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Stock Market Growth: An Analysis of Cointegration and Causality

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ABSTRACT

This paper examines the relationship between stock market growth and economic growth, privatization; stock returns in 12 emerging economies from 1988 to 2000. Using monthly data, both the Johansen Cointegration and Granger Causality tests are employed. Results from cointegration tests suggest a long run relationship between stock market liquidity and size and real activity, privatization, and stock returns in five countries, India, Korea, Malaysia, the Philippines and Zimbabwe. The results of Granger causality tests indicate that there is a bi-directional relationship between stock market growth indicators and real economic activity, privatization, and stock returns for most of these countries. These results seem to validate the co-existence of both the supply-leading and demand-following hypotheses in the intermediate stages of the economic development i.e., the existence of a bi-directional relationship between finance (stock markets) and economic growth.

1. INTRODUCTION

EMERGING STOCK MARKETS have undergone radical changes in the last two decades, and the cauldron is still bubbling. As defined by measures such as market capitalization and trading value, emerging stock markets have grown dramatically. Why have such profound changes come about in the 1980s and 1990s? There are a number of possibilities. First, most emerging economies have been in a period of economic expansion since the early 1980s, following the steep worldwide recession of 1980-1982. Secondly, by the early 1980s, a process of financial liberalization had been undertaken in most emerging economies; different types of barriers have been lowered and competition had been intensified. At the heart of this process was the privatization of state-owned enterprises, which stimulated stock market activity by expanding the supply of shares. A third factor was the higher returns on investing in emerging stock markets relative to developed markets. High

returns attracted more domestic and foreign participants. These factors have profoundly affected emerging stock markets.

Although there is a growing body of theoretical and empirical literature on the role of the financial sector and stock market developments in economic growth, stock market growth and expansion has not been investigated comprehensively, particularly for emerging markets. In addition, the causal links between stock markets and economic performance have not been examined in a time series framework for emerging stock markets. This may be explained by a lack of suitable data.

In this paper, an examination is made of monthly data for 12 emerging markets between 1988 and 2000 to shed some light on the direction of this relationship. Is the causality from stock markets to economic performance or from economic performance to stock markets - or does it work both ways? The sample period and countries selected are based on data availability. To answer these questions, the time series properties of the selected variables will be examined to determine if they are stationary. Secondly, two techniques will be used to investigate the empirical association between stock market growth and real activity. The two techniques are the Johansen cointegration test and the Granger causality test.

The following section contains a brief overview of the theoretical and empirical literature that point to the causal link between financial sector development and economic performance. Next, there is a summary of information on stock market growth indicators and other relevant variables. Then, the time series properties of the variables used will be examined. The next section contains a discussion of the tests for cointegration between stock market indicators, real sector performance, a proxy for financial liberalization and returns on investing in stock markets. Following that, an examination is made of the causality issue between both stock market indicators and relevant variables.

2. Financial sector development and economic growth: theory and evidence

The relationship between financial sector development and economic growth has been a continuous issue in the development literature. Some economists hold the view that financial development is a necessary condition for achieving high rates of economic growth (McKinnon, 1973; Shaw, 1973). This premise has been named in the literature as the 'supply-leading' role of financial development. According to this view, financial development can promote overall economic performance in the following ways. A well- functioning financial system helps small savers to pool funds; financial markets stimulate savings by providing savers with access to a wide variety of instruments; financial markets provide a more efficient allocation of capital through increasing the portion of financial saving in total wealth; an efficient financial system creates

more wealth, as financial intermediaries redirect savings from individuals and slow-growing sectors to faster-growing sectors; financial markets help financial intermediaries partially to overcome the adverse selection problem in credit markets; finally, financial markets are a catalyst for specialization in production, development of entrepreneurship and the adoption of new technology.

Although plausible, the supply-leading view is only one possible explanation. Patrick (1966) held a different view, termed the 'demand-following' role of financial development. According to this view, economic growth creates a need for modern financial institutions and related services; development in the financial sector is facilitated by growth in the real sector of the economy. As the real sector expands and grows, it needs a wider range of financial services and a growing number of institutions to provide these services. Patrick argued that financial intermediation helps the transfer of resources from the slow-growing sectors to the fast-growing sectors of the economy. Therefore, the need for financial intermediation depends also on the variance in growth rates among different sectors of the economy.

A third view suggests a combination of the supply-leading and demand-following hypotheses. This proposition implies that both hypotheses are jointly valid. This implies that there are two-way relationships between financial sector development and economic growth (bi-directional causality). This sort of causality pattern seems likely over the long-run (Greenwood and Smith, 1997). More to the point, Patrick (1966) argued that the direction of causality changes over the course of development. There seems to be an interaction between the 'supply-leading' and the 'demand-following' hypotheses. During the early stages of development, financial sector expansion plays a growth-augmenting role through the creation of financial institutions and the supply of financial assets. This is consistent with the 'supply-leading' view. However, in the more advanced stages of development, financial sector expansion plays a 'demand-following' role.

Interestingly, there are a number of prominent economists who regard finance as a relatively unimportant factor in growth (Lucas, 1988; Stern, 1989). This view implies that the two variables — finance and economic growth — are causally independent.

It must be acknowledged that the high and positive correlation between financial development and real economic growth reported in many previous studies does not necessarily support the supply-leading hypothesis. It is consistent with at least three of the four views discussed. Clearly, if the causal relationship between financial development and economic growth in a given country is consistent with the demand-following hypothesis, this may imply that some previous empirical studies are meaningless. On the other hand, if the two variables are independent, this may suggest that the empirical results of these studies, linking financial development to economic growth, are spurious. This implies that studies examining the relationship between financial

development and economic growth should focus on the correlation and direction of causality between the two variables.

In this regard, Levine and Zervos (1996) recognized the importance of the causality issue. They recommended that future research should examine the time-series properties between stock market development and economic growth because cross-country regressions do not resolve this. Studies that have tested explicitly for causality between economic growth and financial intermediation are not common. Moreover, cointegration analysis is not commonly used in these studies. More recently, however, some studies have used cointegration techniques to examine the relationship between financial deepening and economic growth.

Few researchers have examined the relationship between financial intermediation and economic growth using Causality procedures. Even when doing so, these economists have given little or no attention to the economic growth-stock market connection. In one example from economic history, Fisher and Thurman (1989) showed that causality did not run from financial variables to the real sector in Sweden in the 19th century (1861-1910). Instead, causality ran from the real sector to financial variables, which tends to support the demand-following hypothesis. In contrast, Ahmed and Ansari (1998) found that Granger causality tests provide strong support for the supply-leading hypothesis in three South Asian countries (India, Pakistan, and Sri Lanka) from 1973 to 1991.

Cheng (1999) applied Hsiao's version of the Granger causality test, and cointegration analysis to examine the nature of the empirical relationship between financial deepening and economic growth in Korea and Taiwan. Cheng's results indicated that causality runs from financial development to economic growth in postwar Korea and Taiwan. In addition, Cheng found that with respect to Korea, no cointegration tests could be performed and for Taiwan financial development and economic growth variables are not cointegrated. Darret (1999) examined the role of financial deepening in economic growth in three Middle-Eastern countries, Saudi Arabia, Turkey and the United Arab Emirates. Causality test results provided support for the supply-leading hypothesis. That is, financial development led and economic growth followed in these three countries. To test for cointegration, Darret used the Johnasen-Juselius approach. The results rejected the null hypothesis of no cointegration across the three countries. As a consequence, Darret concluded that a stationary relationship exists between economic growth and financial development.

3. Data description and statistics

Two stock market development indicators will be defined. The first indicator is the measure of stock market size and the second indicator is a measure of stock market liquidity. Then, a measure of economic performance and a measure of stock returns are presented. The second sub-section provides summa-

ry statistics on these variables. Finally, the results of unit root tests are presented.

3.1 Measuring stock market development and economic performance

Stock market growth will be examined in terms of its size and liquidity. Two main stock market indicators will be used. Stock Market Size-Market Capitalization measures the size of the stock markets. It is measured as the product of share price and the number of shares outstanding for all stocks traded on the principal exchange(s) of a given country. Market capitalization reflects the importance of financing through equity issues in the capital mobilization and resource allocation processes (Rousseau and Wachtel, 2000). Although large markets do not necessarily function well, market capitalization is widely used as an indicator of stock market growth, provided that stock market size is positively correlated with the ability to mobilize capital and diversify risk.

Stock Market Liquidity-Trading Value measures market liquidity, which is the product of share price and the number of shares traded. As a measure of stock market development, it reflects stock market liquidity and its interaction with market size. For this reason, trading value may be considered a better indicator of stock market growth than market capitalization alone. While not a direct measure of trading costs or the uncertainty associated with trading on a particular market, it reflects liquidity positively on an economy-wide basis (Levine and Zervos, 1998). As an indicator of stock market growth, trading value complements market capitalization. This is because a market may be large, but have little trading. Thus, taken together, market capitalization and trading value provide more information about a country's stock market than using only a single indicator.

Both market capitalization and trading value have potential pitfalls. If markets expect considerable profits, stock prices will increase. This price rise will increase the value of both measures without a real rise in the number of transactions or a reduction in transaction costs. This can be explained because stock markets are forward looking. To gauge the influence of that price effect, the two indicators will be deflated with the local share price index (Rousseau and Wachtel, 2000).

Because monthly data are used, it is not possible to use GDP or GNP as a measure of economic growth. The Industrial Production Index (IND) is used as an indicator for real economic activity. However, because all the sample countries are developing countries, the industrial production index may not reflect the overall economic activity. One must examine the validity of the industrial production index as an indicator for real activity. To determine its validity, the correlation and the covariance are computed of the industry value added and real GDP growth rates for the sample countries. For ten of the twelve countries included in the sample, the correlation between both variables is greater than 0.8, which implies that the industrial production index

could be a good indicator for the economic activity level in these countries.[2] As a proxy of the financial liberalization-privatization process undertaken and improvements in the market structure in many emerging markets, the number of listed companies (LIS) in the stock exchange(s) are used.[3]

There are many ways to define the rate of return on stocks. One way is to measure it as the percentage change in the value of the stock market index. Another way is to use dividend yields. In this paper, IFCG total return index (TRI) is used; return indices introduced by Emerging Market Data Base (EMDB) are total returns, including dividends in US dollars. It is preferable to use the US dollar return series rather than local currency return series for the following reasons. First, a common currency across countries allows for sound comparisons of the results. Second, several emerging markets have experienced relatively high inflation rates, leading to problems with employing returns denominated in the local currency (Soutciogin and Starks, 1988). Finally, these indices reflect changes in the exchange rate since they have been calculated in dollars.[4]

3.2 Summary statistics and correlations

Given the focus on emerging stock markets, the sample includes Chile, Colombia, Greece, India, Jordan, Korea, Malaysia, Mexico, Pakistan, the Philippines, Venezuela, and Zimbabwe. Table 1 presents the means, standard deviations, and the percentage change over the sample period of market capitalization, trading value, industrial production, the number of listed companies, and total return index. For the twelve countries, monthly data are used over the period 1988:01 to 2000:12.

The two stock market indicators exhibit considerable variability across countries in terms of means and percentage change over the sample period. It is interesting to note that Korea and Malaysia are the two highest with respect to market capitalization and trading value. At the same time, it can be seen that Jordan and Zimbabwe have the lowest averages. Measured by market capitalization, the sizes of stock markets have shown phenomenal growth: 28 times in Greece, 19 times in the Philippines, ten times in Chile, and eight times in India over the sample period. The lowest increase was in Jordan at 88 percent. The growth in stock market liquidity, as measured by trading value, was even more striking. It increased more than 360 times in Greece, 116 times in India, 58 times in Pakistan, and 23 times in Chile.

The situation is different with respect to the number of listed companies, where India and Pakistan rank at the top and Venezuela and Zimbabwe have the lowest averages. The growth in the number of listed companies was not striking compared with the two stock market indicators. The highest was in Malaysia (241 percent), and the lowest was in Chile (22 percent).

Turning to the industrial production index, the Philippines has the highest growth at 420 percent, then Malaysia at 269 percent. Zimbabwe has the lowest growth at ten percent. For the total return growth index, Chile

Table 1: Means, standard deviations, and per cent change of stock markets indicators and other relevant variables

Country	*Market capitalisation*			*Trading value*			*Industrial production index (%)*			*Number of listed companies*			*Total return index*		
	Mean	Std. dev.	% change	Mean	Std. dev.	% change	Mean	Std. dev.	% change	Mean	Std. dev.	% change	Mean	Std. dev.	% change
Chile	44,744	25648	999	375.7	344.5	2302	0.05	0.0834	73	245	32.69	22	0.018	0.057	883
Colombia	9,343	6635	659	70.31	69.74	600	-0.21	0.0714	12	126	48.08	38	0.012	0.094	191
Greece	37,807	50400	2828	2,453	4932	36047	-0.32	0.0870	19	183	62.68	181	0.016	0.115	619
India	96,553	53340	852	5,989	11156	11635	0.21	0.0767	107	4,099	1566	179	0.010	0.096	155
Jordan	3,977	1406	88	52.65	41.37	82	-0.15	0.0954	69	107	120.12	55	0.005	0.044	76
Korea	138,268	64938	323	35,784	58617	456	0.53	0.0361	161	720	178.7	235	0.006	0.125	44
Malaysia	126,191	86453	499	5,573	6307	430	0.64	0.0584	269	477	194.4	241	0.012	0.006	49
Mexico	99,570	53009	747	3,153	2218	379	0.21	0.0425	77	199	15.75	-24	0.022	0.108	828
Pakistan	7,366	3795	197	581.	895	5820	0.06	0.1163	16	641	143.6	101	0.009	0.102	68
Philippines	32,191	23700	1932	823.8	764.2	342	0.84	0.0672	420	185	31.71	68	0.008	0.105	23
Venezuela	6,559	3442	205	126.3	147.2	223	2.08	0.1513	12040	80	12.93	32	0.019	0.141	92
Zimbabwe	1,898	1038	236	13.37	13.82	905	-0.05	0.0996	10	62	5.088	32	0.009	0.107	94

Notes:
1. Both market capitalization and trading value figures are in $ US Million.
2. Percent Change = Percentage change over the sample period

ranks at the top at 883 percent, then Mexico at 828 percent, followed by Greece at 619 percent The Philippines is at the bottom at 23 percent. Table 1 also shows a substantial variance among the various indicators.

Table 2 presents the correlation values of market capitalization and the industrial production index, the number of listed companies, and the total return index. In all but one country, market capitalization was positively related to the industrial production index and the number of listed companies, while it was positively related to the total return index in all countries.

Table 2: Correlation of market capitalization and relevant variables

Country	MCAP&IND	MCAP&LIS	MCAP&TRI
Chile	0.85	0.94	0.99
Colombia	0.70	0.88	0.92
Greece	0.20	0.69	0.96
India	0.87	0.90	0.75
Jordan	0.76	0.10	0.97
Korea	0.71	0.66	0.31
Malaysia	0.61	0.52	0.90
Mexico	0.48	-0.52	0.98
Pakistan	0.33	0.68	0.78
Philippines	0.72	0.79	0.79
Venezuela	0.41	0.35	0.91
Zimbabwe	-0.04	0.44	0.93

Note: MCAP = Market Capitalization, IND = Industrial Production Index (%), LIS = The Number of Listed Companies, and TRI = IFCG Total Return Index.

Table 3 shows the correlations of trading value with the same variables. For about three-quarters of the countries, trading value is positively correlated with industrial production, the number of listed companies and the total return index. It is worth mentioning that Mexico has a correlation coefficient of -0.52 between market capitalization and the number of listed companies, which could be explained by the fact that the number of listed companies decreased from 236 to 176 over the sample period.

Both market capitalization and trading value are highly correlated with the industrial production index, the number of listed companies and the total return index. These results might suggest the existence of an economic relationship between stock market size and liquidity on the one hand and economic activity, privatization, and stock returns on the other hand. Table 2 and Table 3 show a significant difference in the correlation coefficients across economies. This cannot be explained on a single-factor basis, since factors such as the stage of development, financial and economic policies, foreign direct investment, institutional and regulatory reforms and country risk might

interact to shape the relationship between stock market developments and growth in economic fundamentals.

Table 3: Correlation of trading value and relevant variables

Country	TV&IND	TV&LIS	TV&TRI
Chile	0.59	0.65	0.74
Colombia	0.54	0.53	0.82
Greece	0.22	0.61	0.92
India	0.61	0.44	0.37
Jordan	-0.03	-0.04	0.09
Korea	0.64	0.33	-0.14
Malaysia	0.38	0.31	0.80
Mexico	0.23	-0.41	0.84
Pakistan	0.38	0.53	0.03
Philippines	0.60	0.70	0.73
Venezuela	-0.03	-0.01	0.76
Zimbabwe	-0.17	0.48	0.73

Note: TV = trading value

3.3 The unit root test

Testing for the existence of statistical relationships among the variables is done in three steps. The first step is to verify the order of integration of the variables. The second step involves testing for cointegration. Evidence of cointegration rules out the possibility that the estimated relationship is 'spurious'. So long as variables have common trends, causality in the Granger sense must exist in at least one direction. Thus, the third step involves testing for the causality direction(s).

A pre-condition for the cointegration of time series is for the series to be integrated of the same order. In other words, if two series are cointegrated of order d then each series has to be differenced d times to achieve stationarity. For $d = 0$, each series would be stationary in levels, for $d = 1$, first differencing is required to obtain stationarity and so on. To drift towards a long-term equilibrium, non-stationary variables must be converted into a stationary process.

The most commonly used approaches to test for stationarity are the Augmented Dickey and Fuller (ADF) test, and the Phillips-Perron (P-P) test. These tests are known as unit root tests. In addition to the ADF and P-P tests, the KPSS test proposed by Kwiatkowski *et al.* (1992) is used, which tests for stationarity as the null hypothesis.

The combined use of the three tests used to investigate the stationarity of the series may result in four possible outcomes. First, rejection by the ADF and P-P and non-rejection by the KPSS test is a strong indication of stationarity. Second, non-rejection by both ADF and P-P and rejection by the KPSS test gives strong evidence of an I(1) process. Third, non-rejection by all tests suggests that the data are not sufficiently informative on the long-run characteristics of the series. Fourth, rejection by all the tests shows that the series is neither an I(0) nor an I(1) process. The merit of testing both stationarity and non-stationarity using the three tests and comparing their outcomes is that any inference drawn is not uncertain.

It might be the case that we fail to reject the null hypothesis of a unit root because of a misspecification concerning the deterministic components of the test. That is, too few or too many deterministic regressors may cause a failure of the test to reject the null hypothesis of a unit root. In this regard, the testing strategy proposed by Dolado *et al.* (1990) was employed.

Table 4 presents the ADF, P-P, and KPSS test results for the five variables under investigation. In this table, a 'Y' entry indicates the data do not reject the null hypothesis of the ADF and P-P tests at the 0.05 significance level. There is a unit root, and it also indicates that the data reject the null hypothesis of KPSS test at 0.05 significance level, which also implies the existence of a unit root.

The ADF results suggest that market capitalization, and the total return index are I(1), where the first differences are integrated of order zero, I(0) for all countries. The results also suggest non-stationarity of trading value in all countries except Venezuela. The unit root hypothesis cannot be rejected for industrial production in all countries except for Greece, Jordan, and Pakistan. In addition, the series of the number of listed companies — as suggested by the ADF results — is non-stationary in all countries except Jordan. Although employing the P-P test gives different lag profiles for the various time series and sometimes lowers the level of significance, the main conclusion is qualitatively the same as reported by the ADF tests. In particular, the P-P test results support the ADF test results. Finally, the KPSS test results are consistent with both ADF and P-P test results for market capitalization, the number of listed companies, trading value, industrial production index and the total return index for all countries, except Chile, Colombia, Jordan for the trading value series and Chile, Colombia, India for the industrial production index.

4. COINTEGRATION ANALYSIS

The cointegration test proposed by Johansen (1991, 1995) is used. The presence of cointegration between MCAP, IND, LIS, and TRI is examined as well as between TV, IND, LIS, and TRI. The Johansen-Juselius system-based procedure was applied with a constant, monthly dummies and a trend term. The trend was restricted to lie in the cointegration space. Previous studies suggest

Table 4: Tests for Unit Roots Hypothesis

	Market capitalisation			*Trading value*			*Industrial production index (%)*			*Number of listed companies*			*Total return index*		
	ADF	P-P	KPSS	ADF	P-P	KPSS	ADF	P-P	KPSS	ADF	P-P	KPSS	ADF	P-P	KPSS
Chile	Y*	Y*	Y*	Y*	Y	N*	Y*	N	N	Y*	Y*	Y*	Y*	Y*	Y*
Colombia	Y*	Y*	Y	Y	Y	N	Y*	N*	N*	Y*	Y	Y	Y*	Y	Y*
Greece	Y*	Y*	Y*	Y	Y*	Y	N*	N*	N*	Y	Y	Y*	Y*	Y*	Y*
India	Y	Y*	Y	Y*	Y	Y*	Y*	N	N	Y*	Y	Y*	Y*	Y	Y*
Jordan	Y*	Y*	Y	Y*	Y	N	N*	N	N*	N	N*	N*	Y*	Y*	Y
Korea	Y	Y*	Y*	Y*	Y	Y*	Y	Y*	Y*	Y	Y	Y*	Y	Y*	Y
Malaysia	Y*	Y*	Y	Y	Y*	Y*	Y*	Y	Y*	Y	Y*	Y	Y*	Y	Y*
Mexico	Y*	Y*	Y	Y*	Y	Y	Y*	Y*	Y*	Y	Y*	Y*	Y*	Y	Y*
Pakistan	Y	Y*	Y*	Y*	Y	Y*	N	N*	N*	Y	Y*	Y*	Y*	Y	Y*
Philippines	Y	Y*	Y*	Y	Y*	Y	Y	Y	Y*	Y	Y*	Y*	Y*	Y	Y*
Venezuela	Y*	Y*	Y	N	N*	N*	Y*	Y	Y	Y	Y	Y	Y*	Y	Y
Zimbabwe	Y	Y*	Y*	Y	Y*	Y*	Y*	Y	Y*	Y	Y*	Y*	Y	Y	Y

Notes:
1. "Y" indicates a non-rejection of the null hypothesis of unit root of ADF and P-P tests and a rejection of the null hypothesis of stationarity of KPSS test.
2. "N" indicates a rejection of the null hypothesis of unit root of ADF and P-P tests and a non-rejection of the null hypothesis of stationarity of KPSS test.
3. An asterisk (*) indicates significance at the 1 percentage level.
4. The lag length structure of i of the dependent variable Y_t in equation (1) is determined using Modified Akiake Information Criterion (MAIC).
5. For Venezuela, exports are used as a proxy for industrial production.

that results from the Johansen cointegration technique are sensitive to lag specification. Hall (1991), for example, finds that whereas the results of coefficient estimates are not very sensitive to lag specification, the likelihood ratio test statistics used to carry out tests on the parameters of the cointegrating vectors can be sensitive to the choice of the vector auto regression (VAR) lag. Here the lag length in the VAR was determined using the Akaike minimum Final Prediction Error (FPE) criterion.

Table 5: Cointegration results for MCAP, IND, LIS, and TRI

	Unrestricted cointegration results		Restricted cointegration results	
Country	*Trace test*	*Max eigenvalue test*	*Trace test*	*Max eigenvalue test*
Chile	None	None	None	None
Colombia	None	None	None	None
Greece	None	None	None	None
India	1*	1	1*	1
Jordan	--	--	--	--
Korea	1**	1**	1*	1*
Malaysia	1**	1**	1*	1*
Mexico	None	None	None	None
Pakistan	None	None	None	None
Philippines	1*	1*	1*	1*
Venezuela	None	None	None	None
Zimbabwe	1*	1	1*	1

Notes:
1. None entry means that Likelihood Ratio (LR) indicates that there are no cointegration equations.
2. 1, 2... refer to the number of cointegration equations.
3. The symbols * and ** denote significance at the five percent and one percent level, respectively.
4. Based on the unit root test results, cointegration analysis was applied to MCAP, LIS, and TRI for Chile, Colombia, Greece, India, and Pakistan. In addition, it was not applied to Jordan's series since variables are not integrated of the same order.

Table 5 presents the trace and max-eigen value test results for MCAP, IND, LIS, and TRI. The trace test results indicate the existence of one cointegrating vector at the one percent significance level for Korea and Malaysia, and the existence of one cointegrating vector at the five percent significance level

in India, the Philippines and Zimbabwe. The max-eigen value test results indicate the existence of one cointegrating vector at the one percent significance level for Korea, and Malaysia and at the 5 percent significance level for India, the Philippines, and Zimbabwe. No cointegrating vectors were detected for the rest of the sample countries.

Table 5 also presents the restricted cointegration estimation, where the number of cointegrating vectors is restricted to one and zero restrictions on certain elements of the α and β' matrices. The restrictions were tested individually and in combination and could not be rejected at the five percent level. Table 6 presents trace test and max-eigen value test results for TV, IND, LIS, and TRI. The trace test results indicate the existence of one cointegrating vector at the five percent significance level for India, Malaysia, the Philippines and Zimbabwe and one cointegrating vector at the one percent significance level for Korea. The max-eigen value test results show the existence of one cointegrating vector for India, Malaysia, and the Philippines at the five percent level and two cointegrating vectors for Korea at the one percent level.

The restricted cointegration estimates shown in Table 6 are consistent with the unrestricted cointegration results where the procedures applied to MCAP, IND, LIS, and TRI, have been repeated for TV, IND, LIS, and TRI. No cointegrating vectors were detected for the rest of the sample countries.

The presence of more than one cointegrating vector, as in the case of Korea, raises the following question. Is it better to have many or only a few cointegrating vectors? Dickey *et al.* (1991) demonstrated that it is difficult to provide a general answer. Cointegrating vectors could be seen as representing constraints that an economic system imposes on the movement of its variables in the long-run. Consequently, they claimed that the more cointegrating vectors there are, the more stable is the system. That is, other things constant, it is preferable for an economic system to be stationary in as many directions as possible. In contrast, Maddala and Kim (1998) argued that having more than one cointegrating vector raises the question of how to interpret the results of a cointegration analysis. If there is only one cointegration relationship, then it may be easy to interpret it as a long-run relationship. However, if there is more than one cointegrating vector, there are problems of interpretation. In light of this argument, the max-eigen value test results regarding Korea could be explained by the possibility of two relationships existing, one determining stock market liquidity and another determining stock return. The second cointegrating vector may describe a stationary relationship between stock returns (TRI) and real economic activity (IND).

Results presented in Table 5 suggest the existence of long-run co-movements among stock market size (MCAP), real economic activity (IND), privatization process (LIS) and stock returns (TRI) in Korea, Malaysia, the Philippines and Zimbabwe. Similarly, the results presented in Table 6 suggest the existence of a long-run connection between stock market liquidity (TV) and the previously mentioned variables.

Although the cointegration results reveal long-run evidence supportive of a link between stock market size and liquidity on the one hand and economic performance, privatization and stock returns on the other hand, directional causality has not been detected. Whether these results are consistent with the supply-leading hypothesis or the demand-following hypothesis has not as yet been determined. The task of the following section is to examine which of the two hypotheses is a better prediction of the stock market-economic growth interaction.

Table 6: Cointegration results for TV, IND, LIS, and TRI

	Unrestricted cointegration results		Restricted cointegration results	
Country	*Trace test*	*Max eigenvalue test*	*Trace test*	*Max eigenvalue test*
Chile	--	--	--	--
Colombia	--	--	--	--
Greece	None	None	None	None
India	1*	1*	1*	1*
Jordan	--	--	--	--
Korea	1**	2**	1**	2*
Malaysia	1*	1*	1*	1*
Mexico	None	None	None	None
Pakistan	None	None	None	None
Philippines	1*	1*	1*	1*
Venezuela	--	--	--	--
Zimbabwe	1*	1*	1*	1*

Notes:
1. None entry means that Likelihood Ratio (LR) indicates that there are no cointegration equations.
2. 1, 2... refer to the number of cointegration equations.
3. The symbols * and ** denote significance at the five percent and one percent level, respectively.
4. 4. Based on the unit root test results, cointegration analysis was applied to TV, LIS, and TRI for Greece, India, and Pakistan. In addition, it was not applied to Chile, Colombia, Jordan, and Venezuela since variables are not integrated of the same order.

6. Causality and error-correction models

The following analysis involves employing vector error-correction modeling and testing for the exogeneity of variables. Engle and Granger (1987) show

that in the presence of cointegration there always exists a corresponding error-correction representation, which implies that changes in the dependent variable are a function of the level of disequilibrium in the cointegrating relationship, captured by the error-correction term and changes in other explanatory variables. In this sense, by using the error-correction term, the VECM modelling represents an additional way to explore for Granger-Causality.

The Granger causality tests describe only short-run relationships between variables. However, it might be the case that additional long-run relationships exist between the variables. Standard Granger causality tests, augmented with error-correction terms and derived from the long-run cointegrating relationships, can be used to assess the long-term effects.
The augmented Granger causality test is formalized as:

$$\Delta X_t = \alpha_0 + \sum_{i=1}^{z} \alpha_{1i} \Delta X_{t-i} + \sum_{i=1}^{T} \alpha_{2i} \Delta Y_{t-i} + \psi \mu_{t-1} + \varepsilon_{1t} \quad (1)$$

$$\Delta Y_t = \lambda_0 + \sum_{i=1}^{R} \lambda_{1i} \Delta Y_{t-i} + \sum_{i=1}^{H} \lambda_{2i} \Delta X_{t-i} + \phi \eta_{t-1} + \varepsilon_{2t} \quad (2)$$

here ΔX and ΔY denote the transformed stationary values of X and Y, μ_{t-1} and η_{t-1} are the error-correction terms that are taken from the long-run cointegration regressions.

$$X_t = \psi + \alpha Y_t + \mu_t,$$

$$Yt = \phi + \lambda Xt + \eta_\tau$$

Including the error-correction terms in the equations provides an extra channel through which causality may be captured. The error-correction coefficients ψ and ϕ are expected to capture the adjustments of ΔX_t and ΔY_t to their long-run equilibrium, while ΔX_{t-i} and ΔY_{t-i} are expected to capture the short-run dynamics of the model. The results of the Granger causality test depend critically on the choice of lag length. Most often, the choice of the lag length is *ad hoc*. However, Lee (1997) argued that this practice is susceptible to potential model misspecification. As Hasio (1981) pointed out, the Akaike minimum Final Prediction Error (FPE) criterion is appealing because it balances the risk of selecting a higher lag against the risk of a low lag. In this study, both the Akaike and Schwarz criteria are employed.

Results of the causality tests are presented in Table 7. Real economic activity Granger-causes stock market size in Korea while a bi-directional causality exists between the two variables in Malaysia and the Philippines. Stock market size Granger-causes real economic activity in Zimbabwe. Stock market size follows the number of listed companies (privatization proxy) in Malaysia and the Philippines, whereas the causality is bi-directional in India and Zimbabwe. On the basis of these estimates, no causality exists between

stock returns and stock market size in India, Malaysia, the Philippines and Zimbabwe. The causal link appears to be bi-directional between stock returns and stock market size in Korea.

Table 7: Granger causality tests

Country	*Direction of causality*	
India	MCAP ↔ LIS*	TV ↔ LIS*
	MCAP ⇳ TRI*	TV ↔ TRI*
	TRI ⇳ MCAP*	
Korea	MCAP ⇳ IND*	TV ⇳ IND*
	IND → MCAP**	IND → TV**
	MCAP ⇳ LIS*	TV ⇳ LIS*
	LIS ⇳ MCAP**	LIS ⇳ TV*
	MCAP ⇳ TRI*	TV ⇳ TRI*
		TRI ↔ TV**
Malaysia	MCAP ↔ IND**	TV ↔ IND**
	MCAP ⇳ LIS*	TV ⇳ LIS*
	LIS → MCAP**	LIS → TV*
	MCAP ⇳ TRI*	TV ↔ TRI*
Philippines	MCAP ↔ IND*	TV ↔ IND*
	MCAP ⇳ LIS*	TV ↔ LIS*
	LIS → MCAP*	TV ⇳ TRI*
	MCAP ⇳ TRI*	TRI → TV**
	TRI ⇳ MCAP*	
Zimbabwe	MCAP → IND*	TV ↔ IND*
	MCAP ↔ LIS*	TV ⇳ LIS*
	MCAP ⇳ TRI*	LIS → TV**
		TV ⇳ TRI*
		TRI → TV**

Notes: 1. $X \rightarrow Y$ = X Granger-causes Y
2. $X \leftrightarrow Y$ = Bi-directional causality
3. $X \nRightarrow Y$ = X does not Granger-cause Y
4. $Y \nRightarrow X$ = Y does not Granger-cause X
5. The symbols * and ** denote significance at the five per cent and the one percent level, respectively.

As reported in Table 7, results indicate that the causal link between stock market liquidity and real economic activity seems to be bi-directional in India, Malaysia, the Philippines and Zimbabwe, while it runs from real economic activity to stock market liquidity in Korea. Results also indicate that the causal link between stock market liquidity and the number of listed companies seems to be bi-directional in India and Zimbabwe and runs from the number of listed companies to stock market liquidity in Korea, Malaysia and the Philippines. Finally, Table 7 shows that no causal link exists between stock market liquidity and stock returns in India, Malaysia, the Philippines, and Zimbabwe, while it is bi-directional in Korea.

The results of the study are important in several aspects: First, out of twelve emerging economies, only five exhibit any type of causal relationship between stock market indicators and the relevant economic variables. These countries are India, Korea, Malaysia, the Philippines and Zimbabwe. Secondly, the results reflect the changing pattern of the finance-growth relationship. In Korea, the country with the highest per capita GDP ($13,062 in 2000), economic growth leads and finance follows (real economic activity Granger-causes stock market indicators, MCAP and TV), while in the other countries (India, Malaysia, the Philippines and Zimbabwe) the bi-directional causality reflects the interaction of supply-leading and demand-following phenomena. Thirdly, the results indicate that financial liberalization policies have contributed in activating stock markets in these countries, where the causality runs from the number of listed companies (privatization proxy) to stock market indicators in Malaysia and the Philippines.

In India and Zimbabwe the financial liberalization process and the stock market are interacting. Here financial liberalization-privatization activates stock markets and the expansion of stock markets provides a wider basis for privatization. In Korea such links cannot be seen. This might be explained by the fact that Korea started the liberalization process earlier. That is, over the sample period, no major steps have been taken. Fourthly, the link between stock market size and stock returns seems to be weak. Two types of causal link exist regarding stock market liquidity and stock returns. It is bi-directional in India, Korea, Malaysia and unidirectional, running from stock returns to stock market liquidity, in the Philippines and Zimbabwe. As mentioned before, most emerging economies experienced high stock returns during the sample period, which seems to be followed by more trading. In addition, liquid markets provide the foundation for raising funds, which will enable projects with investment opportunities to earn high profits. As a consequence, shares will experience high returns.

6. Conclusions

The purpose of this paper was to investigate both the long-run and the short-run interactions between stock market growth and real economic activity, privatization programs, and stock returns in twelve emerging economies over the period 1988-2000. In doing so, several time-series techniques such as unit-

root testing, multivariate cointegration and Granger causality procedures were employed.

The cointegration analysis indicates that the existence of a long-run relationship between stock market growth and real economic activity, privatization, and stock returns in India, Korea, Malaysia, the Philippines and Zimbabwe. On the other hand, such a relationship is absent in Chile, Colombia, Greece, Pakistan and Venezuela. The direction of Granger-Causality was detected through the use of a Vector error-correction model. The Granger causality test results indicate that economic growth leads and finance follows in Korea, while a two-way causality relationship exists in Malaysia, the Philippines and Zimbabwe. The results further show that the privatization programs have a significant impact on stock market activating. In addition, high stock returns seem to play a significant role in increasing stock market liquidity, while such a role has not been found regarding stock market size.

The results of the study are consistent with the proposition introduced by Patrick (1966), whereby the causality pattern between economic growth and finance changes over the development path, i.e. in the early stages finance leads and economic growth follows, while in the later stages, the opposite occurs. However, results regarding the relationship between stock market growth on the one hand and privatization, and stock returns on the other hand, suggest that country-specific issues are important in stock market development. Further research in this field should tackle two issues. First, the changing characteristics of emerging economies must be considered. Secondly, an alternative approach might be to use panel data. Despite the well-known limitations of this approach, combining cross-sectional and time series information might yield more systematic results with respect to the causal link between the variables.

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APPENDIX

Data Sources

The paper uses monthly data from 1988-2000 for 12 countries. The country coverage and the time dimension are based primarily on the availability of data in monthly frequency.

Industrial Production Data: The monthly industrial production index data are taken from the International Financial Statistics (IFS) CD-Rom 2000

Stock Market Data: Monthly data on market capitalization, trading value, the number of listed companies, and total return index are taken from several issues of the International Finance Corporation's (IFC) *Emerging Stock Markets Factbook* (some issues are in Microfilm form).

Table A1: Correlation and covariance of GDP growth rate and industry value added growth rate (1988-1999)

Country	*Correlation*	*Var. of GDP Growth Rate*	*Var. of Industry Value Added Growth Rate*	*Covariance*
Chile	0.8311	0.001231	0.000724	0.000785
Colombia	0.4166	0.000664	0.009514	0.001047
Greece	0.8522	0.000202	0.000826	0.000348
India	0.8118	0.000531	0.001097	0.000619
Jordan	0.5480	0.004664	0.009258	0.003601
Korea	0.9806	0.002141	0.002874	0.002433
Malaysia	0.9717	0.002106	0.004133	0.002867
Mexico	0.9346	0.000985	0.002008	0.001315
Pakistan	0.7124	0.000391	0.000714	0.000376
Philippines	0.9638	0.000821	0.001716	0.001144
Venezuela	0.9202	0.003006	0.005558	0.003761
Zimbabwe	0.8586	0.002091	0.002200	0.001842

Table A2: Correlation and covariance of GDP growth rate and industry value added growth rate (1980-1999)

Country	*Correlation*	*Var. of GDP Growth Rate*	*Var. of Industry Value Added Growth Rate*	*Covariance*
Chile	0.8995	0.002585	0.002299	0.002181
Colombia	0.4375	0.000500	0.006035	0.000760
Greece	0.8224	0.000213	0.000742	0.000327
India	0.7812	0.000389	0.000745	0.000421
Jordan	0.4599	0.004235	0.006169	0.002351
Korea	0.9516	0.002155	0.003403	0.002577
Malaysia	0.9282	0.001805	0.003511	0.002337
Mexico	0.9449	0.001533	0.002925	0.002001
Pakistan	0.5451	0.000495	0.000995	0.000383
Philippines	0.9740	0.001551	0.004000	0.002426
Venezuela	0.9052	0.002359	0.005039	0.003121
Zimbabwe	0.5762	0.002483	0.002130	0.001325

ENDNOTES

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2. Tables A1 and A2 in the Appendix.

3. In fact, we cannot be certain that the number of listed companies on the stock market is all explained by privatization. However, there are some points that might justify using the number of listed companies. First, privatization revenues are the best indicator. However, absence of data mean that the preferred choice is not available. Secondly, while private enterprises may become sufficiently large to warrant listing on the stock market in many emerging economies, still the main source of the increase in the number of listed companies comes from the privatized state-owned enterprises. Thirdly, for countries where the main source of the increase in the number of listed companies comes from growing private enterprises, a significant correlation between the number of private enterprises listed and the number of the privatized state-owned enterprises might be found. That is, private enterprises will not expand and grow unless there is an encouraging environment with privatization as one of its key elements.

4. The impact of exchange rate regimes and exchange rate movements on stock market growth can be traced through two channels. First, the economic growth channel. Exchange rate regimes have a direct impact on export-economic growth that has been assumed to either follow or lead financial-stock market developments. Secondly, there is the stock prices channel. Several studies have explored the relationship between stock prices and exchange rate movements. While the link between exchange rate regimes-movements and economic growth has been established to a large extent, the link between exchange rate regime-movements and stock prices seems to be weak (Solnik, 1987; Mok, 1993). Dollar denomination of market capitalization, trading value and the total return index are used in the paper in an attempt to grasp exchange rate movements since it would reflect changes in the exchange rate.

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