Analysis of Cointegration in Capital Markets of France, Germany and United Kingdom

Hande Erdinc
Joniada Milla
University of Nebraska at Omaha

Abstract: In this paper, we assess whether there is cointegration among stock exchange markets of a bloc of major EU countries of France, Germany, and, United Kingdom. Besides, we probe the cointegration patterns between these countries' capital markets and the world capital market as well, proxy of which is the Morgan Stanley Capital International (MSCI) Index. The main rationale inducing us to focus on these countries is their joint membership in European Union inferring great financial integration among them. Additionally, their economic structures are of the same character, and their relatively high level of development makes them possess the heaviest volume stock exchange markets in the European Union. We exploit monthly data of stock exchange for the period of January 1991 – September 2006. The methodology we use encompasses unit root tests and cointegration tests. Our preliminary results indicate that there exists a long term relationship when we match the European countries with each other. Eventually, we hope that the deduction of our diligent work will be consistent with the preliminarily anticipated results stated previously.

Introduction

The aim of this study is to assess whether there is cointegration among stock exchange markets of a bloc of major EU countries of France, Germany, and United Kingdom for the time period from January 1991 to July 2006. Besides, cointegration patterns between these countries' capital markets and the world capital market are analysed as well.

Finance literature contains considerable number of studies that examine the degree of integration of stock markets around the world. These studies have proved that capital markets all over the world have become increasingly integrated and co-movements among major financial markets have been rising.

The main reason for this trend is a variety of policy changes that contribute to the liberalization and globalization of capital markets [Chou, Ng, Pi, 1994]. According to Ripley [1978] and Bachman et al. [1996], the interdependence among national stock markets may also be the result of some factors that provide indirect links between stock prices in different countries, too. Those factors include: similarity in income patterns, the formation of a currency area strengthening the relationship between domestic economic variables, the role of a dominant financial center within a multinational area facilitating within-area capital flows, a common technological trend assimilating concurrently into different economies, financial deregulations allowing investors to extend their portfolios internationally, and significant international trades in general and in capital goods inducing strong economic ties.

This research area has drawn great attention, and this is because of its result implications in the world of economics. The extent of international capital market integration has a big importance for investor's investment strategy and capital market efficiency. Let's talk on these in turn. Provided that the equity markets under consideration are integrated, then diversification benefits might be limited. This would be the result as an unfavorable movement in one market would reflect an unfavorable movement in other markets, too. So, investing at the same time on a group of cointegrated markets, will not hedge the risk of investing.

Moreover, on the basis of available information, market efficiency is defined as the unpredictability of future price movements. The major implication of the idea that markets are efficient is that price movements do not follow any patterns or trends. This means that on the basis of available information it is not possible to predict future price movements. Such an unpredictable pattern of the price movement is called a 'random walk'. Testing a random walk model is the main methodology for testing the market efficiency. There are different forms of market efficiency based on the extent of information available. The most commonly observed and analyzed is the weak-form market efficiency (the information set includes only information on historical returns). Consequently, capital market integration may contradict weak-form market efficiency if one market's movements can be used to predict another market's movements.

To sum up, inspired by Ortiz [2006] on "Patterns of Cointegration in NAFTA Capital Markets", our paper undertakes a review of the issues surrounding capital markets' relationships and more specifically, the extent to which we may expect our selected international capital markets to be cointegrated. Section 2 reviews the available empirical evidence regarding the degree to which international stock exchange markets are cointegrated. We proceed in section 3 by stating the main methodology we exploited to find what is behind the enormous array of the data made use of. Section 4 includes our concrete empirical results obtained from unit root and cointegration tests. These results, then, lead us to make a final résumé and conclusion on the target of our research in section 5.

Literature Survey

The literature review develops a theoretical background for the study through a review of relevant theories. The literature review places the study in context by reviewing prior stock market integration studies in both global and regional contexts. Although there has been extensive research on equity market integration, there is no set agreement on this phenomenon. The studies of long-run relationships provide mixed results. Research results differ according to the methodology used, the model, the data, the sample, and the time period. Some studies have concluded that world equity markets are integrated, that the US market is the most influential stock market in the world, and that the Japanese market is the second most influential. On the other hand, some studies have reported no lead or lag relationships among international markets at all.

It would be proper to begin with the paper that was our source of inspiration, Ortiz [2006]. This study tests financial integration among NAFTA capital markets, and between these markets and the world capital market. Results evidence a time-varying integration among NAFTA capital markets, and a mild segmentation and a time-varying integration between these markets and the world capital market.

As in this study we focus on analyzing the cointegration in capital markets of three major EU countries, in this literature review, we mostly concentrate on the studies that examine the patterns of cointegration on EU member countries. These studies generally find the evidence of stock market integration within the EU, reemphasizing the possibility of economic integration via policy coordination in explaining stock market interdependence.

Arshanapalli and Doukas [1993] use unit root and cointegration analyses to examine relationships and interactions among the stock markets of New York, Japan, Paris, Frankfurt, and London, from January 1980 to May 1990. The authors conclude that there has been an increasing interdependence among these stock markets after the crash of 1987, except for Japanese stock market. The French, UK, and German markets are significantly affected by the US market. The Japanese market performance has no links at all with any market in the US, France, Germany, and UK.

Koutmos [1996] finds evidence that the stock markets of France, Germany, Italy, and the UK are integrated because they are affected not only by local news, but also by international news, especially unfavorable, stemming from other markets.

Friedman and Shachmurove [1997] also find that the larger markets of the EU comprising France, Germany, the Netherlands, and UK are highly related, but the smaller markets are more independent, implying larger benefits from short-run diversification by extending stock investment into those smaller countries. Moreover, the British stock market appears to be the leading market in the EU since it explains most of its own innovations and high proportions of the innovations in other markets.

Gallagher [1995], and Knif and Pynnonen [1999] find weak or no evidence of EU stock market integration. Gallagher [1995] suggests that Irish investors may increase long-run diversification benefits by extending their domestic stock portfolios to encompass the German and UK stock markets, because no evidence of cointegration is found between the Irish and German stock markets, or between the Irish and UK stock markets. Additionally, Knif and Pynnonen [1999] suggest that the Nordic countries appear to constitute separate region in Europe since they find no cointegration relationship between these markets and the other European stock markets. However, their findings of no cointegration using three-year, daily data should not be interpreted as the lack of long-run stock market integration because cointegration is a long-run property and hence long time spans of data, rather than data frequency, are needed to appropriately test for existence of cointegration [Hakkio and Rush, 1992].

In contrast, evidence of stock market integration within the EU tends to be strong when a cointegration analysis is performed over an extended period of time. Such result is found in Serletis and King [1997], and Rangvid [2001].

Serletis and King [1997] find evidence of two common stochastic trends in ten EU stock markets using quarterly data from 1971 to 1992. They suggest that complete integration of, or a single shared common trend in EU stock markets is not observed potentially because of some existing differences in fiscal and monetary policies across EU countries. Using time-varying estimation, they also find evidence of an increase in convergence of stock prices over time, indicating that the linkages among the EU stock markets have been strengthening and the convergence has been an ongoing process.

Rangvid [2001] uses a recursive cointegration analysis to examine the degree of stock market integration among France, Germany, and the UK during the period from the first quarter of 1960 to the first quarter of 1999. They find that the number of cointegrating vectors increases from zero in the late 1960s to two as the estimation period gets expanded into the late 1990s. This suggests that the three major European stock markets have been increasingly integrated and driven by a fewer number of common market trends over time. Moreover, the integration appears to precipitate in the 1980s when capital restrictions are lifted throughout the EU area and increase throughout the 1990s when the moves toward the EU are more pronounced than those in previous decades because of the economic convergence criteria stipulated in the Maastricht Treaty (1992).

Similarly, Phengpis [2004] is an empirical analysis conducted upon stock price indices of five major EMU countries (France, Germany, Italy, the Netherlands, and Spain) , five non-EMU countries (Australia, Hong Kong, Japan, Singapore, and Switzerland), the US and UK for the period from January 1979 until June 2002. Unlike those of non-EMU countries, stock market price indices of the five EMU countries studied are cointegrated over the full sample period, over time, and even after controlling for the 1987 US stock market crash or the 1997 Asian financial crisis.

Finally turning back to our topic, our main concern would be to give answers to the following questions:

- Which of the three major stock markets in the EU is the dominant market such that it is the source of common stochastic trends and may provide collective news and information that are relevant to all other EU stock markets?
- Are there any long-run linkages and causal relationships between stock market integration among EU countries, and these countries and the world capital market (MSCI) as well?

Data and Methodology

Throughout this paper we make use of the monthly frequency of the data covering the period from January 1991 to July 2006 for France, Germany, and UK stock markets and the Morgan Stanley Capital International Index (MSCI). MSCI is used as a proxy for the world stock market index because it is built on more than 1500 stock prices from 23 stock markets around the world. Concerning our monthly series, instead of using month-end closing values of stock markets as most papers have done up to now, we generate the monthly frequency of the data by taking the monthly average of the daily closing values of stock prices. We consider this originality a new idea in the context of better capturing the stock price movements throughout the month.

We use monthly series in this study, rather than daily series, because cointegration is a long-run property and hence long time spans of data, rather than high data frequency, is essential to appropriately test for the existence of cointegration [Hakkio and Rush, 1992; Bailey and Stulz, 1990]. That is, the high number of observations as a result of a long time span (rather than as a result of high frequency of the data) grasps better the cointegration relation among capital market returns.

The FTSE 100 (UK), CAC 40 (FR), DAX 30 (GR) are used to represent the three EU markets respectively. Furthermore, in this analysis we transform our data into logarithms, that is into stock market returns. This transformation is necessary because the rate of returns is what all economic agents observe and are concerned about.

So, lnFR = monthly stock market returns for France.
lnGR = monthly stock market returns for Germany.
lnUK = monthly stock market returns for United Kingdom.
lnMSCI = monthly stock market index of the MSCI Index.

The cointegration analysis of our study covers an extended and relatively long period of time including the recent data of the last 15 years so as to allow common trends to be detected by cointegration analysis. Such a time period accentuates the potential influences of economic convergence on stock market integration, that appears to be reinforced by the dependence among EU countries as a result of Maastricht Treaty (1992), the 1990s initiative of increasing policy coordination towards the formation of the EU and the ECB (European Central Bank)'s centralized monetary policy via the euro.

The standard classical estimation methods are based on the assumption that the mean and variances of the stochastic series are constant and time invariant. However, applications of unit roots have shown that a large number of economic series are non-stationary, that is, their means and variances change over time. This happens because time series data reflect a process that involves trend, cycle and seasonality. By removing these deterministic and/or stochastic patterns, the remaining data becomes stationary. The unit root tests determine the stationarity characteristics of the data. The ADF test of unit root is conducted within the context of three distinct models of generating processes of a series y as follows:

$$\Delta y_t = \rho y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + u_t$$ Model (1) without any constant and trend.

$$\Delta y_t = \alpha + \rho y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + u_t$$ Model (2) with constant but no trend.

$$\Delta y_t = \alpha + \beta t + \rho y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + u_t$$ Model (3) with constant and trend.

The null hypothesis is: $H_0: \rho = 0$, meaning that a unit root exits in y, that is, y is non-stationary. If a variable is stationary, that is it does not have unit roots, it is said to be integrated of order zero or I(0). When the non-stationarity problem is present in series data, the original data is differenced and retested. If a variable is not stationary in its level form, but stationary in its first differenced form, it is said to be integrated of order one or I(1). More generally, the series y_t will be integrated of order d, that is, y_t ~ I(d), if it is stationary after differencing d times, so y_t contains d unit roots (Dickey and Fuller, 1981). Through this process, the order of the integrated process for each data series is established.

Only when our unit root tests indicate that all variables are integrated of the same order should we go further to examine whether the stock markets under study are cointegrated.

Earlier studies investigate market integration in two lines of research. The first and the oldest is the financial asset pricing perspective. According to this line, national markets are considered to be integrated if securities with the same risk characteristics are priced the same across borders, regardless where the securities are traded. The second line of research defines market integration from a statistical perspective and markets are considered to be integrated if national stock prices share a common long-run equilibrium relationship. All the papers that we took reference and talked about in our literature survey pursue this line of research, namely Arshanapalli and Doukas [1993], Koutmos [1996], Friedman and Shachmurove [1997], Gallagher [1995], and Knif and Pynnonen [1999], Serletis and King [1997], Rangvid [2001], Phengpis [2004]. Our research adopts the later view and uses Johansen and Juselius (JJ) cointegration tests as the main methodology, too.

The basic idea behind cointegration is that if all the components of a vector time series process y_t have a unit root, or in other words, y_t is a multivariate I(1) process, it is said to be cointegrated when a linear combination of them is stationary, that is if the regression produces an I(0) error term. Johansen and Juselius [1990] proposed two types of hypothesis tests to help determine r, the number of cointegrating vectors. They are:

1. *Trace test:* The null hypothesis is that there are r or fewer cointegrating vectors in the system. The statistic is: $-T\sum_{i=r+1}^{p}\ln(1-\hat{\lambda}_i)$. To determine the number of cointegrating vectors, r, we test the sequence of null hypothesis r=0, r≤1, r≤2,....., r≤(q-1). If r≤q is the first null accepted then we conclude that there are r=q cointegrating vectors.
2. *Maximal eigenvalue test:* The null hypothesis of the test is that the number of cointegrating vectors is r versus the alternative hypothesis that the number is r+1. The test statistic is $-T\ln(1-\hat{\lambda}_{r+1})$. To determine the number of cointegrating vectors, r, we test the sequence of null hypothesis r=0, r=1,....., r=p-1. If r=q is the first null accepted, then we conclude that there are r=q cointegrating vectors.

Cointegration regressions show the long-run, or equilibrium relationships between economic variables. Cointegration analysis will be conducted at both bivariate and multivariate levels in order to obtain more insight into the interrelationships among our markets of concern. Focusing only on bivariate or only on multivariate cointegration analysis might miss important information because it is possible that variables are not cointegrated at bivariate level but are cointegrated collectively, or vice versa.

Our aim in this study is to find only one cointegrating vector of the four-variate cointegrating regression among world stock market and the three selected EU countries. At the same time, we aim to find one cointegrating vector for the three-variate and bivariate cointegration regression equations among the EU countries as well. This implies that, in the long-run, there exists one equilibrium relationship between these variables throughout the time span under observation. In this instance, equilibrium refers to a situation where a shock may have a permanent effect on the levels of each of the processes, but any resulting disequilibrium will eventually die out completely.

This study employs an additional diagnostic technique proposed by Stock and Watson [1993], namely DOLS, to augment the robustness of the conventional JJ cointegration trace test. Dynamic Ordinary Least Squares provide efficient parameter estimators of the cointegrating relationships.

Finally, after determining the lag length in the VAR system, we then proceed to conduct the Granger test of causality. This will help us to see if the results gained from the cointegration tests are supported.

Empirical Analysis

This section presents the empirical results of this study. It is organized as follows: graphing the data all together, providing the correlation matrix, and evaluating the cointegration tests' results after firstly performing the ADF test for stationarity. Finally, Granger causality test results will be examined to see the causality between the four stock markets.

We refer to Graph-1 to get a visual idea of the basic characteristics of our time series. As it can be easily noted, the four time series show the same trend through the period under observation. We proceed with the correlation matrix included in Table-1. Pairwise correlation coefficients are remarkably high.

The traditional approach of testing market integration by referring to correlation coefficients cannot provide complete and enough information in this regard. To avoid this problem, this paper studies market integration by inspecting the long-run relationship among international stock market prices. In order to obtain a consistent regression equation, a compulsory condition is the data's stationarity. This can be tested by performing the ADF test. The outcomes are recorded in Table-2. First, we tested the null hypothesis of unit root for the level, and we failed to reject the null concluding that the level of the time series are non-stationary, that is they are not I(0). Then, we took the first differences and repeated the unit root test. This time, we succeeded in rejecting the null of unit root at all significance levels. Thus, the first differences of the logarithmic values of the price indices for France, Germany, UK, and MSCI came out to be stationary. They are all together integrated of order one, that is they are I(1).

Having all the series integrated of the same order, we can now test their cointegration relationships. The results we obtained are included in Table-3. According to Johansen and Juselius [1990] and Kasa [1992], in case of conflict between trace and the maximum eigenvalue tests, the former is superior. So, we refer to trace test to evaluate our results. We succeeded in getting one cointegrating vector from the following combinations:

- ✓ lnMSCI, lnGR, lnFR, lnUK
- ✓ lnMSCI, lnGR, lnFR
- ✓ lnMSCI, lnGR, lnUK
- ✓ lnGR, lnFR, lnUK
- ✓ lnMSCI, lnGR
- ✓ lnGR, lnUK
- ✓ lnFR, lnUK

Thus, cointegration is present where there is a combination of non-stationary variables that is stationary, just like in our case. The finding of our study is that the four stock markets are cointegrated meaning that an equilibrium relationship between them exists in the long-run. Furthermore, a cointegration relationship was also obtained between the three major EU countries. But when looking at the cointegration relationships in pairs, test results prove the existence of a long-run relationship except for Germany-France combination.

The results of the DOLS found in Table-4 give us statistically significant coefficients of cointegrating relationships if tested at 10%. Generally, their signs came out to be in accordance with the correlation coefficients.

Finally, the Granger causalities based on stock markets are analyzed to shed important light on the intertemporal relationships between the markets under study. Results of the causality tests show significant unilateral causal relationship from world stock market index to UK, from UK to France, and from UK to Germany; whereas there is no evidence of causality between France and Germany. Thus, Granger causality directions support the cointegration test results.

Conclusion

As stated also in our abstract, our preliminary results indicate that there should exist a long term relationship when we match the European countries with each other. The main rationale inducing us to focus on these countries is their joint membership in European Union inferring great financial integration among them. Additionally, their economic structures are of the same character, and their relatively high level of development makes them possess the heaviest volume stock exchange markets in the European Union.

But what did the empirical results of this study tell us about the degree of integration among the selected EU countries?

Firstly, as the correlation is a preliminary indication of market integration, referring to the correlation coefficients is a necessary but not sufficient step. As discussed a little before, returns among the stock markets show a high positive correlation.

After confirming that all four of our series were integrated of order one, I(1) by ADF unit root test, the data underwent the trace test of cointegration.

The results proved that one cointegrating vector is present in both multilateral and bilateral combinations. Stated simpler, the combinations of the integrated of order one (non-stationary) variables came out to be stationary. So, stock exchange markets are linked in the long-run, "in the sense that they tend not to drift apart over time" [Throop, 1994, p. 11]. All combinations, except for the France and Germany bilateral case, exhibit a long-run co-movement.

Stock Watson Dynamic OLS test of cointegration was used to support our JJ trace test results. What we got is that there is cointegration between the variables of interest, the coefficients are very good and the t-results are all statistically significant at 10 %.

This deduction is consistent with the preliminarily anticipated results stated in our abstract. Interestingly, the test results show that UK stock returns' movements explain and can also be explained by the variations in the other two countries' stock exchange returns, making in this way UK a leading indicator between these three EU countries. This is also supported by the generally unidirectional causality confirmed by the Granger causality test.

Ultimately, we concentrate in commenting on the implications of the findings of this research work. We firstly discuss the effectiveness of international diversification benefits. Since this work involves a statistical view of market integration, an acceptance of the integration indicates that the international stock markets share a long-run equilibrium relationship. Namely, they do have a tendency to move together in the long-run. Therefore, international financial diversification benefits are limited among France, Germany and UK. However, as there is found no cointegration between France and Germany, investors can benefit by diversifying their investment portfolios among these two countries.

Last but not least, we discuss the market efficiency mentioned previously in the introduction.

The world stock index and the three major EU countries are cointegrated. This implies market inefficiency because the past information in one market can be used to help predict the price movements in another market. Consequently, the weak-form market efficiency is violated.

These findings are consistent with those of Arshanapalli and Doukas [1993], Koutmos [1996], Friedman and Shachnurove [1997], and Phengpis [2004].

References

Alsuhaibani, S.I., (2004). "Financial Integration of Stock Markets in the Gulf Cooperation Council Countries".

Arshanapalli, B. & Doukas, J., (1993). "International Stock Market Linkages: Evidence from the pre- and post-1987 period", *Journal of Banking and Finance*.

Bachman, D., Choi, J.J., Jeon B.N., and Kopecky, K.J., (1996). "Common Factors in International Stock Prices: Evidence from a Cointegration Study", *International Review of Financial Analysis*.

Bailey, W., Stultz, R.M., (1990). "Benefits of International Diversification: The Case of Pacific Basin Stock Markets", *Journal of Portfolio Management*.

Cheng, H., (2000). "Cointegration Test for Equity Market Integration: The Case of the Great China Economic Area (Mainland China, Hong Kong, and Taiwan), Japan and the United States".

Devine, M., (1997). A technical paper, "The cointegration of International Interest Rates, A Review".

Dickey, D.A. & Fuller, W.A., (1981). "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", *Econometrica*.

Friedman, J. & Shachmurove, Y., (1997). "Co-movements of Major European Stock Markets: A Vector Autoregression Analysis", *Global Finance Journal*.

Gallagher, L., (1995). "Interdependencies among the Irish, British and German Stock Markets", *The Economic and Social Review*.

Johansen, S. & Juselius, K., (1990). "Maximum Likelihood Estimation and Inference on Cointegration with Applications to Demand for Money", *Oxford Bulletin of Economics and Statistics*.

Knif, J. & Pynnonen, S., (1999). "Local and Global Price Memory of International Stock Markets", *Journal of International Financial Markets, Institutions and Money*.

Koutmos, G., (1996). "Modeling the Dynamic Interdependence of Major European Stock Markets", *Journal of Business Finance and Accounting*.

Lin, Antsong, (1991). "An Application of Cointegration to Investigate Global Capital Market Integration". Doctoral Dissertation, University of Texas at Arlington.

Ng, Thiam Hee, (2000). "Economic Integration in Southeast Asia". Thesis, University of Wisconsin, Madison.

Ortiz, E. & Lopez-Herrera, F., (2006). "Patterns of Cointegration at the NAFTA Capital Markets".

Phengpis, C., (2004). "Long-Run Stock Market Integration and Economic Convergence in the European Monetary Union".

Pi, L., Chou,R., Ng, V., (1994). "Cointegration of International Stock Market Indices", *Proceedings of American Statistics Association annual meetings*.

Rangvid, J., (March 2001). "Predicting Returns and Changes in Real Activity In Emerging and Developed Economies", *Manuscript, Copenhagen Business School*.

Serdyuk, A., (2006). "Tests of Random Walk and Market Efficiency in Western European Countries: An Empirical Study".

Serletis, A. & King, M., (1997). "Common Stochastic Trends and Convergence of European Union Stock Markets", *The Manchester School*.

Stock, J.H. & Watson, M.W., (1993). "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems", *Econometrica*.

Appendix

Graph-1 Time series plot of the stock market indices

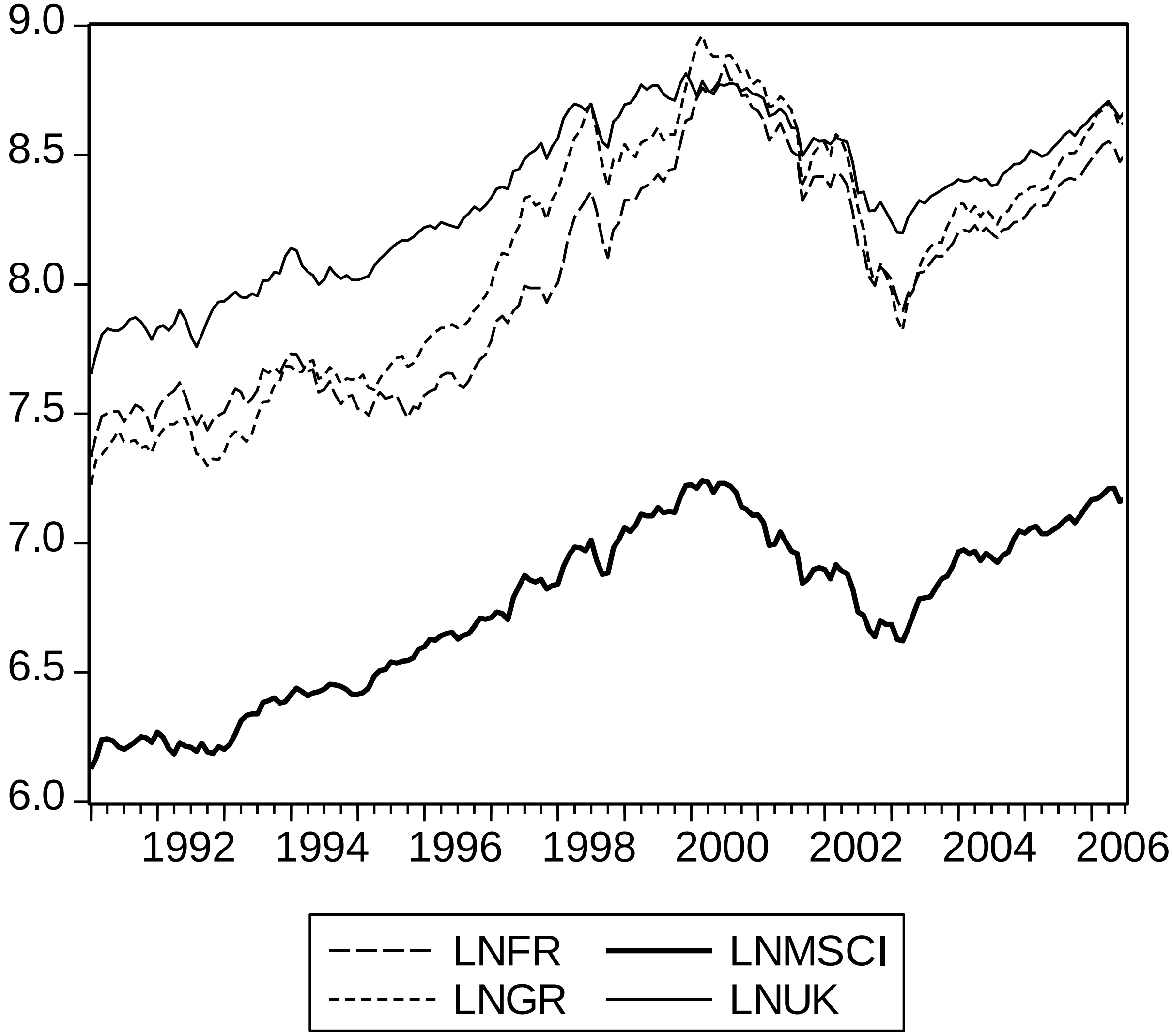

Table-1 Correlation matrix

Pairwise Correlation Matrix	lnFR	lnGR	lnMSCI	lnUK
lnFR	1.000000	0.968594	0.935903	0.927643
lnGR	0.968594	1.000000	0.972521	0.981103
lnMSCI	0.935903	0.972521	1.000000	0.973639
lnUK	0.927643	0.981103	0.973639	1.000000

Table-2 Augmented Dickey-Fuller (ADF) test

Variable	Case	Lags	Level	Case	Lags	Difference
lnMSCI	No Trend	1	-1.256	No Trend	0	-11.106*
lnFR	No Trend	1	-1.1282	No Trend	0	-10.561*
lnGR	No Trend	1	-1.3055	No Trend	0	-9.749*
lnUK	No Trend	1	-1.6487	No Trend	0	-11.0437*

The critical values for the case with no trend are -3.46 for 1%, -2.88 for 5% and -2.57 for 10% significance level.
* Reject null of unit root at 5% and 10% significance level. (i.e. time series is stationary)

Table-3 Johansen-Juselius cointegration test results

	Variables	Null	LAGS	TREND	
				Max.E	Trace
1	lnMSCI	r =0	1	30.2*	36.32*
	lnGR	r≤1		6.12	6.12
2	lnUK	r =0	1	25.96*	32.34*
	lnGR	r≤1		6.38	6.38
3	lnUK	r =0	1	13.35*	23.63*
	lnFR	r≤1		10.28	10.28
4	lnMSCI	r =0	1	30.5*	48.12*
	lnGR	r≤1		13.75*	17.62
	lnFR	r≤2		3.87	3.87
5	lnMSCI	r =0	1	34.55*	55.74*
	lnGR	r≤1		14.23*	21.19
	lnUK	r≤2		6.96	6.96
6	lnUK	r =0	1	29.58*	48.48*
	lnFR	r≤1		14.59*	18.90
	lnGR	r≤2		4.32	4.32
7	lnMSCI	r =0	1	36.81*	74.54*
	lnGR	r≤1		18.36*	37.73
	lnFR	r≤2		15.42*	19.37
	lnUK	r≤3		3.95	3.95

* Significance referring to the following critical values:

The critical values for the case with trend for 10% significance level are:

	L-max	Trace	L-max	Trace	L-max	Trace
r =0	19.88	58.96	16.13	39.08	12.39	22.95
r≤1	16.13	39.08	12.39	22.95	10.56	10.56
r≤2	12.39	22.95	10.56	10.56		
r≤3	10.56	10.56				

Table-4 Stock-Watson test results

		lnMSCI	lnGR	lnFR	lnUK	c
1	Coefficients		0.0937	0.1856	0.6263	-0.7352
	Significance	1.0000	0.0921	0.0431	0.0000	0.0444
		lnMSCI	lnFR	lnGR	c	
2	Coefficients	1.0000	-0.0775	0.7179	1.5469	
	Significance		0.1540	0.0000	0.0000	
		lnMSCI	lnGR	lnUK	c	
3	Coefficients	1.0000	0.3104	0.5503	-0.3616	
	Significance		0.0000	0.0000	0.2139	
		lnGR	lnFR	lnUK	c	
4	Coefficients	1.0000	0.4919	0.9307	-3.6012	
	Significance		0.0000	0.0000	0.0000	
		lnUK	lnGR	lnFR	c	
5	Coefficients	1.0000	0.8500	-0.2735	3.6436	
	Significance		0.0000	0.0000	0.0000	
		lnFR	lnUK	lnGR	c	
6	Coefficients	1.0000	-0.8105	1.3315	3.9855	
	Significance		0.0000	0.0000	0.0000	
		lnMSCI	lnGR	c		
7	Coefficients	1.0000	0.6539	1.4440		
	Significance		0.0000	0.0000		
		lnGR	lnUK	c		
8	Coefficients	1.0000	1.5420	-4.7554		
	Significance		0.0000	0.0000		
		lnFR	lnUK	c		
9	Coefficients	1.0000	1.2427	-2.3466		
	Significance		0.0000	0.0000		