Integration and behavioural patterns in emerging Balkan stock markets

Aristeidis Samitas [a], Dimitris Kenourgios [b, *], Nikos Paltalidis [c]

[a] Department of Business Administration, Business School, University of the Aegean, 8 Michalon Str., 82100 Chios, Greece, E-mail: a.samitas@ba.aegean.gr
[b] Department of Economics, University of Athens, 5 Stadiou Str., Office 213, 10562 Athens, Greece, E-mail: dkenourg@econ.uoa.gr
[c] Faculty of Finance, Cass Business School, City University London, 105 Westbourne Terrace, W2 6QT, Paddington, UK, E-mail: N.Paltalidis@city.ac.uk

Abstract

This paper examines dynamics in the relationship between Balkan and developed stock markets. Conventional cointegration tests, regime shifts and Monte Carlo simulation provide evidence in favour of long-run cointegrating relationship, which limits the portfolio diversification benefits in the region. It also investigates for alternative profitable strategies in the short run, testing the overreaction hypothesis in the Balkan stock markets using an asymmetric non-linear smooth-transition (ANST) GARCH model. The findings support that overreaction have disturbed this convergence generating excess volatility with asymmetric mean reversion patterns. The findings also support that a "momentum" portfolio strategy is the most appropriate for exceptional returns in Balkan emerging markets.

EFMA classification codes: 370; 620; 630; 320

Keywords: Balkan stock market integration; Regime switching; Asymmetric mean reversion; Overreaction; Momentum strategy

---

Acknowledgement: The authors are grateful to anonymous referees for their helpful comments. All remaining errors are the authors' responsibility.

[*] Presenter and corresponding author: 5 Stadiou Str., Office 213, Athens 10562, Greece, tel: +30 210 3689449, fax: +30 210 3225542, e-mail:dkenourg@econ.uoa.gr.

1. Introduction

Recent developments in international financial markets and the consequent globalization have attracted a number of studies to provide evidence on international stock markets convergence. The literature on emerging stock markets supports that they became less segmented from the world markets elevating the benefits of economic growth created via improvements in allocational efficiency and reductions in macroeconomic volatility (e.g., Baele et. al., 2004).

Cointegration methodology developed by Engle and Granger (1987) and Johansen (1988) has been adopted in a numerous studies investigating the long- run comovements between international stock markets. These studies have traditionally focused on European and U.S mature equity markets, Asian and Latin American emerging markets and to a lesser extent on Central European stock markets, providing evidence on long-run interrelationships[1].

However, the long-run stable equilibrium relationships conjectured by these techniques are not suitable for modeling the dynamic process of stock market integration as it is incomplete and continues to exhibit strong variations over time[2]. Recent studies have highlighted the time-varying nature of intermarket relations (e.g., Bekaert and Harvey, 1995). Campos et al. (1996) and Gregory and Hansen (1996)

[1] See, for example, Francis and Leachman (1998), Phylaktis (1999), Manning (2002), Chen et al. (2002), Chaudhuri and Wu (2003), Voronkova (2004), and Syriopoulos (2006).

[2] Kim et al. (2005) support that only the existence of an equilibrating process and not the driving forces behind the long-run equilibrium are investigated in standard cointegration analyses. Masih and Masih (2002) provide evidence that the Johansen procedure is heavily dependent on time series that exhibit few outlying observations.

find that the time-varying relations along with some structural breaks are possible to deteriorate the power of cointegration tests, rejecting null hypothesis of cointegration. Hence, their methodology takes into account the possibility of instability in short–run relations. Furthermore, their research based on Monte Carlo simulation technique verifies that when a shift in parameters takes place, standard test for cointegration lose power and provides false signals. Voronkova (2004) adopts the Gregory and Hansen (1996) test and finds several equilibrium relations omitted by the conventional cointegration testing procedures, showing that long-run relations do not cease after a structural change has occurred.

Based on the evidence that international stock markets share common trends, portfolio diversification by investing in different emerging markets is limited in the long-run. Therefore, recent empirical studies test the overreaction hypothesis searching for alternative profitable strategies in the short-run. The examination of this hypothesis arises also from the excess returns exercised in international emerging equity markets during the last decade. These returns indicate that the convergence to global stock markets may not be as straightforward in the short-run.

Overreaction hypothesis states that investors overreact to unanticipated news, resulting in exaggerated movements in stock prices followed by corrections - prices revert to the mean (DeBondt and Thaler, 1985). In addition to this medium-term tendency toward reversals of trend, there is a shorter weak tendency toward momentum or contrarian stock prices' movements. Momentum strategies (buy winner stocks and sell loser stocks) stem from overreaction and the main cause of intermediate-term momentum but long term overreaction is the heuristic-driven bias (Daniel et al., 2001). On the other hand, a contrarian portfolio strategy (buy undervalued stocks and sell overvalued ones) essentially exploits the time-varying conditional reverting behavior of stock prices in the short- run (Nam et al., 2001)[3].

This paper examines the interrelationships among seven emerging Balkan stock markets (Romania, Bulgaria, Serbia, FYROM, Turkey, Croatia, and Albania), the U.S. and three developed European stock markets (UK, Germany, and Greece). Our analysis also employs MSCI Emerging European Markets against MSCI Developed Markets because these indices are considered to be globally respective and regionally perspective. Since the stock markets in the region may be small in capitalization, or may have infrequent trading, we use the following three methodologies: i) conventional cointegration tests; ii) Gregory and Hansen (1996) test which provides stronger evidence on possible cointegrating vectors via a clear regime shift in parameters; and iii) Monte Carlo simulation technique to test sensitivity of the cointegration estimation.

Furthermore, we examine the short-run interrelationships between the above stock markets by testing the overreaction hypothesis using an asymmetric non-linear smooth-transition generalized autoregressive conditional heteroskedasticity (ANST – GARCH) model and propose the most appropriate strategy to be followed by international asset managers, traders and investors in the Balkan stock markets. The

[3] Many studies support that momentum strategies work in developed international stock markets (e.g., Jegadeesh and Titman, 1993; Conrad and Kaul, 1998; Rouwenhorst, 1998; Schiereck et al., 1999). On the other hand, Nam et al. (2001) and Lasfer et al. (2003), among others, provide supportive results for the overreaction hypothesis and contrarian profits in U.S. stock markets. Several comprehensive studies document momentum in emerging stock markets (e.g., Rouwenhorst, 1999b; Hameed and Kusnadi, 2002).

performance of the U.S. market is used as the benchmark. A higher return from the benchmark implies that Balkan portfolio provides excess returns.

Our empirical analysis provides five main findings: (i) there is a time-varying cointegrated relationship in the long run between emerging Balkan and developed equity markets limiting international portfolio diversification benefits; (ii) Monte Carlo tests for cointegration are able to signal system equilibrium; (iii) the acceptance of the overreaction hypothesis in the short run eliminates the power of cointegration inverting the purported correlation; (iv) volatility in Balkan markets is asymmetric implying that contemporaneous return and conditional return volatility are negatively correlated; (v) a momentum strategy can be used from international investors and asset managers in the short-run taking the advantage from information linkages and excess volatility in Balkan emerging markets.

This paper contributes to the existing literature in three ways: (i) there is no other study investigating the Balkan stock markets integration to the best of our knowledge; (ii) we specify an ANST –GARCH model to test the overreaction hypothesis providing more accurate results due to its consistent and flexible nature; (iii) following developed markets' price behavior, we suggest a momentum strategy as the most appropriate for exceptional returns in Balkan emerging stock markets.

The structure of the paper is organized as follows: Section 2 provides an overview of the Balkan economic and financial environment. Section 3 analyzes methodological issues. Section 4 presents the data. The empirical results are reported in Section 5. The final section contains the concluding remarks.

2. The Balkan stock markets and economies

Over the last decade, impressive changes have occurred in Balkans; from the conflicts and economic collapse to the break up of traditional trade within the region. Since 2000, the Balkan economies are through a transitory phase of structural adjustment towards a market oriented economic system. Nevertheless, during all these years, the Balkan region displays robust growth rates, expanding more rapidly than the EU average.

Table 1 presents key financial statistics for the Balkan region. Average growth measured as a percentage of GDP exceeded 4% in the Balkan region. Romania, Croatia, Bulgaria and Turkey are among the top performers. Inflation continues to drop to a single-digit annual rate throughout the region. Since 2004, inflation rates converge to the EU average. The simultaneous growth increase and inflation decrease appreciated capital inflows of foreign direct and capital investments.

The Balkan stock markets have a brief history compared to the mature markets of Europe and US. These markets started trading in the mid ‘80s-mid ‘90s with a small number of stocks, many of which were illiquid. During 2000-2006, stock prices in Balkan markets increased on average over 70% in dollar terms, compared to the 15% of MSCI world market return. Among the Balkan stock markets, Turkey, Romania, Bulgaria and Croatia are considered the most developed, in terms of capitalization, turnover and market return.

Despite the robust growth rates, the Balkan stock markets remain small in terms of capitalization, turnover and liquidity compared to developed markets. At the end of 2006, all these markets together amounted to less than 7% of the German stock market. The market capitalization is small and the trading activity is low with value traded as a share of market capitalization averaging less than 20%. Institutional investors are small in Balkans economies, with the exception of ISE in which they own above 50% of the free float shares. However, prospects for these markets seem to be prosperous due to the vast restructuring effort in public and private sectors, the expectation to join EU, the increased value of institutional investors' assets and improvements in investor protection.

Insert Table 1

3. Methodology

3.1 Two – regime error correction model

We apply Augmented Dickey and Fuller and Philips and Perron unit root tests in order to test for nonstationarity in the series. Due to the shortcomings of these tests, we also apply the Kwiatkowski, Philips, Schmidt, and Shin- KPSS test that assumes stationarity under the null hypothesis. In order to allow for the possibility of a structural change, we use the Zivot and Andrews sequential test for a unit root with the alternative hypothesis of stationarity and a single structural change in the deterministic trend.

Then, we apply the Gregory and Hansen (1996) test which states the null hypothesis of no cointegration against the alternative of cointegration with one structural break. Gregory and Hansen suggest three alternative model specifications.

Model 1 accommodates the changes in parameters of the cointegration vector under the alternative. A level shift model allows for a change only in the intercept.

$$Y_{1t} = \mu_1 + \mu_2 \varphi_{t\tau} + \alpha' y_{2t} + \varepsilon_t, \qquad t = 1,\ldots,n. \qquad (1)$$

Model 2 accommodates a trend in the data, while also restricts the changes to shifts in the level.

$$Y_{1t} = \mu_1 + \mu_2 \varphi_{t\tau} + \beta t + \alpha' y_{2t} + \varepsilon_t, \qquad t = 1,\ldots,n. \qquad (2)$$

Model 3 is the most general specification that allows for changes both in the intercept and in the slope of the cointegration vector.

$$Y_{1t} = \mu_1 + \mu_2\, \varphi_{t\tau} + \alpha'_1\, t + \alpha'_2 y_{2t}\, \varphi_{t\tau} + \varepsilon_t, \qquad t = 1,\ldots,n \qquad (3)$$

The dummy variable which captures the structural change is represented as $\varphi_{t\tau} = 0$, $t \leq [n\tau]$ and $\varphi_{t\tau} = 1$, $t \geq [n\tau]$, where $\tau \in (0,1)$ is a relative timing of the change point with the break point changing over the previous interval.

3.2 Monte Carlo simulation

Monte Carlo simulation technique is applied to test if cointegration produces false signals. We focus on the two regime model with fixed switching transition probabilities $\alpha'_1 = \alpha'_2 = 0$ ($= \beta_1 = \beta_2 = 0$). For each Monte Carlo experiment, 400 simulated series are generated (scenario generation process) from Model 3, replicated under the null hypothesis of a random walk (no cointegration) with i.i.d. normal innovations. We begin by evaluating the performance of maximum likelihood estimation when the true model is the endogenous switching model in equation (3). We consider two portfolios – one for the Balkan stock markets and the other for the mature markets measured both in daily average absolute return – with sample size for the simulated series $T = 400$.

For each simulation, we generate the vector of exogenous explanatory variables as $x_t = [1, x_t^*]$ where $x_t^* \sim i.i.d.N(0,2)$, and fix the vector of regime switching parameters to $\beta_1 = (\beta_{0,1}, \beta_{1,1})' = (1.0,1.0)'$, $\beta_2 = (\beta_{0,2}, \beta_{1,2}) = (-1.0,-1.0)'$, $\sigma_1 = 0.33$, $\sigma_2 = 0.67$. We consider three different sets of transition probabilities corresponding to moderate persistence ($p_{11} = 0.7$, $p_{22} = 0.7$), high persistence ($p_{11} = 0.9$, $p_{22} = 0.9$), and differential persistence ($p_{11} = 0.7$, $p_{22} = 0.9$). We also consider three different values for ρ corresponding to high correlation $\rho = 0.9$, moderate correlation $\rho = 0.5$, and zero correlation $\rho = 0$. We record the outcome of 5% nominal size Wald and Likelihood ratio tests of the null hypothesis $p = 0$. For those cases where $p \neq 0$, we use size adjusted critical values taken from Monte Carlo simulation generated with p = 0, to measure the power of the tests. The levels adopted in our research has been used because these allow control for many parameters affecting the size distortion of the LR and Wald test statistics, such as the speed of adjustment, the correlation between the innovations, and the signal to noise parameters.

3.3 Overreaction hypothesis

This research attempts to identify patterns that assist international investors and fund managers to forecast future movements in Balkan stock markets. The stock market overreaction hypothesis asserts that investors tend to overreact to new information which results in exaggerated movements in share prices; as a result prices deviate from the actual values implied by the new information. Once investors considered the news in more detail, the overreaction wanes causing share prices to move back to their equilibrium levels. Hence, we test the overreaction hypothesis which provides information about market return paths evolution over time. The hypothesis tested is that developed markets returns exhibit Balkan markets returns. The acceptance of the above hypothesis implies overreaction to Balkan markets movements due to developed ones.

Asymmetric reverting patterns in return dynamics cannot be captured from the conventional autoregressive model restricted by the constant serial correlation coefficient. In this case, it is required a non-linear autoregressive model that allows serial correlation to change in response to a prior positive and negative return shock.

Following Nam et al. (2001), the modelling strategy is to capture asymmetry in both the conditional mean and variance process, asymmetric return reversals in the conditional mean equation and the asymmetric volatility response in the conditional variance equation. For an excess return series R_t of a stock index, we specify an asymmetric non-linear smooth- transition (ANST) GARCH model[4]. The model used in this study, allowing for asymmetry in conditional variance and return functions, has the following specifications:

$$R_t = \mu + \left[\Phi_1 + \Phi_2 \cdot F(\varepsilon_{t-1})\right] \cdot R_{t-1} + \varepsilon_t \quad (4a)$$

$$h_t = a_0 + a_1 \varepsilon_{t-1}^2 + a_2 h_{t-1} + \left[b_0 + b_1 \varepsilon_{t-1}^2 + b_2 h_{t-1}\right] \cdot F(\varepsilon_{t-1}) \quad (4b)$$

where $F(\varepsilon_{t-1}) = \{1+\exp[-\gamma(\varepsilon_{t-1})]\}^{-1}$ is a smooth transition and continuous function of the value of ε_{t-1}; R_t is the excess return of a market index at time t; Φ_1 and Φ_2 are the time-varying serial correlations; h_t is the conditional variance and ε_t the white noise series of innovations, denoting a collective series of news at time t. The returns persistence in the model is governed by the sum of the coefficients $[\alpha_1 + b_1 F(\varepsilon_{t-1})] + [\alpha_2 + b_2 F(\varepsilon_{t-1})]$. The speed of transition between volatility regimes is governed by parameter γ. The greater the value of γ, the faster the transition between volatility regimes. When $F(\varepsilon_{t-1}) = 0$ due to a large negative shock ($\varepsilon_{t-1} \ll 0$), returns persistence is measured by $(\alpha_1 + \alpha_2)$. When $F(\varepsilon_{t-1}) = 1$ due to a large positive shock ($\varepsilon_{t-1} \gg 0$), returns persistence is measured by $(\alpha_1 + b_1) + (\alpha_2 + b_2)$. The asymmetric effect implies the value of $(\alpha_1 + \alpha_2)$ is greater than the value of $(\alpha_1 + b_1) + (\alpha_2 + b_2)$. Thus, $b_1 + b_2 < 0$ captures excess returns generated from asymmetric volatility response to positive or negative shocks. Following Nam et al. (2001), $\varepsilon_{t-1} < 0$ yields a value of $F(\varepsilon_{t-1}) < 0.5$. In

[4] There are several asymmetric GARCH models focused on financial time series that allow an asymmetry in both the conditional mean and variance equations within the models. They include the modified model by Glosten et al. (1993) and Gonzalez-Rivera (1998), the sign- and volatility-switching ARCH (SVSARCH) model by Fornari and Mele (1997), the Markov switching volatility ARCH (MSVARCH) model by Hamilton and Susmel (1994) and ANST-GARCH models by Nam et al. (2001).

contrast, when $\varepsilon_{t-1}>0$, then $F(\varepsilon_{t-1}) >0.5$. If an asymmetric mean reverting pattern is a result of overreaction on the part of investors that causes mispricing, then Φ_1 should be negative and Φ_2 positive.

Suppose that the dynamics of Balkan stock market return (R_t) evolve with the following non-linear autoregressive process:

$$R_t = \mu + \phi^{+} R_{t-n} + \varepsilon_t, if\ \varepsilon_{t-1} \geq 0.5 \qquad (5a)$$

$$R_t = \mu + \phi^{-} R_{t-n} + \varepsilon_t, if\ \varepsilon_{t-1} \leq -0.5 \qquad (5b)$$

where $|\varphi^-|<1$ and $|\varphi^+| <1$ for stationarity condition of R_t; R_{t-n} is the developed markets excess return, where n is the time horizon (n= 1,2,3…etc.) and R_t is the Balkan market return (or reaction). This specification allows a different autoregressive process for R_t under a prior positive and negative return shock. Hence, $\mu+\varphi^+ = X$ a vector of explanatory variables available at time t when there is a positive shock, while $\mu+\varphi^- = X$, when there is a negative shock. The returns used are daily average for all Balkan and developed markets. We follow the same procedure testing MSCI Emerging European markets against MSCI Developed markets. We also set r as the conditional asymmetric correlation which specifies the degree of persistence for the models above.

We search for abnormal price performance in the short-term window (up to 1 day after the developed markets excess return) following Balkan markets positive (negative) price shocks. It is important to mention here that if Balkan emerging markets do not react in the very first day after the excess return (return >0.5 or <-0.5) exercised in the developed markets, we assume that Balkan market movements are not affected from the developed markets information received. Thus, we focus our tests in capturing the very short-term reaction of Balkan stock markets.

4. Data

The data used in this study consist of the daily closing prices (in logs) in seven Balkan stock markets, US, United Kingdom, Germany and Greece. The stock market indices of interest are SOFIX of Bulgaria, VANGUARD of Romania, CROBEX of Croatia, MBI10 of FYROM, ISE NATIONAL 50 of Turkey, BELEX of Serbia, TIRANA General Index of Albania, S&P500 of US, FTSE100 of UK, Xetra DAX of Germany and the Athens General Index (ASE) of Greece. The MSCI Emerging European and the MSCI Developed markets (in dollar terms) are included because these indices avoid, to some extent, infrequent trading and take into account abnormal inflation. Moreover, these indices are more respective globally and perspective regionally.

All the national stock indices are selected to guarantee representativeness of the domestic markets examined in this study. Furthermore, following studies on other emerging stock markets, we use indices expressed in national currencies (e.g., Voronkova, 2004). This restricts their changes to movements in the security prices and avoids distorting the cointegration analysis results with devaluations of the exchange rates that took place in the region. Moreover, all Balkan daily closing prices are adjusted to inflation.

The high frequency data incorporated here include information on short-run market interactions that may be absent in lower frequency data. The data were obtained from national stock exchanges and Bloomberg database. The sample covers a period of six years, from January 2000 till February 2006, due to constraints on data availability (1340 observations). Because most markets are operating in the same time zone, the problem of non-overlapping trading hours does not arise, except the US. Price changes in Europe are reflected the next day because trading on European Stock exchanges is over by the time trading on the American market commences. Also, when a stock exchange is closed due to a national holiday, we use the previous day closing prices.

5. Empirical results

The results from ADF and PP unit root tests indicate that the null hypothesis of a unit root in the levels cannot be rejected for any time series, while a unit root in the first differences is rejected at the 5% significance level. As a result, the stock markets follow a process integrated of order one. The KPSS test results support the findings of the two previous tests. The Zivot-Andrews test produce results that conform to the outcomes of the other unit root tests[5].

Table 2 reports descriptive statistics in the Balkan stock market returns that are of prime interest to international portfolios. All stock price series show leptokurtosis and there is evidence of negative skewness except for the Albanian case. Skewness is a particular feature of returns in Balkans emerging markets. Significant kurtosis and negative skewness (long left tail) indicate rejection of normality in stock return distributions.

Insert Table 2

5.1 Conventional cointegration tests

Since the null hypothesis of unit root test cannot be rejected, we test a model with constant restricted to the cointegration space, a model with unrestricted constant to the cointegration space, and a model with a linear trend in the cointegration sector

[5] Results are not presented here due to space limitation and are available on request.

in order to search for the presence or the absence of cointegrating relationships in the data set.

The Johansen cointegration tests are not presented here due to space limitation. The findings support the hypothesis that the stock markets in this region are interdependent, implying the possibility of partial stock price forecasts using data from the neighboring countries[6]. The maximum eigenvalue and trace tests of Johansen (1988) and Johansen and Juselius (1990) carried out for the seven Balkan stock markets show that they are linked by a single, common long-run relation, in all three versions of the models. Our empirical findings also support the existence of one cointegrating vector with the mature equity markets. This could be due to the fact that Balkan equity markets present small capitalization and infrequent trading compared to developed markets. Therefore, we proceed the analysis by employing Gregory – Hansen residual-based cointegration test and Monte Carlo simulation for further empirical evidence.

5.2 Gregory – Hansen residual-based cointegration test results

The results from Gregory - Hansen test are presented in Tables 3 and 4. The test is performed for model 1, model 2 and model 3. Table 3 reports cointegration results among Balkan stock markets. The pairwise test results show that the null hypothesis of no cointegration is rejected in most cases, since we find one cointegrating vector (significant Philips Z_t test at the 5% level). Moreover, Gregory and Hansen test using model 3, which allows for changes both in the intercept and in

[6] The optimal lag structure was chosen by the Akaike Information Criterion minimization and the absence of autocorrelation in the VAR residuals; one lag for the levels of variables was included.

the slope of the cointegration vector, produces the stronger cointegrating relation among Balkan stock markets.

Insert Table 3

Applying Gregory and Hansen test in all three models, we observe that there is no evidence of cointegration between Albanian stock market and its neighbours. As a result, Albanian stock market seems to share very weak linkages with most of the Balkans markets. This may be due to several market failures observed, like low trading volume, liquidity and capitalisation, disturbing the convergence to other regional markets.

Table 4 reports Gregory and Hansen cointegration results between Balkan and developed stock markets. Our findings provide evidence that rejects the null hypothesis of no cointegration. This implies that a structural change is present in the pattern of long-run stock market comovements. Figure 1 shows the probability to occur a structural break using model 3 for Balkan markets against US S&P500. When the value approaches one (1), the probability is higher. On the other hand, when the value approaches zero (0), the probability is very low. Also, Figure 1 provides evidence that a structural break appeared for all Balkan markets in year 2001.

Insert Figure 1

This evidence echoes the results from the conventional cointegration tests and indicates the pivotal influence of "foreign factors" on Balkan stock markets. The presence of equilibrium relations could be attributed to the growing exposure of the Balkan markets to foreign capital flows, the liberalization of the markets and the common regional economic prospects for full EU enrolment.

Our findings also suggest that the Athens Stock Exchange (ASE) plays a critical and leading role in the Balkan region among the developed stock markets.

Indeed, ASE shares the stronger cointegrating relationship with most of the Balkan markets (Romania, Bulgaria, Serbia and FYROM). This is due to the historical neighboring between Greece and these countries, the extensive trade and strong financial penetration of Greek firms in the region. Moreover, German stock market seems to share stronger linkages with the Turkish, Croatian and Albanian stock markets.

Insert Table 4

Although we provide strong evidence of cointegration between Balkans and developed stock markets using all three models, we find weak cointegration relationships in model 1 between FYROM (MBI-10) and US (S&P500) stock markets, and between Albanian stock market and all the developed counterparts. Finally, using MSCI total return indices, we find that the strongest cointegration relationship is between MSCI Emerging European markets and MSCI Developed ones. Our evidence of long-run linkages between Balkan and developed markets implies limited diversification benefits for international portfolios allocated to these markets. International investors should expect restricted portfolios gains in the short-run due to volatile behaviour and high risk of these markets.

5.3 Monte Carlo simulation results

Monte Carlo simulation investigates the likelihood to exist cointegrating vectors between the emerging Balkans stock markets and the developed ones grouped as two separate portfolios. Our findings indicate that the null hypothesis of random walk (no cointegration) is rejected at conventional significance levels, supporting the results obtained from Gregory and Hansen test.

Table 5 reports Monte Carlo simulation results between developed and Balkan stock markets, as well as between MSCI Developed and MSCI Emerging European markets. In our analysis we investigate maximum likelihood estimation of the endogenous switching model 3, since it produces the stronger cointegrated results using Gregory and Hansen test. Particularly, we report the mean of the maximum likelihood point estimates (β_1,β_2), the mean of the standard errors for these parameter estimates (σ_1, σ_2), and the rejection rate of the test (p = 0).

The estimation bias that occurs from the endogenous state variable is close to their true value. The mean estimates of σ_1 and σ_2 are also biased downwards. The estimates of $\beta_{1,1}$ and $\beta_{1,2}$ are close to their true values. Since the estimates are close to their true values and the LR test is not rejected, we provide endogenous estimators with very accurate estimates. Indeed, for all values of the transition probabilities p, the mean parameter estimates are nearly identical to their true values.

Insert Table 5

We also find that the Wald test is oversized for both tests, with rejection rates as high as 11.2% for the first sample (Balkan vs. Developed stock markets) and 10.1% for the second sample (MSCI emerging vs. MSCI developed). However, the LR test has roughly correct size for both samples. Overall, Monte Carlo technique confirms that maximum likelihood estimates are supportive for our case. The LR test appears to be a fairly reliable test for endogenous switching model 3. The presence of cointegration indicates that common dynamics bring the Balkan markets, US, UK, Gernamy and Greece towards a long-run equilibrium path.

5.4 Overreaction hypothesis results

The fluctuations of the mature markets appear to have a significant impact on the emerging Balkan stock markets, limiting the portfolio diversification benefits. The overreaction hypothesis provides sufficient patterns to predict future market movements in the Balkan region through the developed markets fluctuations.

Insert Table 6

Table 6 reports the results of overreaction using models 5a,b. As long as Φ_1 is negative and Φ_2 positive, the overreaction hypothesis is accepted for Balkans market movements. Our findings indicate that there asymmetric mean reverting movements in the short horizon, disturbing cointegration. The acceptance of the overreaction hypothesis abandons cointegration in the short-run, a priori. This implies the existence of mispricing behaviour from investors in the short-run, which reverts to the mean (equilibrium level) in the long-run.

In Table 6 we report that p-value >0 implying that the negative serial correlation with a prior negative return shock is correlated with the cointegrating relationship between Balkan and developed markets. While conditional asymmetric correlation r is positive with a strong statistical significance at 1% level, $\Phi_1 <0$ confirms the positive effect developed markets exercise on Balkan markets. Hence, the hypothesis that Balkan stock markets indices initially deviate from the actual values, implied by the new information received from the developed markets, and then move back to their equilibrium level, is not rejected giving rise to the overreaction hypothesis.

Consequently, short run deviations away from equilibrium can be expected to reverse (mean reversion pattern), thereby implying a degree of market predictability. A momentum strategy is consistent with the evidence from developed markets supporting behavioural explanations. The most important behavioural bias is the overestimation of the information provided in the long- term.

In Table 6 we observe that α_0, α_1 and b_0 are positive while b_1 is negative providing support to a momentum portfolio strategy. Since $b_1 + b_2 < 0$, the model captures the asymmetric volatility response to positive or negative return shocks. Also, the high value for the parameter γ implies that the transition among volatility regimes occurs very quickly. In 1% critical level, $\Phi_1 < 0$ and $\Phi_2 > 0$ provide support on the asymmetric pattern of price reversals where negative returns are more likely to revert to positive returns ($\Phi_1 + \Phi_2 > 0$) than positive returns to negative ones. Testing the MSCI Emerging markets against MSCI Developed markets, the speed of adjustment from a prior negative shock to a positive is again accepted. However, in these indices, $\Phi_1 + \Phi_2$ are slightly higher than zero, implying that the speed of adjustment is not very strong.

Table 7 reports the momentum strategy results applied in our sample. The findings support that the Balkans markets produce excess returns in a short-term window (days 0-3). We provide evidence of 1.2% excess return when allowing for 1 day implementation delay. In other words, Balkan markets receive asymmetric information on day 1, while it was produced in developed markets in day 0 (= currently). As a result, emerging markets follow the movement of the developed markets from day 1 to day 2. On day 3, Balkan markets reverse to the mean.

Insert Table 7

Particularly, an international investor could hold a long position in the Balkan markets during the first day of the post shock in developed markets prices (= day 2). At the third day the asset manager exercises his gains. Overall, a momentum strategy in Balkan stock markets provides an efficient way for investors to generate excess returns. However, several market failures that may prevent successful implementation of a momentum portfolio strategy in Balkan stock markets are the lack of liquidity and low volume.

6. Concluding remarks

This study investigates short and long-run relationships among seven Balkan stock markets, the US and three developed European markets during the period January 2000-February 2006. The existence of long-run comovements between Balkan and developed stock markets is estimated through linear and non-linear methodologies. Although Johansen cointegration tests provide evidence of one cointegration relationship, once a regime treatment that allows for structural breaks is included (Gregory-Hansen test), equity market integration in Balkan region is verified. Finally, Monte Carlo simulation rejects the null hypothesis of no cointegration. Thus, our results imply that the diversification benefits for international investors with long horizon strategy in Balkan stock markets are quite limited.

These findings imply that long-run investors who diversify their portfolios across Balkan stock markets should expect rather short-run modest portfolios gains, given the volatile behavior of portfolio returns to market shocks. Testing for the overreaction hypothesis we identify a suitable short-run strategy when investing in the Balkans. A shock in the developed equity markets has in a great extent direct impact on Balkan markets movements. Using an ANST-GARCH model, the results support the overreaction hypothesis and the existence of asymmetric mean reverting patterns in the Balkans portfolio. As a result the information which is currently available from the developed markets is not fully reflected in the Balkans future prices, providing the opportunity for investors to take advantage from the mean reverting movement.

The unexpected increase (decline) in developed stock prices creates an unexpected raise (drop) in Balkans stock prices in the short-run. Following a momentum strategy, an investor holding a Balkan markets portfolio could achieve excess return which is at least marginally higher than the benchmark (US stock market return). This explains the time variation of stock returns in Balkan region making asymmetric information, in a great extent, predictable. The disparity and the asymmetry are largely attributable to mispricing behavior from investors, who consistently overreact to certain market news with optimism and pessimism unwarranted by time-varying market movements.

References

Baele, L., Ferrando, A., Hordahl, P., Krylova, E., Monnet, C., 2004. Measuring financial integration in the Euro area. Occasion Paper 14, European Central Bank.

Bekaert G., Harvey C.R., 1995. Time – varying world market integration. Journal of Finance 50, 403 -444.

Campos, J., Ericcson, N.R., Hendry, D.F., 1996. Cointegration tests in the presence of structural breaks. Journal of Econometrics 70, 187 – 220.

Chaudhuri, K., Wu, Y., 2003. Random walk versus breaking trend in stock prices: Evidence from emerging market. Journal of Banking & Finance 27, 575-592.

Chen, G., Firth, M., Rui, O., 2002. Stock market linkages: Evidence from Latin America. Journal of Banking and Finance 26, 1113-1141.

Conrad, J., Kaul, G., 1998. An anatomy of trading strategies. Review of Financial Studies 11, 489-519.

Daniel, K., Hirshleifer, D., Subrahmanyam, A., 1998. Investor psychology and security market under-and overreactions. Journal of Finance 56, 921-965.

De Bondt, W.F.M., Thaler, R., 1985. Does the stock market overreact? Journal of Finance 40, 793-805.

Engle, R.F., Granger, C.W., 1987. Cointegration and error correction: Representation, estimation and testing. Econometrica 55, 251-276.

Fornari, F., Mele, A., 1997. Sign- and volatility-switching ARCH models: theory and applications to international stock markets. Journal of Applied Econometrics 12, 49-65.

Francis, B.B., Leachman, L.L., 1998. Superexogeneity and the dynamic linkages among international equity markets. Journal of International Monetary Fund 17, 475 - 494.

Glosten, L., Jagannathan, R., Runkle, D., 1993. On the relation between the expected value and the volatility of the nominal excess return on stocks. Journal of Finance 48, 1779 – 1801.

Gonzalez–Rivera, G., 1998. Smooth-Transition GARCH Models. Studies in Nonlinear Dynamics and Econometrics 3, 61-78.

Gregory, A.W., Hansen, B.E., 1996. Residual based tests for cointegration in the models with regime shifts. Journal of Econometrics 70, 99 – 126.

Hameed, A., Kusnadi, Y., 2002. Momentum strategies: evidence from Pacific Basin stock markets. Journal of Financial Research 25, 383–397.

Hamilton, J.D., Susmel, R., 1994. Autoregressive conditional heteroskedasticity and changes in regime. Journal of Econometrics 64, 307-333.

Jegadeesh, N., Titman, S., 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. Journal of Finance 48, 65-91.

Johansen, S., 1988. Statistical analysis of cointegration vectors. Journal of Economic Dynamics and Control 12 (2), 231-254.

Johansen, S., Juselius, K., 1990. Maximum likelihood estimation and inference on cointegration with application to the demand for money. Oxford Bulletin of Economics and Statistics 52, 169-210.

Kim, S.J., Moshirian, F., Wu, E., 2005. Dynamic stock market integration driven by the European Monetary Union: An empirical analysis. Journal of Banking & Finance 29, 2475 – 2502.

Lasfer M, Melnik, A. and Thomas, D., 2003. Short term reaction of stock markets in stressful circumstances. Journal of Banking & Finance 27, 1959-1977.

Manning, N., 2002. Common trends and convergence? South East Asian equity Markets, 1998 – 1999. Journal of International Money and Finance 19, 183 – 202.

Masih, A., Masih, R., 2002. Propagative causal price transmission among international stock markets: Evidence from the pre- and post- globalisation period. Global Finance Journal 13, 63-91.

Nam, K., Pyun, C.S., Avard, S.L., 2001. Asymmetric reverting behaviour of short-horizon stock returns: An evidence of stock market overreaction. Journal of Banking & Finance 25, 807–824.

Phylaktis, K., 1999. Capital market integration in the pacific basin region: An impulse response analysis. Journal of International Money and Finance 18, 267 – 287.

Rouwenhorst, K. G., 1998. International momentum strategies. Journal of Finance 53, 267-284.

Rouwenhorst, K. G., 1999b. Local return factors and turnover in emerging stock markets. Journal of Finance 54, 1439-1464.

Schiereck, D., De Bondt, W., Weber, M., 1999. Contrarian and momentum strategies in Germany. Financial Analysts Journal 55, 104–116.

Syriopoulos, Th., 2006. Risk and return implications from investing in emerging European stock markets. Journal of International Financial Markets, Institutions and Money 16, 283-299.

Voronkova, S., 2004. Equity market integration in Central European emerging markets: A cointegration analysis with shifting regimes. International Review of Financial Analysis 12, 633 – 647.

Table 1
Financial statistics for the Balkan region

Countries	Year	GDP	Inflation	FDI[a]	FCI[b]	Market Capitalisation[a]	Turnover[a]	Market Return
Turkey	2000	3.4%	34.2%	1.2	12%	361	0.9	-45.32%
	2001	-7.5%	54%	2	8%	302	0.76	-29.1%
	2002	7.9%	21.6%	0.5	6%	268	0.7	-44.46%
	2003	5.8%	8.6%	0.5	7%	346	0.8	75.67%
	2004	9%	8.2%	0.7	13%	469	1.2	27.88%
	2005	7.4%	7.6%	2.4	21%	578	2.07	84.9%
	2006	7.1%	8%	4.7	26%	660	2.65	-12.68%
Romania	2000	5.7%	14.5%	2	1%	0.4	0.032	-36.82%
	2001	5.7%	12.5%	2.5	1%	0.4	0.035	-27.55%
	2002	5.1%	6.3%	2.1	4%	0.9	0.057	-57.08%
	2003	5.2%	5%	2.4	6%	1.6	0.081	29.71%
	2004	8.4%	3.4%	6.1	11%	2.3	0.12	73.56%
	2005	4.1%	3.2%	6.5	18%	4.01	0.162	64.32%
	2006	7.5%	3.8%	8	23%	7.5	0.21	47.8%
Bulgaria	2000	2.5%	7.8%	5.9	0.3%	0.003	0.001	-29.63%
	2001	4%	7.4%	6.1	0.6%	0.005	0.001	-32.9%
	2002	4.8%	5.9%	6	1.1%	0.005	0.001	-68.73%
	2003	4.5%	2.3%	10.4	3%	0.009	0.002	19.24%
	2004	5.6%	6.1%	11.8	6.7%	0.02	0.005	35.6%
	2005	5.5%	5%	10.9	11.3%	0.03	0.007	58.94%
	2006	6.1%	7.3%	16.6	18%	0.05	0.011	16.89%
Croatia	2000	2.9%	7.6%	6	1.2%	0.03	0.007	-34%
	2001	3.4%	7.1%	8.3	1.6%	0.04	0.011	-37.18%
	2002	3.6%	6%	8.6	2.1%	0.05	0.015	-73.86%
	2003	5.7%	4.2%	10.9	3.2%	0.08	0.028	29.03%
	2004	7.2%	3%	11.2	5.7%	1.9	0.049	45.55%
	2005	8.3%	2.5%	11.4	10.4%	4.1	0.076	69.47%
	2006	6.3%	3%	13.6	17%	6.1	0.12	42.26%
Serbia	2000	2.6%	11.7%	0.9	0.3%	0.008	0.002	-20.72%
	2001	5.1%	10.2%	1.6	0.5%	0.01	0.003	-38.29%
	2002	4.5%	8.3%	3	0.7%	0.01	0.004	-44.33%
	2003	2.4%	6.5%	6.7	1.6%	0.02	0.008	16.98%
	2004	9.3%	5.1%	3.9	3.9%	0.03	0.014	31%
	2005	6.8%	4.9%	5.9	7.5%	0.05	0.023	35.02%
	2006	4.7%	3%	5.5	11%	0.08	0.035	37.51%
FYROM	2000	1.2%	7.4%	2.4	1.0%	0.04	0.001	-13.28%
	2001	1.3%	6%	3.6	1.3%	0.04	0.002	-30.94%
	2002	1.9%	3.1%	3.8	2.4%	0.04	0.002	-42.66%
	2003	3.3%	2.2%	4.5	4%	0.06	0.005	10.49%
	2004	4.7%	1.7%	5.7	6.9%	0.08	0.01	17.65%
	2005	5.2%	1.6%	5.9	11.3%	1.09	0.019	38.1%

	2006	6%	2%	6.6	19.7%	1.4	0.03	49.92%
Albania	2000	7.7%	4.2%	3.7	0.4%	N/A	N/A	-43.77%
	2001	6.5%	3.5%	3.2	0.6%	N/A	N/A	-48.96%
	2002	4.7%	1.7%	3	0.5%	0.001	0.001	-69.72%
	2003	6%	3.3%	1.3	1.2%	0.002	0.002	8.73%
	2004	6%	2.2%	0.8	1.7%	0.003	0.003	12.54%
	2005	5.5%	2%	0.5	0.9%	0.005	0.005	65.06%
	2006	5.1%	2.4%	1	1.1%	0.009	0.005	48.72%

[a] Foreign direct investments (FDI), market capitalization and Turnover in million Euros. [b] Foreign capital investments (FCI) as a percentage of GDP.

Source: IMF

Table 2
Descriptive statistics

Countries	Min	Max	Standard Deviation	Skewness	Kurtosis
Turkey	-0.18	0.18	0.020	-0.2	8.04
Romania	-0.15	0.14	0.018	-0.14	6.93
Bulgaria	-0.17	0.21	0.022	-0.18	7.87
Croatia	-0.14	0.14	0.019	-0.09	7.16
Serbia	-0.15	0.21	0.022	-0.21	8.39
FYROM	-0.14	0.18	0.019	-0.15	7.40
Albania	-0.16	0.15	0.024	0.07	7.26

Table 3
Gregory-Hansen test for cointegration among Balkan equity markets[a]

Indices[b]	Break Point			Philips Z_t		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
ISE NATIONAL 50 – VANGUARD	0.61	0.61	0.63	-4.90*	-4.90*	-4.92*
ISE NATIONAL 50 – SOFIX	0.45	0.45	0.48	-4.80*	-4.81*	-4.82*
ISE NATIONAL 50 – CROBEX	0.43	0.43	0.42	-4.81*	-4.81*	-4.81*
ISE NATIONAL 50 – MBI - 10	0.34	0.41	0.39	-4.75*	-4.80*	-4.79*
ISE NATIONAL 50 – BELEX	0.34	0.35	0.37	-4.75*	-4.76*	-4.77*
ISE NATIONAL 50 – TIRANA General	0.30	0.31	0.35	-4.70*	-4.73*	-4.76*
VANGUARD – SOFIX	0.58	0.60	0.56	-4.86*	-4.90*	-4.85*
VANGUARD – CROBEX	0.42	0.44	0.48	-4.80*	-4.79*	-4.81*
VANGUARD –MBI – 10	0.34	0.32	0.37	-4.69*	-4.70*	-4.72*
VANGUARD – BELEX	0.38	0.37	0.39	-4.71*	-4.71*	-4.71*
VANGUARD – TIRANA General	0.45	0.49	0.48	-4.72*	-4.73*	-4.73*
VANGUARD - ISE NATIONAL 50	0.43	0.45	0.45	-4.81*	-4.82*	-4.82*
SOFIX – ISE NATIONAL 50	0.41	0.42	0.46	-4.72*	-4.72*	-4.80*
SOFIX – VANGUARD	0.42	0.43	0.48	-4.72*	-4.73*	-4.82*
SOFIX – CROBEX	0.39	0.42	0.47	-4.70*	-4.72*	-4.81*
SOFIX – MBI 10	0.37	0.40	0.45	-4.69*	-4.69*	-4.78*
SOFIX – BELEX	0.38	0.39	0.44	-4.70*	-4.68	-4.76*
SOFIX – TIRANA GI	0.36	0.38	0.41	-4.68	-4.67	-4.71*
CROBEX – ISE NATIONAL 50	0.41	0.44	0.45	-4.71*	-4.74*	-4.80*
CROBEX – VANGUARD	0.45	0.43	0.46	-4.73*	-4.73*	-4.81*
CROBEX – MBI 10	0.40	0.40	0.45	-4.69*	-4.69*	-4.80*
CROBEX – BELEX	0.42	0.41	0.46	-4.73*	-4.70*	-4.81*
CROBEX – TIRANA GI	0.39	0.40	0.42	-4.69*	-4.69*	-4.73*
MBI 10 – ISE NATIONAL 50	0.42	0.41	0.46	-4.72*	-4.71*	-4.82*
MBI 10 – VANGUARD	0.41	0.41	0.45	-4.71*	-4.71*	-4.81*
MBI 10 – SOFIX	0.40	0.40	0.43	-4.71*	-4.70*	-4.79*
MBI 10 – CROBEX	0.41	0.40	0.44	-4.71*	-4.70*	-4.80*
MBI 10 – BELEX	0.39	0.39	0.42	-4.69*	-4.69*	-4.78*
MBI 10 – TIRANA GI	0.37	0.39	0.40	-4.67	-4.69*	-4.75*
BELEX – ISE NATIONAL 50	0.39	0.40	0.45	-4.69*	-4.70*	-4.81*
BELEX – VANGUARD	0.42	0.41	0.46	-4.72*	-4.71*	-4.83*
BELEX – SOFIX	0.41	0.40	0.44	-4.71*	-4.70*	-4.81*
BELEX – CROBEX	0.43	0.41	0.46	-4.73*	-4.71*	-4.83*
BELEX – TIRANA GI	0.37	0.38	0.40	-4.68	-4.68	-4.74*
TIRANA GI – ISE NATIONAL 50	0.42	0.43	0.40	-4.72*	-4.74*	-4.71*
TIRANA GI – VANGUARD	0.40	0.42	0.39	-4.70*	-4.72*	-4.70*
TIRANA GI – SOFIX	0.40	0.43	0.40	-4.70*	-4.73*	-4.71*
TIRANA GI – CROBEX	0.41	0.43	0.40	-4.71*	-4.74*	-4.71*
TIRANA GI – MBI 10	0.39	0.42	0.39	-4.69*	-4.72*	-4.69*
TIRANA GI – BELEX	0.38	0.40	0.38	-4.68	-4.70*	-4.68

[a] We specify three model options, as following:
Model 1: $Y_{1t} = \mu_1 + \mu_2 \varphi_{t\tau} + \alpha' y_{2t} + \varepsilon_t$,
Model 2: $Y_{1t} = \mu_1 + \mu_2 \varphi_{t\tau} + \beta t + \alpha' y_{2t} + \varepsilon_t$,
Model 3: $Y_{1t} = \mu_1 + \mu_2 \varphi_{t\tau} + \alpha'_1 t + \alpha'_2 y_{2t} \varphi_{t\tau} + \varepsilon_t$
This note also applies in Table 4.
[b] The correspondence between stock markets and indices is: SOFIX: Bulgaria; VANGUARD: Romania; CROBEX: Croatia; MBI10: FYROM; ISE NATIONAL 50: Turkey; BELEX: Serbia; TIRANA GI: Albania.
* Denotes significance at the 5% level.

Table 4
Results for the Gregory – Hansen test for cointegration between Balkan and developed equity markets

Indices	Break Point			Philips Z_t		
	Model 1	*Model 2*	*Model 3*	*Model 1*	*Model 2*	*Model 3*
Model 1						
ISE NATIONAL 50 – S&P	0.34	0.32	0.36	-4.75*	-4.71*	-4.76*
ISE NATIONAL 50 – FTSE 100	0.36	0.33	0.38	-4.77*	-4.72*	-4.78*
ISE NATIONAL 50– DAX	0.42	0.40	0.41	-4.82*	-4.80*	-4.82*
ISE NATIONAL 50 – ASE GI	0.38	0.35	0.38	-4.80*	-4.74*	-4.79*
VANGUARD – S&P	0.32	0.34	0.35	-4.71*	-4.71*	-4.73*
VANGUARD – FTSE 100	0.35	0.35	0.36	-4.73*	-4.71*	-4.73*
VANGUARD – DAX	0.41	0.37	0.42	-4.80*	-4.78*	-4.81*
VANGUARD – ASE GI	0.42	0.44	0.41	-4.81*	-4.83*	-4.81*
SOFIX – S&P	0.32	0.32	0.35	-4.70*	-4.70*	-4.71*
SOFIX – FTSE 100	0.33	0.36	0.37	-4.70*	-4.73*	-4.73*
SOFIX – DAX	0.37	0.41	0.41	-4.74*	-4.78*	-4.78*
SOFIX – ASE GI	0.40	0.39	0.42	-4.80*	-4.78*	-4.81*
CROBEX – S&P	0.31	0.31	0.32	-4.76*	-4.72*	-4.78*
CROBEX – FTSE 100	0.31	0.32	0.32	-4.77*	-4.73*	-4.79*
CROBEX – DAX	0.33	0.34	0.39	-4.78*	-4.75*	-4.81*
CROBEX – ASE GI	0.33	0.38	0.37	-4.78*	-4.77*	-4.79*
MBI – 10 – S&P	0.26	0.30	0.29	-4.60	-4.71*	-4.69*
MBI – 10 – FTSE 100	0.29	0.32	0.31	-4.70*	-4.74*	-4.72*
MBI – 10 – DAX	0.31	0.35	0.35	-4.72*	-4.78*	-4.78*
MBI – 10 – ASE GI	0.30	0.38	0.37	-4.71*	-4.79*	-4.79*
BELEX – S&P	0.28	0.27	0.27	-4.62*	-4.65*	-4.62*
BELEX – FTSE 100	0.27	0.28	0.27	-4.62*	-4.67*	-4.67*
BELEX – DAX	0.30	0.30	0.31	-4.65*	-4.68*	-4.70*
BELEX – ASE GI	0.32	0.39	0.37	-4.70*	-4.77*	-4.76*
TIRANA GI – S&P	0.21	0.23	0.24	-4.54	-4.61*	-4.61*
TIRANA GI – FTSE 100	0.22	0.25	0.26	-4.55	-4.62*	-4.62*
TIRANA GI – DAX	0.24	0.26	0.29	-4.56	-4.62*	-4.64*
TIRANA GI – ASE GI	0.21	0.24	0.26	-4.54	-4.61*	-4.63*
MSCI E.E.Markets – MSCI D.M.	0.68	0.66	0.70	-4.84*	-4.81*	-4.86*

The correspondence between stock markets and indices is: S&P: US; DAX: Germany; FTSE100: UK; ASE GI: Greece; SOFIX: Bulgaria; VANGUARD: Romania; CROBEX: Croatia; MBI10: FYROM; ISE NATIONAL 50: Turkey; BELEX: Serbia; TIRANA GI: Albania.

* Denotes significance at the 5% level

Table 5
Monte Carlo simulation results

p_{11} = 0.7 p_{22} =0.7
Balkan vs. developed markets

	$\beta_{0,1}$	$\beta_{0,2}$	$\beta_{1,1}$	$\beta_{1,2}$	σ_1	σ_2
Endog. Estimator	0.97 (0.05)	-0.98(0.08)	1.00 (0.01)	-0.99 (0.02)	0.32 (0.04)	0.66 (0.05)
Wald Test	11.2%					
LR Test	6.4%					

MSCI Developed Markets vs. MSCI Emerging European Markets

Endog. Estimator	0.98 (0.05)	-0.97(0.06)	1.00 (0.01)	-1.00 (0.01)	0.48 (0.02)	0.83 (0.02)
Wald Test	10.1%%					
LR Test	9.7%					

p_{11} = 0.7 p_{22} =0.9
Balkan vs. developed markets

Endog. Estimator	1.00 (0.06)	-1.00 (0.07)	1.00 (0.02)	-1.00 (0.02)	0.33 (0.04)	0.66 (0.05)
Wald Test	9.1%					
LR Test	5.2%					

MSCI Developed Markets vs. MSCI Emerging European Markets

Endog. Estimator	1.00 (0.02)	-1.00 (0.02)	1.00 (0.009)	-1.00 (0.009)	0.48 (0.02)	0.83(0.03)
Wald Test	9.9%					
LR Test	9.4%					

p_{11} = 0.9 p_{22} =0.9
Balkan vs. developed markets

Endog. Estimator	1.00 (0.03)	-1.00 (0.06)	1.00 (0.02)	-1.00 (0.04)	0.33 (0.03)	0.67 (0.06)
Wald Test	7.2%					
LR Test	5.1%					

MSCI Developed Markets vs. MSCI Emerging European Markets

Endog. Estimator	1.00 (0.01)	-1.00 (0.01)	1.00 (0.007)	-1.00 (0.007)	0.42 (0.02)	0.81 (0.02)
Wald Test	8.5%					
LR Test	7.2%					

Sample for T = 400. Each cell contains the mean of the maximum likelihood point estimates and the mean of the standard errors of these estimates from the Monte Carlo experiment. Endogenous estimator refers to the maximum likelihood estimator allowing the state process to be endogenous, so that p $\in (-1, 1)$.

The standard error is used to calculate confidence intervals for our true sample.

Wald and LR tests' significance at 5% level.

Table 6

Estimation of Overreaction[a]

Coefficients	Results for Models 5a, b [b]	
	Balkans vs. Developed	MSCI E.E.M vs. MSCI Developed
Φ_1	-0.0526 (-11.890)	-0.0403 (-6.557)
Φ_2	0.0712 (12.042)	0.0414 (10.931)
α_0	0.0174 (0.748)	0.0266 (0.895)
α_1	0.1268 (5.829)	0.0948 (3.100)
ρ-value	0.0074	0.0081
b_0	1.281 (4.273)	1.2900 (4.966)
b_1	-1.4438 (-5.063)	-1.4422 (-5.007)
b_2	- 1.5006 (-5.947)	-1.5839 (-6.735)
r	0.063	0.089
γ	157.89 (2.004)	203.44 (2.157)

[a] We specify the following ANST-GARCH model as the conditional mean and variance equations:

$$R_t = \mu + \left[\Phi_1 + \Phi_2 \cdot F(\varepsilon_{t-1})\right] \cdot R_{t-1} + \varepsilon_t$$

$$h_t = a_0 + a_1\varepsilon_{t-1}^2 + a_2 h_{t-1} + \left[b_0 + b_1\varepsilon_{t-1}^2 + b_2 h_{t-1}\right] \cdot F(\varepsilon_{t-1})$$

[b] Balkan stock market return (R_t) evolves with the following nonlinear autoregressive process:

$$R_t = \mu + \phi^{+} R_{t-n} + \varepsilon_t, if\ \varepsilon_{t-1} \geq 0.5$$

$$R_t = \mu + \phi^{-} R_{t-n} + \varepsilon_t, if\ \varepsilon_{t-1} \leq -0.5$$

Values in parentheses are the Bolleslev-Woolbridge *t*-statistics.

Table 7

Momentum Strategy

Day	Developed markets excess return	Balkan markets excess return	Strategy
0	≥0.5 % or ≤0.5%	Position unchanged	Position unchanged
1	Reverse to the mean	1.2%	Long if return ≥0.5%, short if ≤0.5%
2	Reverse to the mean	0.2%	Hold position
3	Position unchanged	-0.6%	Close position

Figure 1

Regime probability in the Balkan region