).



Note: The dashed lines are the two standard error bounds, and the vertical lines are the opening dates identified by Henry (H) (1997) and Kim and Singal (KS) (1997).

Figure III. Recursive Residuals.

TABLE 3. Tests for Structural Change.

	Henry		Kim-Singal	
Country	Chow	Wald	Chow	Wald
Argentina	0.015	0.046	0.02	0.055
	[0.985]	[0.977]	[0.980]	[0.973]
Brazil	2.123	4.146	0.793	1.94
	[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]
Greece			3.015	6.655
			[0.051]	[0.036]**
India	1.196	2.964	0.897	1.569
	[0.304]	[0.227]	[0.409]	[0.456]
Korea	1.004	2.008	4.749	9.7
	[0.368]	[0.366]	[0.009]**	[0.008]**
Malaysia	0.599	1.284		
	[0.551]	[0.526]		
Mexico	0.09	0.224	0.09	0.224
	[0.914]	[0.894]	[0.914]	[0.894]
Pakistan			0.162	1.09
			[0.850]	[0.580]
Philippines	0.48	1.282	0.37	3.006
	[0.620]	[0.527]	[0.691]	[0.222]
Taiwan			0.418	0.78
			[0.659]	[0.677]
Thailand	0.465	0.919	0.93	1.722
	[0.629]	[0.632]	[0.396]	[0.423]
Turkey			0.245	0.41
			[0.783]	[0.815]
Venezuela	0.612	1.279	0.607	1.264
	[0.544]	[0.527]	[0.546]	[0.532]
Zimbabwe			1.708	3.963
			[0.183]	[0.138]

Note: The null hypothesis is no structural change. Break points are those from Henry (1997, Table 3) and Kim and Singal (1997, Appendix). Numbers in brackets are p-values. An empty space indicates there were data on only one side of the break date.

**Significant at the 5 percent level.

tests). The Chow test is valid provided 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). The results of the structural change tests are in Table 3.

Neither test rejects the null hypothesis that there is no structural change for all countries in the sample, except for Korea and Greece. Although the recursive

TABLE 4. Permutation Tests.

	Henry	Kim-Singal
Mean	0.35	0.519
Median	0.848	0.46
Std. dev.	0.42	0.341
Skewness	0.13	0.827
Kurtosis	0.393	0.444

Note: The null hypothesis is no difference in moments before and after the breakpoints. Reported are the one-sided p-values for 10,000 permutations.

coefficients show a jump around the opening dates, the changes are not statistically significant for the most part. Therefore, the split-sample estimates of equation (2) do not provide evidence that the market efficiency changed before and after stock market liberalization. However, the market may have adapted at the time the opening was announced rather than at the actual opening.

Permutation Tests

To check whether the distribution of the excess return series changes before and after liberalization, we compare the first four sample moments of the series before and after liberalization. Since financial series are known to have distributions that depart from normality, we perform a nonparameteric procedure that does not require distributional assumptions. The test we use is the two-sample permutation test as illustrated by Johnston and DiNardo (1997). 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 with those from the permutated groups, where the moments are split into two groups by drawing without replacement from the entire pre- and post-liberalization samples. Unlike the country-specific breakpoint tests, this pooling procedure ignores country-specific differences and focuses on the difference before and after liberalization. The results of the permutation tests are shown in Table 4.

The tests show no evidence of differences in the first four sample moments before and after liberalization. The breakpoint tests (Chow and Wald) under the generating process (2) and the permutation tests for the sample moments of the excess return series r_t generally indicate no change in the underlying distribution before and after liberalization.

Unit Root Tests

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. This is a sufficient condition (but not necessary) for market efficiency, and it is widely used as a test of market efficiency (Fama (1970)). We also test a more general hypothesis of whether the log price index follows a unit root process.

Several tests are available for testing a random walk or unit root in a series. As a robustness check, we present results from three tests of the unit root hypothesis. The first is the efficient unit root test proposed by Elliott, Rothenberg, and Stock (1996), which they call the DF-GLS test. The DF-GLS test is optimal among tests based on sample second moments in the sense that the power function is near the asymptotic power envelope. The second is the test proposed by Kwiatkowski, Phillips, Schmidt, and Shin (1992), which we call the KPSS test. While most of the unit root tests (including the DF-GLS test) take the unit root as the null hypothesis, the KPSS test checks the null hypothesis of a stationary root against the alternative of a unit root. The third test is the variance ratio test proposed by Lo and MacKinlay (1988) and widely used in the finance literature. While the DF-GLS and KPSS tests are tests for a unit root, the variance ratio test is a test of random walk.[5]

Before we present the results, we discuss Monte Carlo evidence regarding small-sample behavior of each test.[6] The unit root tests are sensitive to the serial correlation present in the test regression. Elliott, Rothenberg, and Stock (1996) and Kwiatkowski, Phillips, Schmidt, and Shin (1992) find evidence that allowing for too large a serial correlation lag can lead to deterioration in test performance. For the variance ratio test, Lo and MacKinlay (1989) find evidence that the performance of the test depends on the lag interval chosen to test for uncorrelated increments. In particular, choosing an interval too large may deteriorate test performance. Given these results, we perform the test using different serial correlation lags (for the unit root tests) and lag intervals (for the variance ratio test).

Table 5 shows the results for the DF-GLS test. We include a constant and a 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 fail to reject the hypothesis of a unit root in the (log) market price index both before and after market liberalization. This suggests that the stock market was already efficient before market opening.[7]

The results for the KPSS tests are shown in Table 6. As with the DF-GLS tests, we include a constant and linear trend as exogenous regressors in the

[5]As Lo and MacKinlay (1989) note, a unit root process can be decomposed into a random walk component and a stationary component. The unit root tests test the presence of the random walk component, while the random walk tests test the presence of the stationary component.

[6]This Monte Carlo evidence can be found in Elliott, Rothenberg, and Stock (1996), Kwiatkowski, Phillips, Schmidt, and Shin (1992), and Lo and MacKinlay (1989). We are not aware of results directly comparing the three tests under the same experiment.

[7]The exceptions are Brazil and India for the Kim and Singal (1997) dates with 12 lags. Liberalization of the Brazilian market changed the log price process from $I(1)$ to $I(0)$, while liberalization of the Indian market changed the log price process from $I(0)$ to $I(1)$.

TABLE 5. DF-GLS Tests (Nonstationary Null Hypothesis).

	Before Henry	After Henry	Before Kim-Singal	After Kim-Singal
Panel A. DF-GLS (4 Lags) 5 Percent Critical Value: -2.89				
Argentina	-1.722	-1.59	-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
Greece			-1.255	-1.436
India	-1.844	-2.142	-2.637	-2.059
Korea	-1.5	-0.498	-1.522	-0.338
Malaysia	-2.39	-1.349		
Mexico	-1.619	-1.331	-1.619	-1.331
Pakistan			-1.776	-1.18
Philippines	-1.27	-1.236	-1.318	-1.048
Taiwan			-1.582	-1.982
Thailand	-1.919	-0.041	-1.291	0.034
Turkey			-2.072	-1.817
Venezuela	-1.595	-1.511	-1.504	-1.466
Zimbabwe			-1.816	-1.482
Panel B. DF-GLS (12 Lags) 5 Percent Critical Value: -2.89				
Argentina	-1.726	-1.32	-1.736	-1.62
Brazil	-2.181	-2.271	-2.672	-3.104**
Chile	-1.641	-1.067	-1.82	-1.847
Colombia	-2.278	-1.765	-2.151	-2.214
Greece			-1.667	-2.886
India	-2.637	-1.662	-3.181**	-1.916
Korea	-1.893	-1.18	-2.116	-0.845
Malaysia	NA	-1.214		
Mexico	-2.014	-1.444	-2.014	-1.444
Pakistan			-0.779	-1.965
Philippines	NA	-2.206	NA	-1.999
Taiwan			-2.038	-2.879
Thailand	-2.403	-1.222	-2.181	-1.283
Turkey			-1.092	-0.852
Venezuela	-2.598	-1.584	-2.515	-1.783
Zimbabwe			-1.892	-1.843**

Note: DF-GLS stands for the efficient unit root test proposed by Elliott, Rothenberg, and Stock (1996). NA indicates an insufficient number of observations to perform the test. An empty space indicates there were data on only one side of the break date.

**Significant at the 5 percent level.

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

TABLE 6. KPSS Tests (Stationary Null Hypothesis).

	Before Henry	After Henry	Before Kim-Singal	After Kim-Singal
Panel A. KPSS (4 Lags) 5 Percent Critical Value: 0.146				
Argentina	0.235**	0.284**	0.235**	0.279**
Brazil	0.370**	0.216**	0.293**	0.13
Chile	0.501**	0.507**	0.389**	0.361**
Colombia	0.280**	0.193**	0.284**	0.303**
Greece			0.442**	0.329**
India	0.202**	0.330**	0.196**	0.154**
Korea	0.277**	0.171**	0.617**	0.356**
Malaysia	0.11	0.182**		
Mexico	0.349**	0.404**	0.349**	0.404**
Pakistan			0.268**	0.310**
Philippines	0.161**	0.162**	0.156**	0.185**
Taiwan			0.211**	0.114
Thailand	0.247**	0.329**	0.322**	0.325**
Turkey			0.132	0.319**
Venezuela	0.216**	0.207**	0.192**	0.201**
Zimbabwe			0.573**	0.150**
Panel B. KPSS (12 Lags) 5 Percent Critical Value: 0.146				
Argentina	0.115	0.145	0.115	0.143
Brazil	0.173**	0.119	0.141	0.089
Chile	0.216**	0.228**	0.166**	0.175**
Colombia	0.139	0.108	0.14	0.165**
Greece			0.196**	0.159**
India	0.1	0.175**	0.099	0.102
Korea	0.132	0.087	0.255**	0.176**
Malaysia	0.221**	0.117		
Mexico	0.152**	0.187**	0.152**	0.187**
Pakistan			0.167**	0.169**
Philippines	0.405**	0.095	0.500**	0.107
Taiwan			0.135	0.072
Thailand	0.118	0.165**	0.147**	0.165**
Turkey			0.145	0.165**
Venezuela	0.122	0.114	0.115	0.11
Zimbabwe			0.240**	0.106**

Note: KPSS stands for the the unit root test proposed by Kwiatkowski, Phillips, Schmidt, and Shin (1992). An empty space indicates there were data on only one side of the break date.

**Significant at the 5 percent level.

Newey-West HAC covariance estimate.[8] The results for lag truncation 4, which is the lag order selected by the automatic procedure suggested by Newey and West

[8]The results of the KPSS tests are 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 given in Campbell and Perron (1991).

TABLE 7. Variance Ratio Tests (2 Lags; Nonstationary Null Hypothesis).

	Before Henry	After Henry	Before Kim-Singal	After Kim-Singal
Argentina	0.023	0.035	0.011	0.042
	(-0.201)	(-0.5)	(-0.098)	(-0.6)
Brazil	0.126	-0.043	-0.001	0.086
	(-1.417)	(-0.396)	(-0.007)	(-0.639)
Chile	0.139	0.29	0.158	0.291
	(-1.663)	(2.887)**	(2.012)**	(2.905)**
Colombia	0.326	0.332	0.356	0.497
	(-1.716)	(2.456)**	(3.585)**	(2.214)**
Greece			0.018	0.117
			(-0.175)	(-1.51)
India	-0.071	0.129	0.056	0.151
	(-0.641)	(-1.242)	(-0.548)	(-1.501)
Korea	0.039	0.135	0.004	0.281
	(-0.491)	(-0.937)	(-0.054)	(-1.325)
Malaysia	-0.001	0.141		
	(-0.007)	(-1.287)		
Mexico	0.275	0.287	0.275	0.287
	(-1.759)	(-1.443)	(-1.759)	(-1.443)
Pakistan			0.019	0.19
			(-0.151)	(-1.277)
Philippines	0.461	0.346	-0.106	0.352
	(-1.842)	(3.376)**	(-0.408)	(3.439)**
Taiwan			0.079	0.074
			(-0.506)	(-0.994)
Thailand	0.012	0.047	0.029	0.023
	(-0.088)	(-0.631)	(-0.231)	(-0.293)
Turkey			0.277	0.171
			(1.651)	(-1.82)
Venezuela	0.017	0.048	0.035	0.089
	(-0.143)	(-0.372)	(-0.292)	(-0.737)
Zimbabwe			0.145	0.166
			(-1.863)	(-1.304)

Note: The first row reports the variance ratio estimates minus one. Numbers in parentheses are the heteroskedastic robust z-statistics. An empty space indicates there were data on only one side of the break date.

**Significant at the 5 percent level.

(1994) for most of our subsample sizes, reject the stationary null in favor of the unit root alternative for most countries (except for three cases, which are all marginally insignificant). These results are consistent with the DF-GLS results and provide further evidence that the markets were fairly efficient even before liberalization.

However, the results for lag truncation 12 are less clear cut. Four cases suggest the market becomes more efficient after liberalization ($I(0)$ to $I(1)$) and five

TABLE 8. Variance Ratio Tests (6 Lags; Nonstationary Null Hypothesis).

	Before Henry	After Henry	Before Kim-Singal	After Kim-Singal
Argentina	0.019	0.358	0.003	0.397
	(-0.073)	(-1.417)	(-0.011)	(-1.577)
Brazil	0.212	-0.314	-0.137	-0.104
	-0.982	(-1.177)	(-0.659)	(-0.357)
Chile	0.905	0.128	0.722	0.41
	(4.105)**	(-0.573)	(3.527)**	(-1.543)
Colombia	0.443	1.19	1.02	1.195
	(-1.27)	(3.664)**	(3.636)**	(2.427)**
Greece			0.108	0.357
			(-0.451)	(-1.435)
India	-0.124	0.135	-0.126	0.789
	(-0.476)	(-0.522)	(-0.507)	(2.421)**
Korea	0.243	0.127	0.181	0.086
	(-1.068)	(-0.459)	(-0.942)	(-0.212)
Malaysia	0.749	0.274		
	(-1.578)	(-0.982)		
Mexico	0.356	0.575	0.356	0.575
	(-1.094)	(-1.463)	(-1.094)	(-1.463)
Pakistan			-0.196	0.251
			(-0.636)	(-0.797)
Philippines	0.513	0.938	-0.263	0.938
	(-1.017)	(3.849)**	(-0.450)	(4.017)**
Taiwan			0.316	0.012
			(-0.827)	(-0.052)
Thailand	0.41	0.336	0.424	0.288
	(-1.453)	(-1.222)	(-1.516)	(-1.034)
Turkey			1.579	0.507
			(3.510)**	(2.073)**
Venezuela	0.137	0.592	0.184	0.679
	(-0.517)	(2.113)**	(-0.675)	(2.500)**
Zimbabwe			0.909	0.648
			(4.865)**	(2.000)**

Note: The first row reports the variance ratio estimates minus one. Numbers in parentheses are the heteroskedastic robust z-statistics. An empty space indicates there were data on only one side of the break date.

**Significant at the 5 percent level.

cases suggest the opposite. However, most cases (seventeen of the twenty-six pairs of subsamples) still show no change before and after the opening date.

The results of the variance ratio tests are shown in Tables 7–9. 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. As an indication of increased efficiency, we can count the cases where the test indicates

TABLE 9. Variance Ratio Tests (12 Lags; Nonstationary Null Hypothesis).

	Before Henry	After Henry	Before Kim-Singal	After Kim-Singal
Argentina	-0.093	0.82	-0.093	0.857
	(-0.270)	(-1.87)	(-0.271)	-1.955
Brazil	0.511	-0.352	-0.004	-0.049
	(-1.557)	(-0.866)	(-0.013)	(-0.119)
Chile	1.675	0.411	1.361	0.783
	(4.999)**	(-1.208)	(4.399)**	(1.968)**
Colombia	0.411	2.256	1.248	3.961
	(-0.946)	(4.437)**	(2.923)**	(8.528)**
Greece			0.524	0.792
			(-1.51)	(2.009)**
India	0.192	0.123	-0.096	0.862
	(-0.51)	(-0.328)	(-0.283)	-1.726
Korea	0.416	0.647	0.413	0.997
	(-1.176)	(-1.772)	(-1.407)	(-1.849)
Malaysia	0.508	0.033		
	(-0.721)	(-0.075)		
Mexico	0.585	0.776	0.585	0.776
	(-1.356)	(-1.535)	(-1.356)	(-1.535)
Pakistan			-0.599	1.281
			(-1.312)	(3.105)**
Philippines	8.263	0.971	NA	1.176
	(12.086)**	(2.788)**	NA	(3.368 **
Taiwan			0.085	0.118
			(-0.16)	(-0.325)
Thailand	0.827	0.575	0.814	0.695
	(2.253)**	(-1.482)	(2.126)**	(-1.754)
Turkey			2.819	0.645
			(4.228)**	(-1.705)
Venezuela	0.15	0.781	0.148	1.523
	(-0.358)	(-1.869)	(-0.343)	(3.788)**
Zimbabwe			1.799	2.173
			(6.298)**	(4.409)**

Note: The first row reports the variance ratio estimates minus one. Numbers in parentheses are the heteroskedastic robust z-statistics. An empty space indicates there were data on only one side of the break date. NA indicates an insufficient number of observations to perform the test.

**Significant at the 5 percent level.

a change in the process from $I(0)$ to $I(1)$. No cases are evident for 2 lags, while two cases are evident for 6 lags and four cases for 12 lags.

Chow and Denning (1993) propose 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

TABLE 10. Multiple Variance Ratio Tests (Nonstationary Null Hypothesis).

	Before Henry	After Henry	Before Kim-Singal	After Kim-Singal
Argentina	0.27	1.87	0.271	1.955
Brazil	1.557	1.177	0.659	0.639
Chile	4.999**	2.887**	4.399**	2.905**
Colombia	1.716	4.437**	3.636**	8.528**
Greece			1.51	2.009
India	0.641	1.242	0.548	2.421**
Korea	1.176	1.772	1.407	1.849
Malaysia	1.578	1.287		
Mexico	1.759	1.535	1.759	1.535
Pakistan			1.312	3.105**
Philippines	12.086**	3.849**	0.45	4.017**
Taiwan			0.827	0.994
Thailand	2.253	1.482	2.126	1.754
Turkey			4.228**	2.073
Venezuela	0.517	2.113	0.675	3.788**
Zimbabwe			6.298**	4.409**

Note: An empty space indicates there were data on only one side of the break date.

**Significant at the 5 percent level.

shown in Table 10.[9] For most countries the random walk null cannot be rejected before and after liberalization. This is again consistent with the hypothesis that markets were already efficient by the time of liberalization. Of the twenty-six pairs of subsamples, twenty show no change in the process before and after the opening date. Of the six pairs that indicate a change, only one case (Turkey) shows the market becomes more efficient after the opening date.

Inference Removing the Noisy Period

As mentioned in the analysis of recursive residuals, the period around the opening date typically exhibits temporary large noise. This noise may weaken the powers of the statistical tests conducted above. To check the effect of these noisy periods on our results, we have redone the analysis in the previous section removing the noisy period around the opening dates. While removing the noisy observations may increase the power of the tests, the lower degrees of freedom from fewer observations may decrease the power of the tests. Therefore an issue arises as to how many observations to remove from the sample. We remove a fixed number of observations before and after the opening dates identified by Henry (1997) and Kim

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

TABLE 11. Comparison of Results from the Full Sample and Those from a Sample Excluding Twelve Observations from Each Side of the Opening Date.

	Full Sample	Exclude +/- 12 Observations
Chow tests	1/26	1/24
Wald tests	2/26	1/24
Permutation tests	0/5	0/5
DF-LS (4 lags)	0/26	0/23
DF-LS (12 lags)	2/23	2/22
KPSS (4 lags)	4/26	4/24
KPSS (12 lags)	9/26	11/23
Variance ratio (2 lags)	4/26	3/24
Variance ratio (6 lags)	8/26	7/24
Variance ratio (12 lags)	8/24	5/23
Multiple variance ratio	6/26	5/24

Note: Entries are the fraction of cases that indicate a change in the efficiency of the market around the opening date.

and Singal (1997). The results for removing six monthly observations on each side of the opening dates (for a total of twelve observations) and those for removing twelve monthly observations on each side (for a total of twenty-four observations) both show essentially no difference from the results in the previous section.[10] Table 11 summarizes the results of the tests on the full sample and on a sample that excludes twelve observations from each side of the official break date.[11] The results show the fraction of cases that indicate a change in the behavior of the stock price/return. Little statistical evidence indicates a break in the behavior of stock prices around the opening dates, let alone that market efficiency has increased after the market opening.

Testing the Composite Portfolios

So far we have examined the behavior of individual stock prices before and after a known breakpoint. Another approach is to examine the behavior of a portfolio of stock price indexes. To apply our comparative approach to a portfolio of stock prices, we need a known breakpoint for the portfolio. We are not aware of any study that estimates an "official opening date" for a portfolio of emerging stock

[10]A working paper version that reports the results for removing twelve observations on each side of the opening dates is available upon request. For tests involving lags of a series, we controlled the sample so as not to use lagged values from the other side of the opening dates. This essentially removed the first few observations after the opening date. Results for these tests did not differ for the post-opening sample.

[11]One more case is excluded from the DF-GLS than from the KPSS and variance ratio tests. This is because the DF-GLS test requires lagged data of the original series, while the KPSS and variance ratio tests only require sample autocovariance/autocorrelations of the residuals.

prices, nor do we think it is a meaningful concept. Although it is natural to consider a single breakpoint for individual stock market data at the opening date, a portfolio of such stock prices may exhibit multiple breaks.

Therefore, to analyze the behavior of portfolios, we take a two-step approach. We first perform a semiparameteric test to estimate an unknown breakpoint in the portfolio series. We then perform unit root tests for the subsamples before and after the estimated break to see if there is a change in the stationarity property of the series. The test we employ assumes only one break in the portfolio series. If multiple breaks occurs, the test will presumably pick the break with the most "significant" change in the underlying series. We believe financial liberalization likely has a large effect on the stock markets, and, as a result, the structural break date will likely be close to the time of the actual financial liberalization.[12]

The EMDB global database contains three total return price index series: a composite index, an index of Asian stocks, and an index of Latin American stocks. These series are shorter than most individual stock return series and begin only in 1985:01.[13] To estimate the unknown breakpoint, we use the semiparameteric test by Bai (1996). It assumes a parameteric (linear) form for the regression function but makes minimal assumptions regarding the distribution of the error term. The idea is to find the break in the sample such that the empirical distribution functions of the error terms from the two subsamples are most different. As is well known, data from financial markets tend to exhibit heavy-tailed distributions. The nonparametric nature of the test is likely to be robust against such departures from the normal distribution.[14] To implement Bai's test, we assume the underlying data-generating process for the portfolio series is given by the first-order autoregressive process (2). The results of the test are reported in Table 12. Of the three portfolios, only the Asian index exhibits a (marginally) significant break.[15] All estimated breaks occur relatively early in the sample. In particular, the break for the Latin American index is reasonably close to March 1989, when Nicholas Brady announced a foreign debt reduction initiative, now known as the Brady plan. Since many Latin American countries were under heavy foreign debt, the initiative was a major step in helping these countries take steps toward liberalization. Indeed, Krugman (1992) states that the effect of the debt reduction initiative was so great that the term "emerging markets" starts to appear in the literature just after the Brady plan was announced.

[12]Bekaert, Harvey, and Lumsdaine (1998) also use the endogenous structural break approach to date financial changes in emerging markets.

[13]As with the individual country indexes, the composite indexes include dividends and capital gains.

[14]Although this test identifies a breakpoint, it does not permit inference regarding the breakpoint.

[15]The test has a nonstandard distribution. The 5 percent critical value tabulated in Bai (1996) is 0.866.

TABLE 12. Bai Breakpoint Tests.

Index	M_n^*	Break
Composite	0.751	1987:06
Asia	0.881**	1987:04
Latin America	0.492	1988:02

**Significant at the 5 percent level.

The unit root tests applied to the subsamples before and after the estimated breakpoints are reported in Tables 13 and 14. The results from the DF-GLS and KPSS tests confirm those from the individual stock price series: the portfolio series are nonstationary both before and after the estimated break. The Lo-MacKinlay (1988) variance ratio tests also confirm these results: the random walk null hypothesis cannot be rejected in all subsamples except one. The tests from the portfolio indexes therefore suggest that opening of the emerging markets did not affect the efficiency of the overall indexes.

IV. Concluding Remarks

The battery of tests applied to emerging market price indexes 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.

The liberalization dates 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, the simple announcement of liberalization (if it is believed credible) should suffice to alter the nature of the market. In fact, most of our statistical results indicate that the markets were already efficient before the actual opening date, suggesting the effect of forward-looking investors. We are currently working on the idea to compare the official opening date with the breakpoint identified by a fully data-based statistical method. Any difference between the endogenously identified breakpoint and the official opening date will indicate the effect of expectations.

We analyze 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.

TABLE 13. Unit Root Tests Before and After the Estimated Breakpoint from Bai's Test.

	DF-GLS(4)		DF-GLS(12)		KPSS(4)		KPSS(12)	
Index	Before	After	Before	After	Before	After	Before	After
Composite	-1.685	-1.672	-2.754	-1.663	0.414**	0.540**	0.414**	0.540**
Asia	-1.201	-1.223	NA	-1.432	0.308**	0.685**	0.308**	0.685**
Latin	-1.622	-1.242	-1.12	-1.254	0.607**	1.840**	0.607**	1.840**

Note: DF-GLS tests the null hypothesis of nonstationarity, while KPSS tests the null hypothesis of stationarity. NA indicates insufficient observations in the subsample to compute the test, and the numbers in parentheses indicate the number of lags used.

TABLE 14. Lo-MacKinlay Variance Ratio Tests Before and After the Estimated Breakpoint from Bai's Test.

	2 lags		6 lags		12 lags	
	Before	After	Before	After	Before	After
Composite	0.421	0.19	0.639	0.23	0.615	0.113
	(2.316)**	(-1.623)	(-1.411)	(-0.84)	(-0.893)	(-0.296)
Asia	-0.197	0.055	-0.437	0.28	-0.598	0.286
	(-0.873)	(-0.578)	(-0.903)	(-1.127)	(-0.844)	(-0.789)
Latin America	0.176	0.112	0.461	0.136	0.734	0.173
	(-1.284)	(-1.131)	(-1.346)	(-0.557)	(-1.408)	(-0.482)

Note: The first row reports the variance ratio estimates minus one, while the second row reports heteroskedasticity robust z-statistics in parentheses.

**Rejection of the random walk null at the 5 percent level.

References

Bai, J., 1996, Testing for parameter constancy in linear regressions: An empirical distribution function approach, *Econometrica* 64, 597–622.

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

Bekaert, G. and C. R. Harvey, 1997, Emerging equity market volatility, *Journal of Financial Economics* 43, 22–77.

Bekaert, G., C. R. Harvey, and R. Lumsdaine, 1998, Dating the integration of world capital markets, Working paper, Stanford University.

Buckberg, E., 1995, Emerging stock markets and international asset pricing, *World Bank Economic Review* 9, 51–74.

Campbell, J. Y. and P. Perron, 1991, Pitfalls and opportunities: What macroeconomists should know about unit roots, in O. Blanchard and S. Fischer, eds.: *NBER Macroeconomics Annual* (MIT Press, Cambridge, MA).

Chow, V. K. and K. C. Denning, 1993, A simple multiple variance ratio test, *Journal of Econometrics* 58, 385–401.

Claessens, S., S. Dasgupta, and J. Glen, 1995, Return behavior in emerging stock markets, *World Bank Economic Review* 9, 131–51.

Elliott, G., T. J. Rothenberg, and J. H. Stock, 1996, Efficient tests for an autoregressive unit root, *Econometrica* 64, 813–36.

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

———, 1991, Efficient capital markets: II, *Journal of Finance* 46, 1575–1617.

Greene, W. H., 1993, *Econometric Analysis*, 2d ed. (MacMillan).

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

Johnston, J. and J. DiNardo, 1997, *Econometric Methods*, 4th ed. (McGraw-Hill).

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

Krugman, P., 1992, *The Age of Diminished Expectations* (MIT Press, Cambridge, MA).

Kwiatkowski, D., P. C. B. Phillips, P. Schmidt, and Y. Shin, 1992, Testing the null hypothesis of stationary against the alternative of a unit root, *Journal of Econometrics* 54, 159–78.

Lo, A. W. and A. C. MacKinlay, 1988, Stock market prices do not follow random walks: Evidence from a simple specification test, *Review of Financial Studies* 1, 41–66.

———, 1989, The size and power of the variance ratio test in finite samples, *Journal of Econometrics* 40, 203–38.

Newey, W. and K. West, 1994, Automatic lag selection in covariance matrix estimation, *Review of Economic Studies* 61, 631–53.

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