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International Capital Movement, Portfolio Diversification and Financial Crisis

by
Stella Karagianni

1. International Portfolio Diversification – A Literature Review

The analysis of returns from international diversification began several years after Markowitz formalized portfolio theory in the 1950's. It was Grubel (1968) who first analyzed the potential profits form international diversification using a 2-asset/2-country model. Subsequent studies by Levy and Sarmat (1970), Lessard (1973) and Solnik (1974) presented further evidence to support the usefulness of international diversification. In the spirit of modern portfolio theory, the basic argument in this literature is that international diversification reduces risk without sacrificing expected returns. A basic requirement is that national markets are relatively uncorrelated or even negatively correlated. Although the analysis of international portfolios is complicated by the existence of additional risk factors, such as political instability and currency uncertainty, it has been assumed that most of this risk can be reduced in a well diversified portfolio.

A series of articles have presented empirical evidence concerning the availability of diversification benefits in international investment, some of which are reviewed below. A basic concern in this literature has been the effect of financial crises such as the 1973-4 and 1979-81 energy crises, the October 1987 international financial crisis, the 1990 and 1996 Asian emerging market crises and the Latin America crisis of 1994-95. The analytical tools that have been used include correlation analysis, cluster analysis, principal components analysis, causality analysis and cointegration analysis.

Panton, Lessig and Joy (1976) first considered the importance of investigating the stability of market interdependencies and considered it of equal importance to measuring the interdependencies themselves. They used Spearman correlation analysis and found that correlation coefficients are

relatively stable in the short-run, when estimated over three years samples, but become unstable over longer time periods. Cluster analysis of weekly returns from the 12 largest stock markets for the period 1963-72 revealed groupings of national stock markets which remain stable in the long-run.

Maldonaldo and Saunders (1981) analyzed the stability of correlation coefficients estimated from monthly and annual data for US, Japan, Canada, Germany and UK from 1957-1978. They used Box-Jenkins analysis and runs tests to show that the time series of annual correlation coefficients follow random walks. They also demonstrated that there is only some marginal forecastability of correlation coefficients for short-run periods of up to six months. Philippatos, Christofi and Christofi (1983) analyzed monthly returns from 14 major stock markets for the period 1957-78. They adopted the Maldonaldo-Saunders methodology using longer time horizons and obtained inconclusive results. Examination of correlation coefficients estimated over 4- and 5-year periods indicated that they remain stable over time. Application of PCA in two sub-samples of the data showed that most of the variation in returns is explained by one common principal component which appears stable through time. Meric and Meric (1989) investigated the stability of correlations between 17 national stock markets for the period 1973 to 1987 using various estimation samples from 1.5 to 7.5 years. Statistical tests showed that the stability of the correlation matrix is a function of the period over which the correlation coefficients are estimated, with coefficients becoming more stable in the long-run. Von Furtsemberg and Jeon (1989) used daily data from US, UK, Germany and Japan for the period 1986 to 1988 to study the variation in correlation coefficients after financial crises. They used PCA analysis of lead-lag effects to show that markets became increasingly integrated after the October 1987 crisis. Bertero and Mayer (1990) estimated correlations between monthly returns for three geographical regions, Europe, North America, and Pacific, for the period 1981-88. They found that correlations not only increased during periods of crises, but remained high for a significant period after. Examination of the variance-covariance matrix for 23 national stock markets revealed distinct groups of markets with very strong internal correlation.

Longin and Solnik (1995) researched the stability of the correlation matrix for six major stock markets over the period 1960-1990. They applied

formal statistical procedures to test the stability of correlation and variance/ covariance matrix estimated over 5-year periods and obtained inconclusive results. As an alternative explanation to the scenario of correlation matrix instability they employed a multivariate GARCH to model conditional variance and correlation. They found that correlation coefficients had a significant upward trend over time and exhibited strong increases during periods of crises. Overall, they found that correlations have increased over the past 30 years and that other variables such as interest rates and profits may have explanatory power of correlation. Patel and Sarkar (1997) investigated if the benefits from international diversification for US investors are reduced during periods of crises. They looked at correlations between US and emerging South American and Asian markets for varying horizons of one month to 30 months. They found that correlations are inversely related to investment horizon length and that diversification benefits in emerging markets exist as long as a long-term investment horizon is retained.

Eun and Shim (1989) used Vector Autoregressive (VAR) models to analyze the returns of 9 major markets using daily data from 1979-85. They found that no market is exogenous in the model and that there exist strong dynamic interdependencies between the markets under study. The US market had the strongest effect on other markets while it is influenced very little by others. The analysis also revealed the existence of compact market groups and market segmentation due to time asynchronies and inefficiencies. Von Furtsemberg and Jeon (1989) also used VAR analysis to investigate the effect of crises. They found that markets have become increasingly sensitive to movements of the Japanese market while the US does not appear to assume an increasingly important role. However, the effects of the Japanese market are not long-lasting but somewhat transitory. The UK market was found to have a stronger and longer-lasting effect after the October 1987 crisis.

Malliaris and Urrutia (1992) applied Granger causality analysis to 6 stock markets: US, Japan, UK, Hong Kong, Singapore and Australia, using daily data over sub-periods around the 1987 crisis. Although they found no causality effects prior to the crisis, in the majority of cases the null hypothesis of no-causality could not be rejected for after the period after crisis. The authors uncovered a variety of causality patterns in both directions along with

contemporaneous influences. Their results supported the scenario that Tokyo had a passive role during the 1987 and that the US along with the other Asian markets did not have a leading role.

Alexakis and Siriopoulos (1999) investigated the dynamic relationships between six Asian stock markets, namely, Japan, Hong Kong, Malaysia, Taiwan and Thailand, for the time, before, during and after the financial crisis of 1997. The applied linear and non linear Granger causality tests in order to detect the way that the crisis of October 1997 was propagated among those countries. Using linear Granger causality tests confirmed the results of previous research (Malliaris and Urrutia 1992). In general, their results indicate the presence of a more bi-directional non linear Granger causality between the Asian stock markets for the period of 2/1/1997 - 1/10/1998, although for the period before the crisis (2/1/1997 - 30/9/1997) this result is not confirmed. This result is interesting for the practitioners and the regulators, as it indicates the changes in investors' behaviour in periods of crises.

Elyasiani, Perera and Puri (1998) used daily data from 1989-94 to examine the contemporaneous and dynamic interdependencies between the emerging Sri Lanka market and its main trade partners: Taiwan, Singapore, Hong Kong, North Korea, India and the US. Granger causality tests revealed that no market had a statistically significant effect on the Sri Lanka market performance and that a large portion of variation in returns is explained by past returns themselves. They found weak interdependencies between the remaining markets. Overall, the results supported the case that the Sri Lanka market is highly segmented and independent and functions with its own dynamics.

Several studies such as Taylor and Tonks (1989), Byers and Peel (1993), Kasa (1992), Arshanapalli and Doukas (1993) used mainly monthly data and showed varying degrees of cointegration between developed stock markets. Results seem to be influenced by the data: if data are coming from the period prior or after the 1987 crisis and if returns are measured in local or dollar denomination. Smaller and emerging capital markets have been analyzed by studies such as Allen and MacDonald (1995), Hung and Cheung (1995), Siriopoulos (1996), Markellos and Siriopoulos (1996) and Choudhry (1996). An important article by Richards (1995) criticizes the empirical findings

regarding the existence of cointegration on the fact that most of it has been based on asymptotic critical values. He also criticizes the importance given to predictability and shows Monte Carlo evidence.

In this paper we attempt to provide additional empirical evidence on the issue of international portfolio diversification in five emerging stock markets for US, UK and Japanese investors. In the second section we present the data and the empirical results, and in the third section we conclude with discussion.

2. An Empirical Study of Portfolio Diversification in Five Emerging Markets

Data from 5 emerging, Greece, Turkey, Portugal, Mexico and Korea, and 3 developed markets, US, UK and Japan, was examined using cointegration analysis of Engle-Granger two-step and the maximum likelihood of Johansen. The data consisted of monthly closing prices collected from OECD/Main Economic indicators. More specifically: NYSE Common Stocks (US, 1/80-8/98), TSE Topix (Japan, 1/80-8/98), FTSE-A (UK, 1/80-7/98), ASE Composite (Greece 1/85-8/98), BVL General Share Price Index (Portugal, 1/98-7/98), ISE National-100 (Turkey, 1/86-7/98), MSE Share Price Index (Mexico, 1/80-7/98) and KSE KOSPI (Korea, 1/81-7/98). Data was separated, in two sub-samples and covered the complete period while observations during the October 1987 crisis was removed[1].

In table 1 we present the results of the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests for the stationarity of the returns of our series. According to the obtained results we consider the first differences of the returns in the following.

The Engle-Granger theory of cointegration (Mills 1993) provides a consistent method of testing long-term relationships between financial markets. This is the most recent approach and has been widely applied in the financial literature (Markellos and Siriopoulos 1997). In fact, cointegration analysis searches for some common trend(s) between nonstationary time series. If cointegration between a set of variables is established, then these

1. I would like to thank Mr. Costas Papadopoulos for his assistance in the computational part of this paper.

Table 1
Results from DF and ADF Unit Root Tests

Market	*Levels*			*First Differences*		
	Prior Crisis	**Complete Period**	**After Crisis**	**Prior Crisis**	**Complete Period**	**After Crisis**
US	-2.413 (1)	-3.084 (1)	-2.322 (1)	-7.004 (0)*	-9.826 (1)*	-9.591 (0)*
UK	-2.402 (0)	-2.618 (1)	-3.669 (2)*	-8.934 (0)*	-10.574 (1)*	-9.480 (0)*
Japan	-1.127 (0)	-1.148 (1)	-2.684 (1)	-7.068 (0)*	-10.364 (0)*	-8.297 (0)*
Greece		-2.510 (1)	-2.087 (1)		-8.562 (0)*	-9.151 (0)*
Turkey		-2.220 (0)	-2.481 (0)		-10.766 (0)*	-10.929 (0)*
Portugal			-0.583 (1)			-6.099 (0)*
Korea	0.2065 (0)	0.3263 (1)	-1.346 (1)	-6.911 $(0)_t$*	-9.917 (0)*	-8.242 (0)*
Mexico	-34.832 (0)	-0.812 (1)	-2.340 (1)	-7.337 $(0)_t$*	-10.698 (0)*	-8.778 (2)*

Asterisks denote significance at the 5% level. Numbers in brackets give the number of lags used in the DF test regressions and was selected according to the SIC. Index *t* indocates that a deterministic time trend was used in the DF test regressions.

will share a statistical equilibrium. In the long-run these variables will not drift appart, and an error-correction mechanism will correct short-run disequilibrium movements. In the context of financial markets this means that prices on cointegrated assets will be driven by common factors to move together on some shared trend. Thus, the benefits of an internationally diversified portfolio will be limited.

Testing for cointegration is a two-step procedure that involves determining the order of integration[2] of the variables under study (see Table 1) and then examining if these variables have some linear combination with residuals that are stationary. In tables 2a, 2b and 2c presents the results we obtained.

2. Appart from DF and ADF tests, there are other approaches to characterizing the order of integration of stock market prices and returns. Markellos and Siriopoulos (1997) use different approaches, namely, the DF and ADF unit root test, the semi-parametric Geweke, Porter-Hudak fractional integration test, and the non-parametric Dechert and Gencay stationarity test.

Table 2a

Results from Engle-Granger Cointegration Tests:

US – Emerging markets

US with	Prior Crisis		Complete Period		After Crisis	
	Trend	*No Trend*	*Trend*	*No Trend*	*Trend*	*No Trend*
Mexico	-1.642 (0)	-2.342 (0)	0.775 (0)		0.633 (0)	
Korea	-1.6747 (0)	-2.505 (1)	1.746 (0)	-2.933 (1)	-0.611 (1)	-2.565 (1)
Greece			-1.197 (1)		-1.572 (1)	
Turkey			-1.764 (0)		-1.477 (0)	
Portugal					-1.727 (1)	-2.064 (1)

Asterisks denote significance at the 5% level. Numbers in brackets give the number of lags used in the DF test regressions and was selected according to the SIC.

Table 2b

Results from Engle-Granger Cointegration Tests:

UK – Emerging markets

UK with	Prior Crisis		Complete Period		After Crisis	
	Trend	*No Trend*	*Trend*	*No Trend*	*Trend*	*No Trend*
Mexico	-1.815 (0)	-3.538 (0)	-1.797 (0)	-2.5239 (0)	-0.121 (0)	-2.367 (2)
Korea	-1.555 (0)	-3.095 (0)	-0.720 (1)	-2.651 (1)	-0.382 (2)	-2.450 (2)
Greece			-1.498 (2)	-3.728 (1)	-1.727 (1)	-2.132 (2)
Turkey			-3.651 (1)*		-3.219 (1)	
Portugal					-1.772 (2)	-4.546 (1)*

Asterisks denote significance at the 5% level. Numbers in brackets give the number of lags used in the DF test regressions and was selected according to the SIC.

From table 2a we can not reject the null hypothesis ("there is no cointegration") between the US market and the emerging markets under study. Table 2b confirms the same results for the case of the UK capital market and the emerging markets in the most of cases. Exceptions are the pairs of UK/Turkey for the total sample period and UK/Portugal for the period after the crisis. Finally, similar results we observe in the third case of the stock market of Japan with the emerging markets.

Table 2c

Results from Engle-Granger Cointegration Tests:

Japan – Emerging markets

Japan with	Prior Crisis		Complete Period		After Crisis	
	Trend	*No Trend*	*Trend*	*No Trend*	*Trend*	*No Trend*
Mexico	-2.363 (0)		-1.280 (1)		-2.747 (1)	
Korea	-1.208 (0)	-2.608 (0)	-1.779 (1)	-1.832 (1)	-1.780 (1)	-2.078 (1)
Greece			-1.864 (1)	-2.820 (1)	-2.232 (1)	-2.434 (1)
Turkey			-2.343 (1)		-2.213 (1)	
Portugal					-2.104 (1)	-2.664 (1)

Asterisks denote significance at the 5% level. Numbers in brackets give the number of lags used in the DF test regressions and was selected according to the SIC.

In total, it seems possible to gain benefits from capital diversification in the emerging markets wich is in accordance with precious empirical results (Siriopoulos 1996, Markellos and Siriopoulos 1997 and others). This means that a fund from US, UK or Japan can reduce its risk if it is moved toward the emerging markets, namely, Greece, Turkey, Portugal, Mexico and Korea. Also, this result provides a possible explanation for the observed irregular returns on these emerging capital markets in recent years. In addition, this result can also explain the great volatility of the returns in emerging markets, and thus, the inefficiency of these markets. Finally, capital movements toward the emerging markets are further supported and justified by the relaxation of exchange controls and other regulatory changes.

Next, we apply the Johansen technique in order to compare our results and the methods. The obtained results are presented in tables 3a, 3b and 3c. From table 3a we conclude in similar as previously results, that the US market is not cointegrated with the emerging markets we study. From table 2b we obtain the same results as from the table 1b with the same exceptions. The same conclusion we draw from table 3c in comparison with the table 1c. Thus, we do not observe significant differences in the two methodologies. In addition we do not can accept the hypothesis that the financial crisis of October 1987 had change the structure of the interdependence between the markets under study.

Table 3a

Results from Johansen Cointegration Tests:

US – Emerging markets

US with	**Prior Crisis**		**Complete Period**		**After Crisis**	
	Trend	***No Trend***	***Trend***	***No Trend***	***Trend***	***No Trend***
Mexico	$k = 1$		$k = 3$		$k = 3$♣	
$\lambda_{max}(0, 1)$	39.401*	37.566*	1.468	13.202	11.115	
$\lambda_{max}(1, 2)$	0.959*	4.770*	0.590	1.457	0.805	
$\lambda_{trace}(0)$	38.360*	42.336*	2.053	14.659	11.920	
Korea	$k = 1$		$k = 3$		$k = 1$♣	
$\lambda_{max}(0, 1)$	14.672	17.975	5.376	14.548		23.037*
$\lambda_{max}(1, 2)$	0.016	7.860	0.626	2.508		5.299
$\lambda_{trace}(0)$	14.688	25.835*	6.002	17.057		28.336*
Greece			$k = 2$		$k = 2$	
$\lambda_{max}(0, 1)$			0.752	12.392	4.138	6.549
$\lambda_{max}(1, 2)$			0.003	6.427	0.098	3.431
$\lambda_{trace}(0)$			6.784	18.820	4.237	9.980
Turkey			$k = 5$		$k = 1$	
$\lambda_{max}(0, 1)$					7.234	
$\lambda_{max}(1, 2)$					2.267	
$\lambda_{trace}(0)$					9.502	
Portugal					$k = 2$	
$\lambda_{max}(0, 1)$						14.697
$\lambda_{max}(1, 2)$						2.732
$\lambda_{trace}(0)$						17.429

Asterisks denote significance at the 5% λevel. Numbers in brackets give the number of lags used in the VAR test regressions and was selected according to the SIC. ♣ indicates that the problem of VAR residual is not resolved by any lag structure.

Table 3b

Results from Johansen Cointegration Tests:

UK – Emerging markets

UK with	**Prior Crisis**		**Complete Period**		**After Crisis**	
	Trend	***No Trend***	***Trend***	***No Trend***	***Trend***	***No Trend***
Mexico	$k = 1$		$k = 3$		$k = 1$	
$\lambda_{max}(0, 1)$	31.952*	31.966*	9.583	23.523*	5.555	18.730
$\lambda_{max}(1, 2)$	1.159	14.048*	1.928	5.012	0.362	4.563
$\lambda_{trace}(0)$	33.111*	46.048*	11.511	28.537*	5.917	23.293
Korea	$k = 1$		$k = 4$		$k = 1$♣	
$\lambda_{max}(0, 1)$		22.840*		18.582		17.717
$\lambda_{max}(1, 2)$		5.620		4.331		11.099
$\lambda_{trace}(0)$		28.460*		22.913		28.816*
Greece			$k = 2$		$k = 2$♣	
$\lambda_{max}(0, 1)$			8.130	18.371	3.875	15.451
$\lambda_{max}(1, 2)$			0.644	6.006	0.094	3.462
$\lambda_{trace}(0)$			8.774	24.377	3.970	18.920
Turkey			$k = 2$		$k = 1$	
$\lambda_{max}(0, 1)$			21.961*		14.254	
$\lambda_{max}(1, 2)$			0.035		1.406	
$\lambda_{trace}(0)$			21.990*		15.660	
Portugal					$k = 6$	
$\lambda_{max}(0, 1)$					20.697*	
$\lambda_{max}(1, 2)$					5.547	
$\lambda_{trace}(0)$					26.245*	

Asterisks denote significance at the 5% level. Numbers in brackets give the number of lags used in the VAR test regressions and was selected according to the SIC. ♣ indicates that the problem of VAR residual is not resolved by any lag structure.

Table 3c

Results from Johansen Cointegration Tests:

Japan – Emerging markets

Japan with	**Prior Crisis**		**Complete Period**		**After Crisis**	
	Trend	***No Trend***	***Trend***	***No Trend***	***Trend***	***No Trend***
Mexico	$k = 1$		$k = 2$		$k = 2$	
$\lambda_{max}(0, 1)$	34.595*		7.494		14.863	
$\lambda_{max}(1, 2)$	2.797		4.275		2.175	
$\lambda_{trace}(0)$	37.392*		11.769		17.038	
Korea	$k = 1$		$k = 2$		$k = 2$	
$\lambda_{max}(0, 1)$	12.001		7.125	7.411	9.722	
$\lambda_{max}(1, 2)$	8.262		5.445	5.794	3.895	
$\lambda_{trace}(0)$	20.263		12.571	13.209	13.618	
Greece			$k = 2$		$k = 2$	
$\lambda_{max}(0, 1)$			10.103	13.486	11.106	13.671
$\lambda_{max}(1, 2)$			3.450	8.626	0.284	7.090
$\lambda_{trace}(0)$			13.553	22.113	11.390	20.761
Turkey			$k = 2$		$k = 1$	
$\lambda_{max}(0, 1)$			15.944*		9.881	
$\lambda_{max}(1, 2)$			0.189		0.850	
$\lambda_{trace}(0)$			16.133		9.966	
Portugal					$k = 2$	
$\lambda_{max}(0, 1)$					14.467	
$\lambda_{max}(1, 2)$					4.292	
$\lambda_{trace}(0)$					18.760	

Asterisks denote significance at the 5% level. Numbers in brackets give the number of lags used in the VAR test regressions and was selected according to the SIC.

3. Conclusions

In this paper we overview the empirical results concerning international capital movement and portfolio diversification between three developed markets (US, UK and Japan) and five emerging capital markets (Greece, Turkey, Portugal, Mexico and Korea). We apply the Engle-Granger and Johancen cointegration techniques for the period before, during and after the financial crisis of October 1987, and we conclude in similar results with previous studies.

The topic of international capital movement and portfolio diversification is continuously interesting, not only for the academicians but also for the regulators. This is confirmed by the regulatory changes in recent years worldwide and the accompanying expansion of trading volume in the stock exchanges. However, the globalization and the integration of the capital markets as well as the harmonization of the regulatory regimes, it is expected to reduce international portfolio diversification benefits in the short-run.

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Abstract

The International portfolio diversification is nowadays a widespread practice in the financial industry. Insurance companies and mutual funds have expanded their investment horizon far beyond local markets thus recognizing the additional profit opportunities available worldwide. An important concern in recent years has been the effect of financial crises on market interdependence. The present study is concerned with reviewing the relevant literature and attempts an empirical investigation of the effect of the 1987 financial crisis on the diversification opportunities that were available in five emerging stock markets for US, UK and Japanese investors.