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An Empirical Examination of International Diversification Benefits in Central European Emerging Equity Markets

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ABSTRACT

The objective of this paper is to examine the short and long-term relationships between the seven developed equity markets of United-States, Canada, United-Kingdom, France, Germany, Italy, Japan and three Central European emerging equity markets of Czech-Republic, Hungary and Poland in order to study their implications on the potential gains from international diversification in these emerging markets. The short-term relationships measured by the correlation matrix indicate a lower level of correlation between developed and emerging equity markets of Central Europe. In order to carry out the long-term relationships we resorted to Johansen cointegration techniques recently developed. The tests show that there is no long-term relationship between G7 developed equity markets and Central European emerging equity markets. Theses results indicate that the increase of financial integration degree and co-movement between equity markets has not significantly affected the expected benefits from international diversification in these emerging markets. These gains remain significantly important for the G7 industrial investors in the Central European emerging equity markets.

JEL Classification: F21, G15

Keywords: International portfolio diversification; Financial integration; Central European emerging markets; Cointegration theory

I. INTRODUCTION

International portfolio diversification was started in with the decision of Morgan Guaranty in 1974 to invest a part of its pension fund outside the United-States. At that time, the US market lived tow successive decreases in 1973 and 1974, but outside the United-States, the returns had been very attractive. Accordingly, the investors have become increasingly more active in foreign capital markets. The investment in international financial market knows a spectacular increase. Recently, as a consequence of market liberalisation, financial markets tended to become more integrated. This integration process implies the increase of correlation between financial markets which can have negative effects on benefits from international diversification. This later depends on markets correlations. If the correlation coefficients between markets are higher, the gains from international diversification are low. On the other hand, if the market correlation is low the gain is very important.

The higher integration between developed markets led us to study the important potential of emerging markets for international portfolio diversification. However, the financial crises especially in Asia and Latin America emerging markets led investors to search for other emerging markets (Flight to quality phenomenon) like the Central Europe emerging markets. Those markets can provide more opportunities to increase benefits from international diversification. The endeavour to bring these economies into line with the western European economies gives them an important priority and led investors to study these investment opportunities.

This study examines the possible benefits from international diversification for the seven developed countries of United-States, Canada, United-Kingdom, France, Germany, Italy, and Japan in the three important emerging equity markets of Central Europe, those of the Czech Republic, Hungary and Poland.

The remainder of the paper is structured as follows; Section II discusses the relevant literature. Section III presents the methodology and the data. Section IV reports our empirical results and Section 5 contains our conclusions.

II. LITERATURE REVIEW

Advantages of International portfolio diversification are inversely related to the correlations between equity markets returns. The international diversification gains decline as the correlations between securities returns become increasingly positive. However, the existence of low correlations between national markets can provide significant benefits from international diversification. Numerous researches have recognized low correlation between international capital markets and highlight the substantial international diversification gains. The early literature in this field, like for example, Grubel (1968), Levy and Sarnat (1970), and Lessard (1973) finds low correlation between developed and emerging equity markets it proves that the benefits from international diversification is considerable for investors of industrial countries in emerging markets.

Other recent studies document the importance of low correlation between developed and emerging markets for generating substantial benefits from international diversification (Eun and Resnick (1984), Errunza and Padmanabhan (1988), Meric and Meric (1989), Bailey and Stulz (1990), Divecha et al. (1992), and Phylaktis et

Ravazzolo (2005)). Many factors can explain the low correlations and consequently the importance of emerging markets in international portfolio diversification strategies: barriers to foreign investment flows on emerging markets in order to preserve the control of national companies; the asymmetric information on securities in emerging markets; strong controls of exchange and the lack in free trade of emerging markets with international markets.

Several authors have used the cointegration techniques to examine the existence of linkages and long term co-movements between developed and emerging markets. They examine their effects on the benefits of international diversification for investment in emerging markets. Kasa (1992) and Arshanapalli and Doukas (1993) prove an evidence of bi-variate cointegration relationship between American and European equity markets. The existence of such linkage affects negatively the benefits of international diversification for US investors in those European markets.

Harvey (1995b) finds that assets in emerging markets provides for American investors high expected returns and low level of risk. He argues that the main interest of emerging markets for a portfolio manager rests in reducing the risk, but not in the enhancement of returns. This result gives an explanation to the low correlation between emerging markets, and with the global markets in comparison with the correlations between developed markets.

DeFusco et al. (1996) show the non-existence of short-term and long-term linkages between the American market and thirteen emerging equity markets in the Pacific Basin, Latin America and the Mediterranean regions. They confirm that these markets are not cointegrated between them. They conclude that this segmentation between US market and these emerging markets in these three regions indicates the possible existence of international diversification benefits in short and long term across theses markets.

Bekaert and Urias (1996) reject the assumption that equity indices in developed countries span the mean-variance frontier of all international equity indices. They prove the existence of gains from international diversification in emerging equity markets. De Santis and Gerard (1997) assess, by using the international capital asset pricing model (ICAPM), that the expected gain from international diversification is on average 2.11 percent yearly for an American investor.

Li et al. (2003) used Bayesian inference approach to examine the impact of short-sale constraints on the existence and the magnitude of the gains from international diversification for American investors in eight emerging equity markets of four Latin American markets (Argentina, Brazil, Chile, and Mexico) and four South-East markets (Hong Kong, South Korea, Singapore, and Thailand). They show that the benefits of international diversification remain substantial for American investors after imposing short-sale constraints on emerging equity markets but not after imposing short-sale constraints on G7 developed equity markets. The authors conclude that the integration of world equity markets reduces, but does not eliminate, the benefits of international diversification in emerging equity markets subject to short-sale constraints. These results reinforce the “home bias puzzle” with respect to investments in emerging markets.

Gilmore and McManus (2005) examine the diversification benefits for American investors in the emerging equity markets of Central Europe (Czech Republic, Hungary and Poland). They conclude that American investors can get a higher level of returns from diversifying their portfolio in Central European equity markets since there are not short-term and long-term linkages between theses markets and US market.

Lagoarde and Lucey (2006) investigate the presence of international portfolio diversification benefits in the most important equity markets of the Middle East and North Africa (MENA) region. Their results show the presence of higher potential of international diversification benefits in this region, whether transaction are denominated in local currencies or in U.S dollars. Furthermore, the portfolio with minimum variance appears as the most promising optimization technique. In addition, portfolios based on local currencies seem to exhibit a higher degree of diversification, while the measure of risk seems to affect profitability less than the optimization model employed. Overall, they show that these under-estimated and under-investigated markets of MENA region should attract more portfolio flows in the future.

Despite the existence of numerous studies about capital market integration between developed and emerging equity markets and their effects on the gains from international diversification, a little attention is given to the investment possibility in Central European equity markets. These markets were isolated under the communist regime for a long period from external influences until the 1990s, date of their re-emergence on international financial arena. The increasing economic growth of these equity markets and their attempt to open their financial markets to foreign investment led us to spare them a particular attention. This research explores the issue of investment opportunities and the possible benefits from international diversification for seven industrial countries in the three main major Central European equity markets of Czech-Republic, Hungary and Poland; we use the recent development of cointegration theory.

III. METHODOLOGY AND DATA

A. Methodology

We use the cointegration approach in order to study first the interdependence relationship between developed markets, and Central European emerging equity markets, and then, to examine the issue of likely benefits of international diversification in this region. This latter allows us to detect a long run co-movement between index series. This co-movement implies the integration between national markets which affect negatively the diversification benefits. The cointegration test examines the stationarity of equity index series. In this way, all series must be non-stationary and integrated of the same order: it is a necessary condition for doing a cointegration analysis. Therefore, we use the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) test.

Appropriate lag lengths of vector autoregression used to determine the maximal order of integration were selected according to the Akaike Information Criterion (AIC) and Schwarz Criterion (SC). After and to determine whether the time series are cointegrated we resort to the Johansen test (1988). The latter allows us to know the number of cointegrated vector of the index series. The existence of long run relationship between series leads to the study of short run relationship by the VECM model. Finally, the Granger causality test (1969) is used to identify the causality sense between index series.

B. Data

The data used in this study consist of daily price indices time series for three Central European emerging stock markets (Czech-Republic, Hungary and Poland), and seven developed stock markets (United-States, Canada, United-Kingdom, France, Germany, Italy, and Japan). The time period covers October 1, 2000, through September 30, 2006, which gives a total of 1565 observations for each market. Indices were obtained from the Morgan Stanley Capital International Data Base (MSCIDB[1]) and all the index series are in US dollars terms. We use stock prices in US dollars in order to eliminate the problem of exchange rate variations (especially between developed and emerging markets).

IV. EMPIRICAL RESULTS

A. Descriptive Statistics

Table 1 provides the descriptive statistics for daily stock returns of markets examined in this study: United-States, Canada, United-Kingdom, France, Germany, Italy, Japan, Czech-Republic, Hungary, Poland. The Czech Republic stock index shows the higher average returns (0,001472) than all other markets (the US market shows the low average returns (-0,000173)). The maximum return vary between (0,038562) in Canada stock market and (0,08372) in the Hungarian market. The minimum return fluctuate between (-0,08963) in the Canadian market to (-0,05017) in the US. The German stock index shows the higher level of risk measured by the standard deviation (0,016138), followed by Poland stock index for the emerging markets (0,015985). The markets of Canada, United-Kingdom and United-States show the low level of risk (respectively: (0,012472), (0,012528) and (0,012807)). The Kurtosis and Skewness statistics indicate that index returns series are leptokurtic and have an asymmetric distribution that rejects significantly the null hypothesis of normality for all the index returns series.

B. Correlation Coefficients between Equity Return Series

Table 2 reports the correlation coefficients between equity return series of developed and emerging equity markets for daily frequencies. The results show positive and higher correlation coefficients between developed markets. The higher correlation is noted between France and United-Kingdom markets (89,84%) followed by the pair of Germany-France (88,221%). The low correlation level is between Japan and Germany (12,021%). We find low correlation coefficients between emerging and developed equity markets. They vary from (10,126%) between US and Czech Republic market to (38,681%) between Hungary and Czech Republic market.

The correlation coefficients indicate that developed markets are more integrated between them, but they are segmented with the emerging equity markets of Central Europe in the short-term. This result shows that there are still some diversification benefits from investment in emerging equity markets of Central Europe in the short run. We investigate further through cointegration techniques whether theses short-term dependences are appropriate indicators for international diversification benefits in the long-term investment in Central European emerging equity markets.

Table 1

Summary statistics of daily equity return[2] series

The Jarque-Bera test[3] for normality rejects the null hypothesis that all the stock index and return series follow a normal distribution.

Statistic	Markets				
	US	Canada	UK	France	Germany
Mean	-0,000173	0,000179	0,000048	0,00000386	-0,0000473
Median	0,000394	0,000594	0,000004	0,000327	0,000374
Maximum	0,06428	0,038562	0,047372	0,05897	0,06986
Minimum	-0,05017	-0,08963	-0,05452	-0,06382	-0,07567
S.D	0,012807	0,012472	0,012528	0,014938	0,016138
Skewness	0,13854	-0,91837	-0,38674	-0,11837	-0,14621
Kurtosis	5,32546	7,8539	6,3692	5,14836	5,10326
Jarque.Bera	364,9372	2216,438	428,6039	287,5639	276,8372
Probability	0	0	0	0	0
N	1565	1565	1565	1565	1565

Statistic	Markets				
	Italy	Japan	Czech Republic	Hungary	Poland
Mean	0,00016	-0,0000739	0,001472	0,001138	0,000631
Median	0,000628	-0,0000318	0,001427	0,001038	0,000683
Maximum	0,06572	0,04938	0,05679	0,08372	0,05862
Minimum	-0,06127	-0,07027	-0,07268	-0,07849	-0,05283
S.D	0,013772	0,014893	0,01562	0,015831	0,015985
Skewness	-0,56738	-0,15718	-0,28603	-0,1773	0,078329
Kurtosis	6,7382	4,93872	4,87382	4,9821	4,43082
Jarque.Bera	463,137	182,7639	139,8452	188,1483	26,84372
Probability	0	0	0	0	0
N	1565	1565	1565	1565	1565

Table 2

Correlation coefficients between daily equity return series

	US	Canada	UK	France	Germany	Italy	Japan	Czech Republic	Hungary	Poland
US	100%	74,4%	65,1%	54,0%	68,2%	39,4%	13,6%	10,1%	13,7%	15,1%
Canada		100%	47,4%	49,3%	62,3%	33,8%	16,8%	19,3%	21,2%	20,1%
UK			100%	89,9%	78,6%	69,3%	20,2%	21,4%	12,2%	22,1%
France				100%	88,2%	81,1%	19,0%	23,6%	27,1%	14,5%
Germany					100%	76,7%	12,0%	18,2%	23,5%	21,2%
Italy						100%	15,6%	22,4%	24,4%	35,5%
Japan							100%	17,5%	18,5%	14,4%
Czech Republic								100%	38,7%	36,6%
Hungary									100%	37,9%
Poland										100%

C. Unit Roots Tests for Stock Prices

Unit root tests developed by Phillips (1987[4]), Perron (1988[5]) and augmented by Dickey–Fuller (1981) (Extension of Dickey and Fuller, 1979[6]) are used for examining the time series stationarity. The presence of unit root in time series of stock prices indicates that series are non-stationary

1. Augmented Dickey–Fuller (ADF) tests

- Model 1 standard[7] $$\Delta Y_t = \rho Y_{t-1} - \sum_{j=2}^{p} \phi_j \Delta Y_{t-j+1} + \varepsilon_t$$

- Model 2 with intercept[8] $$\Delta Y_t = \rho Y_{t-1} - \sum_{j=2}^{p} \phi_j \Delta Y_{t-j+1} + c + \varepsilon_t$$

- Model 3 with intercept and trend[9] $$\Delta Y_t = \rho Y_{t-1} - \sum_{j=2}^{p} \phi_j \Delta Y_{t-j+1} + c + bt + \varepsilon_t$$

Avec : $\varepsilon_t \rightarrow \text{iid}$

Under alternative hypothesis $|\phi_1| \prec 1$, augmented Dickey–Fuller (ADF) tests are based on estimation by ordinary least-squares OLS regression of the tree following models.

2. The Phillips–Perron (PP) test

The Augmented Dickey Fuller (ADF) test assumes that errors are statistically independent and have a constant variance. To overcome this limitation, Phillips and Perron (1988) developed an alternative test which represents a generalization of the Dickey-Fuller test. The advantage of Phillips-Perron test consists of allowing the error disturbances to be weakly dependent and heterogeneously distributed. The Phillips-Perron (1988) model is as follows:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 (t - \frac{T}{2}) + \mu_t$$

Where T is the observations number and the disturbance term μ_t is such that $E(\mu_t) = 0$. The ordinary least squares method is used to estimate the equation. The t-statistic of the α_1 coefficient is corrected for serial correlation in μ_t using the Newey-West[10] procedure for adjusting the standard errors. Table 3 presents the results for the ADF and PP unit root tests applied to the levels and first differences of each series of daily price indices.

For the series in level, the null hypothesis of a unit root cannot be rejected at the tree confidence level. On the other hand, the series in first difference reject the null hypothesis of unit root. This result indicates that all the series of daily price indices is stationary in first difference and consequently they follow I(1) processes (integrated of order one, I(1)).

Table 3
Unit root tests for daily stock indices

Models	Country Index	Index level		First differences	
		ADF	PP	ADF	PP
Model 3 with intercept & trend	Canada	-2.264903	-2.258452	-32.63104	-32.84216
	UK	-1.863192	-1.427318	-33.74201	-35.83217
	France	-1.895273	-1.769420	-35.483162	-35.630621
	Italy	-1.764284	-1.563829	-35.67931	-35.73195
	Japan	-2.351846	-2.284395	-34.87524	-34.92651
	Poland	-1.742816	-1.537291	-32.48013	-32.51392
	Critical Values[11]	*-3.965104 (à 1%)*	*-3.965104 (à 1%)*	*-3.965115 (à 1%)*	*-3.965109 (à 1%)*
		-3.413264 (à 5%)	*-3.413264 (à 5%)*	*-3.413269 (à 5%)*	*-3.413266 (à 5%)*
		-3.128656 (à 10%)	*-3.128656 (à 10%)*	*-3.128659 (à 10%)*	*-3.128657 (à 10%)*
Model 2 with intercept	US	-2.417319	-2.371252	-36.17431	-36.41254
	Critical Values	*-3.435157 (à 1%)*	*-3.435157 (à 1%)*	*-3.435161 (à 1%)*	*-3.435161 (à 1%)*
		-2.863550 (à 5%)	*-2.863550 (à 5%)*	*-2.863552 (à 5%)*	*-2.863552 (à 5%)*
		-2.567890 (à 10%)	*-2.567890 (à 10%)*	*-2.567891 (à 10%)*	*-2.567891 (à 10%)*
Model 1 standard	Germany	-1.382117	-1.373142	-36.57124	-36.58847
	Czech Republic	2.361401	2.584261	-35.39842	-35.23614
	Hungary	4.772143	4.561938	-33.78935	-33.47832
	Critical Values	*-2.566738 (à 1%)*	*-2.566738 (à 1%)*	*-2.566739 (à 1%)*	*-2.566739 (à 1%)*
		-1.941067 (à 5%)	*-1.941067 (à 5%)*	*-1.941067 (à 5%)*	*-1.941067 (à 5%)*
		-1.616536 (à 10%)	*-1.616536 (à 10%)*	*-1.616536 (à 10%)*	*-1.616536 (à 10%)*

D. Johansen Cointegration Test

The Johansen 1988 method relies on the relationship between the rank of a matrix and its characteristic roots (or eigenvalues).

Let X_t be a vector of n time series variables, each of which is integrated of order (1) and assume that X_t can be modeled by a vector autoregression (VAR):

$$X_t = A_1X_{t-1} + ... + A_pX_{t-p} + \varepsilon_t \quad (1)$$

Rewrite the VAR as:

$$\Delta X_t = \Pi x_{t-1} + \sum \Gamma \Delta x_{t-i} + \varepsilon_t \quad (2)$$

$$\Pi = \sum A_i - I, \Gamma_i = -\sum A_i .$$

If the coefficient matrix Π has reduced rank $r \prec k$, there exist k x r matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' x_t$ is stationary. The number of cointegrating relations is iven r, and each column of β is a cointegrating vector. At this level three cases are possible

- First, if Π is of full rank, all elements of X are stationary and none of the series has a unit root.
- Second, if the rank of $\Pi = 0$, there are no combinations which are stationary and there are no cointegrating vectors.
- Third, if the rank of Π is r such that $0 \prec r \prec k$, then the X variables are cointegrated and there exist r cointegrating vectors. Eq. (1) can be modified to allow for an intercept and a linear trend.

The number of distinct cointegrating vectors can be obtained by determining the significance of the characteristic roots of Π. To identify the number of characteristic roots that are not different from unity, we use two statistics: the trace test and the maximum eigenvalue test given by:

$$\Pi \ \lambda_{trace}(r) = -T\sum In(1-\lambda_i) \quad (3)$$

$$\lambda_{max}(r, r+1) = -TIn(1-\lambda_{r+1}) \quad (4)$$

Where λ_i equals the estimated values of the characteristic roots (eigenvalues) obtained from the estimated Π matrix, r is the number of cointegrating vectors, and T is the number of usable observations.

The trace test evaluates the null hypothesis that the number of distinct cointegrating vectors is less than or equal to r against a general alternative.
The maximum eigenvalue test examines the number of cointegrating vectors.

If the variables in X_t are not cointegrated, the rank of Π is equal to zero and all the characteristic roots are equal to zero. Given that In(1)=0, each of the expressions $In(1-\lambda_i)$ will equal zero in that case. Critical values for the test are provided by Johansen and Juselius (1990)[12] and by Osterwald-Lenum (1992)[13].

We use the Johansen (1988) cointegration test to investigate the existence of long-run relationship between developed equity markets and Central European emerging equity markets. The lag structures of vector autoregression model were chosen according to the Akaike Information Criterion (AIC) and Schwarz Criterion (SC). A multilateral Johansen test was applied to the Central European equity markets as a group. The results reported in table 4 indicate no evidence for a multilateral cointegration relationship between these markets. This reveals the absence of long-run stable equilibrium relationship between these markets. We can explain this absence of cointegration vector between Central European equity markets by their segmentation on the long-run. Hence these markets don't have a higher risk between them. Also, there are substantial benefits from international portfolio diversification in the equity markets of Central Europe.

Table 4
The Johansen multilateral cointegration test

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Series: CzechRepublic Hungary Poland

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None	0.032427	26.24813	29.68	35.65
At most 1	0.004138	11.63132	15.41	20.04
At most 2	0.007648	2.317035	3.76	6.65

Trace test indicates no cointegration at both 5% and 1% levels
*(**) denotes rejection of the hypothesis at the 5%(1%) level

The Johansen bivariate cointegration tests between emerging markets (of central Europe) and the G7 developed markets, presented in Table 5, 6 and 7 below, show the absence of bilateral cointegration relationship between the groups of those markets. This result implies the segmentation of this emerging European market with developed markets. These conclusions confirm the results in Gilmore and McManus (2002) (for the Emerging markets of central Europe). They report the segmentation of this group of markets especially with the US market. Hence, US investors with longer-term investment horizons can benefit from diversifying into the Central European equity markets.

Table 5
Bilateral Johansen cointegration tests Results

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: US Czech Republic
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.052471	12.14213	15.41	20.04
At most 1	0.025146	3.113523	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: US Hungary
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.051347	10.41572	15.41	20.04
At most 1	0.023531	2.739193	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: US Poland
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.054729	13.63912	15.41	20.04
At most 1	0.017835	3.382481	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Canada Czech Republic
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.039689	9.73287	15.41	20.04
At most 1	0.015232	1.076477	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Canada Hungary
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.041281	10.38281	15.41	20.04
At most 1	0.013712	3.113826	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Canada Poland
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.053263	9.57937	15.41	20.04
At most 1	0.045218	1.108264	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: UK Czech Republic
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.043239	12.35887	15.41	20.04
At most 1	0.013667	2.035482	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: UK Hungary
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.048135	11.45927	15.41	20.04
At most 1	0.021742	2.157832	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: UK Poland
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.050936	13.37259	15.41	20.04
At most 1	0.049621	1.535931	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Table 6
Bilateral Johansen cointegration tests results

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: France Czech Republic
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.012718	12.93341	15.41	20.04
At most 1	0.022135	1.035811	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: France Hungary
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.024625	12.30229	15.41	20.04
At most 1	0.022411	1.125872	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: France Poland
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.011220	13.51323	15.41	20.04
At most 1	0.000227	0.233234	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Germany Czech Republic
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.019610	12.85419	15.41	20.04
At most 1	0.010145	0.27416	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Germany Hungary
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.037715	11.68758	15.41	20.04
At most 1	0.101034	1.30381	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Germany Poland
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.009384	11.63459	15.41	20.04
At most 1	0.001731	1.004376	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Italy Czech Republic
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.001536	9.24416	15.41	20.04
At most 1	0.105125	3 .31280	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Italy Hungary
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.084951	10.30254	15.41	20.04
At most 1	0.010236	1.27428	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Italy Poland
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.02597	9.68553	15.41	20.04
At most 1	0.001273	1.37338	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Table 7
Bilateral Johansen cointegration tests Results

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Japan Czech Republic
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.016365	11.43501	15.41	20.04
At most 1	0.001741	1.436223	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Japan Hungary
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.017382	11.63271	15.41	20.04
At most 1	0.741711	1.323712	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Sample (adjusted): 10/05/2000 9/30/2006
Included observations: 1563 after adjustments
Trend assumption: Linear deterministic trend
Series: Japan Poland
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*Trace Statistic*	*1% CV*
None	0.032375	10.42683	15.41	20.04
At most 1	0.012642	2.128572	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

These results can be explained first by the recent emergence of these markets (on international financial arena) after their liberation from the communist regime in the 1990. Second, they can be explained by the weak of economic and financial relationship between the economy of this country as a group and with the economy of developed country.

Other factors can explain the segmentation between developed and the emerging markets of central Europe. First, emerging markets of central Europe opened their economy under some conditions, which are very different from those of the United States and Western Europe. This period has been characterised by the transition from planned economies to market economies and by extensive waves of privatization of state-owned companies. Each central European country has tried to liberalize their economy and opened their frontier to international capital flows to attract global investors but they are not yet fully integrated into the international economy. So, it is not surprising that their equity markets would not provide evidence of long-term co-movements with the G7 developed market.

V. CONCLUSION

This paper examines the relationship between the G7 developed capital markets and the emerging markets of Central Europe. Bivariate and multivariate cointegration techniques (Johansen cointegration test (1988)) are used in our analysis. Central European markets started a process of liberalisation of their economies in the beginning of the 1990, to start their integration of European Union. This liberalisation process allows these countries to attract foreign investors and to increase the international capital flows to these markets. The results of cointegration tests showed that the emerging markets of central Europe are segmented as a group and are segmented with the G7 developed markets. The results of our tests reveal that emerging markets can provide substantial gains from international diversification especially for the investors of industrialised countries. We are extending these tests to other countries.

ENDENOTES

1. Morgan Stanley Capital International (www.msci.com)
2. Index returns are estimated as the log-relative of daily prices for October 1, 2000, through September 30, 2006 using the MSCI indices for all markets in the sample : $Return_t = Ln(I_t/I_{t-1})$
3. The Jarque-Bera statistic tests the null hypothesis of a normal distribution and is distributed as a X^2 with 2 d.f. Jarque. C. M et Bera. A. K, (1984), «Efficient tests for normality homoscedasticity and independence of regression residuals », *Economic Letter*, Vol 6, p.255-259
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5. Perron, P. (1988), “Trends and random walks in macroeconomic time series: Further evidence from a new approach”, *Journal of Economic Dynamics and Control*, n° 12, p. 297- 332.

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7. y_t is a pure random walk if $\rho = 0$
8. y_t is a random walk with a drift if $\rho = 0$
9. y_t is a random walk with a drift and linear time trend if $\rho = 0$
10. Newey, W. and West, K., (1987), "Hypothesis testing with efficient method of moments estimation", *International Economic Review*, n°28, p.777-787.
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