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Estimation, Instability, and Non-Stationarity of Beta Coefficients for Twenty-four Emerging Markets in 2005-2021

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Abstract:

Purpose: *The aim of the article is analyse the stability of country beta coefficient for 24 emerging markets between March 2005 and June 2021. The numerous markets studied allow examining the effects on the stability of beta coefficient of various local political, economic and institutional developments (e.g., democratization or intensification of authoritarian rule). The period of several years enables the examination of the effects of global shocks (e.g., financial crisis 2008/2009, pandemic crisis 2020).*
Design/Methodology/Approach: *Estimation covers the beta coefficient defined as the ratio of the covariance of the rate of return of the examined financial instrument and the rate of return of the market portfolio to the variance of the rate of return of the market portfolio. The ratio defined in this way is equal to the coefficient in Sharp linear regression of rate of return of the examined financial instrument (explained variable)and the rate of return of the market portfolio (explanatory variable). The author of the article tested the stability of emerging markets beta using, Chow test, which uses the F statistic, Cusum test based on generalized fluctuations test framework, trend-stationarity analysis (TS) of the time series of beta coefficients obtained in rolling windows, difference stationarity (DS) analysis of the time series beta coefficients obtained in rolling windows too.*
Findings: *The conclusion about the instability of the beta coefficient for 24 emerging markets is based on the results of the Chow, Cusum, trend-stationarity and unit root tests. The results of single tests are not unequivocal due to the random nature of the phenomenon. The study's preliminary hypothesis about the instability of the beta coefficient was not falsified.*
Practical Implications: *Identification of a scientific gap and the need to research a theory that better explains reality and better forecasts for the future, not only in calm times, but also in times of more rapid changes on the markets.*
Originality/Value: *Author's research of instability of beta coefficient for twenty-four emerging market portfolios, Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Qatar, Russia, South Africa, Taiwan, Turkey and UAE with four tests (96 tests in total) over the course of 16 years.*

Keywords: *CAPM, country beta coefficient, systematic risk, stability of beta.*

JEL: *G11, G12, G13.*
Paper Type: *Research study.*

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1. Introduction

Sharp's Model is one of the most important tools supporting the investment decision making on the capital market (Sharpe, 1963). Originally, it was used to build a portfolio of securities as an alternative to the Markowitz model (1959) and is closely related to the Capital Asset Pricing Model (CAPM), which has been widely used as a model for predicting asset returns.
Beta is defined as the ratio of the covariance of the rate of return of the examined financial instrument R_i and the rate of return of the market portfolio R_m to the variance of the rate of return of the market portfolio (alternatively as the product of the linear Pearson correlation and the ratio of standard deviations) (Tofallis, 2008, p. 1359):

$$\beta_i = \frac{cov(R_i, R_m)}{var(R_m)} = cor(R_i, R_m) \times \sqrt{\frac{var(R_i)}{var(R_m)}} \quad (1)$$

where:

R_i - measures the rate of return of the financial instrument,
R_m - measures the rate of return of the market portfolio,
Cov (R_i, R_m) - the covariance between the rates od return,
i is the index of financial instrument.

Estimation directly from this definition requires the estimation of the above-mentioned covariances and variances and the calculation of their quotient (alternatively, the product of the appropriate correlation and the ratio of standard deviations).

The beta coefficient is also an estimator of the parameter of simple linear regression equation proposed by Sharpe (1963). Therefore, the rate of return on shares of the i-th company in the t-th period can be written as (Elton, Gruber, 1998, p.154, Jajuga, Jajuga, 1998, p.63):

$$R_{it} = \alpha_i + \beta_{i\,Sharp} R_{mt} + \varepsilon_{it}, \quad (2)$$

where:

R_{it} - rate of return of shares of the i-th company,
R_{mt} - rate of return on an index of the market,
α_i – the regression intercept, which is a component of the return on shares of the company and independent of the market situation,
$\beta_{i\,Sharp}$ - the slope coefficient (constant over time) which measures the expected change in R_i depending on the change in R_m,
ε_{it} - is Gaussian noise N (0, σ_i) with zero expected value and standard deviation σ_i,
t - number of observations of the time series.

The estimator $\beta_{i\ Sharp}$ obtained from this regression using the least squares method (or the maximum likelihood method) is the beta coefficient explicitly defined in (1). For beta estimation, it becomes unnecessary to estimate covariance (correlation) and variance. It is enough to perform a classical regression. Regression-based methods have become dominant.

With the development of the CAPM model by Treynor (1961), Treynor (1962), Sharpe (1964), Lintner (1965), Lintner (1965), Mossin (1966), an alternative to (2) regression was the regression of the equation in which there is an additional variable: risk-free rate of return R_F:

$$R_i = R_F + \beta_{i\ CAPM}(R_m - R_F) + \varepsilon_i. \qquad (3)$$

In this equation, the risk-free return R_F can be a deterministic constant or a random variable.

Beta coefficient is also called the aggressiveness. Dayaratne et others define beta as a measure of the systematic risk associated with a particular stock. (Dharmaratne and Harris, 2006). Malkiel and Xu (2006) identified this type of risk as the systematic risk, which is undiversifiable.

2. Stability of Beta Coefficient of Emerging Markets – Literature Review

Sharpe model and Capital Asset Pricing Model assumes that the beta is stable and predictable over time (Treynor, 1965). However, this assumption has been contradicted by a number of empirical studies which have found the beta coefficient to be unstable over time. The instability of the beta over time makes it impossible to use the relationships described by the model in the future, which deprives it of prognostic possibilities.

The possibilities of using beta in practice are closely related not only to the correctness of its estimation, but also its stability of the time (Wright, Mason, and Miles 2003). This is due to the fact that if a beta is to be a prerequisite for making investment decisions, the trends that are described by it must be retained in the future. The instability of the beta over time makes it impossible to use the relationships described by the model in the future, because the influence of explanatory variables on the explained variable changes over time, and the inference based on a model with unstable parameters can be biased with large errors.

Many researchers tried to find whether the security betas remain stable irrespective of time investigating the various influences on stability and stationarity of beta, which include the length of estimation and holding periods, different return intervals. Intensive researches referring to beta parameter were carried out especially in highly developed economies, but there are also plenty of papers containing studies about the stability of the beta parameter for developing or post-transition economies.

The studies cover usually individual stocks as well as portfolios, but there are a few researches, which tried to compare results of beta stability between market, especially emerging markets. However, there is no clear decisive result about stability of the beta on individual securities and portfolios in the group of emerging markets. Generally, we can divide them into tree groups:

1) Stable betas (Sromon and Das (2008), George and Bainy (2012), Harish and Mallikarjunappa (2019), Shamsher *et al.* (1994));
2) Non-stable betas (Irala (2007), Sarma and Sarmah (2008), Attya and Eatz **(**2011), Batsirai *et al.* (2013), Razvan *et al.* (2009), Ye (2017), Brooks *et al.* (1998), Sibel Celik (2013);
3) Contradictory result (Rohini and Singh (2008), Ray (2010), Deb and Mistra (2011), Terceño *et al.* (2011).

Beta stability tests are very ambiguous. And this is not only problem of emerging countries, but also these well developed. For example researches conducted on NYSE by Fabozzi and Francis (1977) and Fisher and Kamin (1985) confirmed beta stability over time. The same results was achieved by Faff on Australian Stock Exchange (2001). In turn, analysis of Sunder (1980), Bos and Newbold (1984) and Braun *et al.* (1995), all for NYSE, showed that beta coefficients are highly time-varying. At last, some empirical studies produced contradictory result on the stability of beta on developed markets, just like for emerging markets, e.g., Baesel (1974), Levy (1971), Dębski *et al.* (2011), Dębski and Feder-Sempach (2012), Witkowska (2008).

The literature review presents the differing results of the research conducted so far. Their ambiguity is due to the theory of statistical tests. In statistical research, it is natural for errors of the first or second type to occur, which, even with several dozen studies, may (e.g., with a 5% error probability) yield different results. Moreover, the lack of grounds for rejecting the main hypothesis does not provide a strong statistical basis for concluding that the reality is consistent with this hypothesis, and it is more an incentive to deepen the research. Performing several tests on time and subject-wide data sets enables the gathering of richer information and discussion of the results in order to make the least risky decisions.

3. Research Method

3.1 Model Selection

In the study, we will estimate the beta coefficient as defined in (1). In order to choose the model to be used for estimation, let's compare the beta coefficients calculated by regressions (2) and (3). For this purpose, in CAPM (3) regression, we treat the R_F rate as a random variable (a special case is a deterministic variable whose variance is zero) and transform equation (3) to a simple (univariate) regression by subtracting the R_F rate from R_i and R_m:

$$(R_i - R_F) = \alpha_i + \beta_{i\,CAPM}(R_m - R_F) + \varepsilon_i. \tag{4}$$

Variables $(R_i - R_F)$ i $(R_m - R_F)$ are the excess rates above the risk-free rate. The estimator of $\beta_{i\,CAPM}$ from equations (3) and (4) of the OLS and ML methods is then[2]:

$$\beta_{i\,CAPM} = \frac{cov(R_i - R_F, R_m - R_F)}{var(R_m - R_F)} = \frac{cov(R_i, R_m) - cov(R_i, R_F) - cov(R_F, R_m) + cov(R_F, R_F)}{var(R_m) + var(R_F) - 2cov(R_m, R_F)} = \frac{cov(R_i, R_m) - cov(R_i, R_F) - cov(R_F, R_m) + var(R_F)}{var(R_m) + var(R_F) - 2cov(R_F, R_m)}. \tag{5}$$

In the special case, when the risk-free rate of return R_F is deterministic, its variance and all covariances with its participation are zero and we obtain:

$$\beta_{i\,CAPM} = \frac{cov(R_i, R_m) - cov(R_i, R_F) - cov(R_F, R_m) + var(R_F)}{var(R_m) + var(R_F) - 2cov(R_F, R_m)} = \frac{cov(R_i, R_m)}{var(R_m)} = \beta_{i\,Sharp}. \tag{6}$$

The estimators of the coefficients $\beta_{i\,CAPM}$ and $\beta_{i\,Sharp}$ are then identical and $\beta_{i\,CAPM}$ is the unbiased estimator of the beta coefficient by definition (1).

However, in the general case, when the risk-free rate of return R_F is a random variable, the estimators $\beta_{i\,Sharp}$ and $\beta_{i\,CAPM}$ are equal to each other only in the exceptional case when:

$$\begin{cases} var(R_F) = cov(R_i, R_F) + cov(R_F, R_m) \\ var(R_F) = 2\,cov(R_F, R_m) \end{cases} \tag{7}$$

which is equivalent to the conditions:

$$\begin{cases} var(R_F) = 2\,cov(R_F, R_m) \\ cov(R_i, R_F) = cov(R_F, R_m) \end{cases}.$$

When the conditions (7) are not satisfied, then $\beta_{i\,Sharp} \neq \beta_{i\,CAPM}$, which means that the estimator $\beta_{i\,CAPM}$ is a biased estimator of the coefficient β_i defined in (1). This is a paradox, because, β_i was assumed precisely by definition (1) in deriving the CAPM equation. The unbiasedness of the estimator $\beta_{i\,CAPM}$ requires the assumption of a deterministic risk-free rate of return R_F. Meanwhile, the risk-free rate of return is a random variable with a time-varying expected value (e.g., the effect of central bank

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[2]*When we assume the constraint $\alpha_i = 0$, raw moments appear in the equations instead of central moments.*

intervention) and variance (an increase in variance in the boom period and recession).

We estimate the beta coefficient by regression of the Sharp equation (2). This simplifies the calculations in relation to the application of the CAPM equation (3). We have only one realization of the rates of return at a given point in time necessary for the estimation of the beta coefficient. In other words, for a given moment of time t = 1 ... n (at the end of a day, month, year), we have information about one rate of return of the market portfolio R_m and one rate of return for the examined financial instrument R_i. Sharp's equation (2) takes the form:

$$R_{it} = \alpha_i + \beta_{i\,Sharp} R_{mt} + \varepsilon_{it}, \tag{8}$$

where t is the index of the moments of time from the period T from which the samples of the analysed rates of return are derived.

3.2 Beta Estimation

We estimate the beta coefficient for:
1) the whole period (OLS with assuming the stability of the model, including the beta coefficient), as a result of which we obtain the average value of the beta coefficient over the entire analysed period,
2) subperiods with fixed two-years length rolling windows (Zivot and Wang, 2006), resulting in a time series of beta coefficients.

The two-year length of the time window is dictated by the length of the series (16 years), the monthly data frequency providing the necessary minimum number of degrees of freedom (24-2), the moderate (and the same for each subperiods) the degree of data smoothing and the number of regressions required (172 for each of the 24 countries). Assigning the result of the beta parameter estimation to the end of the interval, results in no beta assigned to the initial two-year period (2005-2007). In the estimation, we assume that the random regression component ε_i is normally distributed. The subject of the study are indices created as a result of weighted averaging of the rates of return of many assets. Based on the central limit theorem, it allows to approximate the index return distribution with a normal distribution.

3.3 Stability Testing

For the use of OLS estimators it is necessary to assume the stability of the model (8) (functional form, parameters α_i and $\beta_{i\,Sharp}$) in the period T from which the data are derived. We use:
1) Chow test (1960), which uses the F statistic,
2) Cusum test (Ploberger and Kramer, 1992), based on generalized fluctuations test framework,

3) trend stationarity analysis (TS) of the time series beta coefficients obtained in rolling windows on the basis of simple OLS regression with significance test of the slope coefficient and the Durbin-Watson Test
4) difference stationarity (DS) analysis of the time series beta coefficients obtained in rolling windows using the extended Dickey-Fuller (ADF) test with the trend (Dickey and Fuller (1979), Dickey and Fuller (1981)) with the number of delays on the basis of Said and Dickey (1984), with a priori selection of the significance level of the tests $\alpha = 0.05$ (probability of the first type error).

We conducted the research in the R statistical program environment using the test implementation:

1) Chow test in F Statistics (Fstats) and Cusum test in Empirical Fluctuation Processes (efp), from library: Testing, Monitoring, and Dating Structural Changes (Strucchange) (Zeileis *et al.* 2002),
2) Augmented Dickey-Fuller Unit Root Test (ur.df) from library Unit Root and Cointegration Tests for Time Series Data, (Pfaff, 2006).

3.4 Data

We examined the beta coefficients established for the sets of monthly rates of return:
1) between March 2005 and June 2021 (16 years), including global fluctuations in risk aversion (speculative bubbles, 2008 financial crisis, asset price inflation, covid-19 crisis). We chose a 2-year rolling windows, which gives 24 observations in the rolling windows. The length of the rolling windows is a compromise between the desire to see short-term fluctuations (the shorter, the less attenuation of short-term trends) and the statistical quality of regression (the longer the window, the more data and more reliable estimates);
2) 24 emerging markets, Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Qatar, Russia, South Africa, Taiwan, Turkey and UAE. In these markets, apart from global changes in risk aversion, political, systemic or institutional disturbances occur more often than in developed countries. Judgmental sampling is more useful when the researcher desires to collect data from a specific group to bring more reliable and precise results (Saunders *et al*., 2009; Taherdoost 2016). Žmuk *et al.* (2016) recommended that if the researcher's target population is small, then to get satisfactory precision and accuracy level of the parameter of the estimate, then researcher need to include 70% of the samples population, here in this study researcher study 75% of the population.

We chose the rate of return from the MSCI World Index (market index) as the variable explaining the rates of return of individual emerging markets. According to the theoretical assumptions of the Sharp/CAPM model, the market index should cover the broadest spectrum of investment instruments available to investors. We also considered an index limited to the total emerging markets (MSCI Emerging Markets) as an explanatory variable. A general index for emerging markets would allow to the discovery of market-specific volatility to a greater extent with the suppression of the impact of global events. The choice of the MSCI World index was determined by its greater compliance with the theory of finance.

The data set includes, monthly rates of return on the market index, rates of return on the index of the analysed asset for given moments of time (panel data) from March 2005 to June 2021 (observations from 196 periods - months). Logarithmic rates of return were used. Data provider: MSCI Inc. (formerly Morgan Stanley Capital International).

Two grossly outliers were identified in the dataset. The logarithmic rates of return of the index were outliers, for Chile from 08' 2007 -1.309 (-130.9%) and for India from 09' 2011 -1.079 (-107.9%). These observations were corrected by the data provider to -0.007 (-0.7%) and -0.007 (-0.7%), respectively. In addition, the logarithmic rate of return of the world index -0.211 (-21.1%) for 10' 2008 is outlier, but it was confirmed in reality (drop in quotations during the financial crisis) and has not been removed. Due to the techniques used (averaging, linear OLS regressions), a significant impact of this observation on the results should be expected.

4. Results

4.1 Beta Coefficient Assuming Regression Stability for 2005-2021

The results of the beta coefficient estimation from equation (8) are presented in Table 1 (all Tables in Appendix). The estimated beta coefficient is on average[3] 1.03 with a minimum of 0.47 (Malaysia) and a maximum of 1.58 (Greece). Investments in emerging market portfolios were on average perceived as slightly more risky (beta> 1) than in the diversified global market portfolio. The standard deviation of the emerging market beta amounted to 0.30, i.e., 68% of emerging market portfolios have a beta in the range of 0.73 - 1.33. Investors evaluate individual emerging markets significantly differently, which, according to the theory, indicates a significant differentiation in the perception of risk in individual markets in relation to global risk.

The coefficient of determination R^2 indicates a weak fit of the model (8) to the data, with R^2 ranging from 0.09 for Pakistan to 0.60 for Mexico. The average fit of the models is 0.41, so the volatility explained by the models accounts for about 41% of all volatility in the emerging markets index return. On average, about 59% of the variability is not explained by the models, which indicates the presence of other sources of variability. These sources may not be Gaussian noise and may be followed by events that change investors' aversion to risk other than those

[3] *Unweighted moments have been used to roughly estimate here and hereafter.*

responsible for the volatility of the global index return. As a result, model (8) may be unstable.

4.2 Beta Stability in Chow and Cusum Tests

The results of the Chow stability tests are presented in Figures 1-24, Cusum in Figures 25-48 (all Figures in Appendix). The values of the F test statistics are presented in Table 2. In 15 emerging markets out of 24 respondents (Table 3), the value of the F Chow statistic was high and very unlikely (right tail of the distribution), thus at the significance level of $\alpha = 0.05$, it is justified to reject the null hypothesis (regression stability) in support of the alternative hypothesis about the instability of the regression function parameters (8).

Most instability occurred in connection with the global financial crisis of 2008. Considering that the increase in risk aversion was widespread at that time and it also occurred in the rate of return on the world index, the increase in risk aversion in 15 emerging markets is much deeper (above average) than globally .

For Argentina, Brazil, Egypt, Greece, Pakistan, Philippines, Poland, Russia and Taiwan, the Chow test did not allow at the significance level of $\alpha = 0.05$ to reject the hypothesis about the stability of the regression parameters especially the beta coefficient. The mean p-value was 0.182 over a variation range of 0.051 (Taiwan) to 0.427 (Philippines). The obtained value of the F statistic, with the truth of the stability hypothesis in the case of these emerging markets, is therefore probable. The Cusum test showed different results. Rejection of the null hypothesis of the stability of the regression coefficients at the significance level $\alpha = 0.05$ in support of the alternative hypothesis of the instability of these coefficients is justified only in the case of Mexico (p-value = 0.014) and Russia (p-value = 0.039). For the rest of emerging markets, the average p-value was 0.407 with a volatility range from 0.105 (Colombia) to 0.880 (Turkey). In their case, while the hypothesis about the stability of the regression coefficients is true, the values of the F statistic are quite probable as well.

Only in the case of Mexico, we rejected the stability hypothesis in support of an alternative hypothesis of instability in the regression parameters according to both tests. The p-value level for Mexico (in Chow's test p-value = 0.0402, in Cusum p-value = 0.014) is similar. In 8 cases (Argentina, Brazil, Egypt, Greece, Pakistan, Philippines, Poland and Taiwan), there were no grounds to reject the null hypothesis of stability according to both tests. In 14 markets of Chile, China, Colombia, Czech Republic, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Qatar, South Africa, Turkey and UAE, there were grounds for rejecting the stability hypothesis with the Chow test, and the Cusum test results did not give grounds for rejecting the stability hypothesis (divergent results)[4].

In the case of Russia, the results of the Chow test did not provide grounds for rejecting the stability hypothesis, and the implementation of the test statistics in the Cusum test made it possible to reject the stability hypothesis (a divergent result). The results of testing the stability of regression parameters with the Chow and Cusum tests in 15 cases out of 24 (62.5%) were divergent, and in as many as 14 cases (58%) the discrepancy was related to the lack of grounds for rejecting the null hypothesis in the Cusum test. More information is needed and a more detailed study of potential instability is needed. We decided to estimate the time series of beta coefficients in order to investigate the possible trend of the beta coefficient (TS trendostationarity) and the random walk and possibly other autocorrelation fluctuations (longer lasting deviations from the trend) - DS difference stationarity study.

4.3 Beta Coefficients Estimated by Regression in a Two-years Rolling Window

Beta time series charts for individual emerging markets estimated by the rolling windows regression method and the average beta level are presented in Figures 49-72.
A visual assessment of the time series of beta coefficients allows to doubt in their random Gaussian fluctuations around the mean value for the years 2005-2021[5]. Approximatelly 2-3 years deviations from the average value of an autocorrelation character are noticeable. To examine them, first, let's determine whether a linear trend can be fitted to the beta time series in order to verify the hypothesis that the slope of the line is equal to zero (beta stability over time).

Stationarity of the beta time series mean value:
The results of simple regression of the time series of beta coefficients are presented in Table 4. The estimated trend line to the time series of beta coefficients is presented in Figures 73-96. In the two emerging markets in Chile (p-value = 0.071) and Colombia (p-value = 0.692) there were no grounds to reject the null hypothesis of the irrelevance (equal to zero) of the slope of the simple regression at the significance level of $\alpha = 0.05$. Therefore, we have no basis to question the

[4]This may indicate a low power of the Cusum test (low probability of rejecting a false null hypothesis). The power of the test depends, among others on the significance level. The lower the significance level, the lower the power of the test. From this point of view, selecting the significance level $\alpha = 0.05$ turned out to be optimal. The power of the stability tests was greater than for other significance levels used in science, e.g. $\alpha = 0.01$, which could reduce the problem of divergent results of the Chow and Cusum stability tests. However, the purpose of this article is not to evaluate the quality of these tests.
[5]The mean value of beta coefficients calculated on the basis of the estimated time series data slightly differs from the value estimated by linear regression for the entire data set 2005-2021 due to different methods.

hypothesis that the beta coefficient is stable in the medium-term for the Chile and Colombia markets in 2005-2021.

In the remaining 22 markets, except Chile and Colombia, we have reason to reject the hypothesis of zero-value beta regression coefficients over time. The p-value in these cases was on average 0.002 with a range from $5.0 * 10^{-27}$ (Hungary) to $3.4 * 10^{-2}$ (Greece). In 22 emerging markets out of 24 (92% of cases) at the significance level $\alpha = 0.05$, the beta coefficient changed linearly over time (deterministic trend) and is unstable in the medium term of 2005-2021.

For 20 emerging market, the slope of the simple beta regression was significantly negative. Its average value was -0.0042 with a minimum value of -0.0071 (Hungary) and a maximum value of -0.0014 (Philippines). The beta in these countries decreased by an average of 0.0042 per month. The decline was mainly due to the outliers from the global financial crisis (then there was a very large increase in risk aversion and the beta reached the level of 2 and more).

Only on 2 emerging markets in Greece and Pakistan, the beta coefficient increased on average by 0.0024 (Greece) and 0.0038 (Pakistan) per month. In Greece, the beta was insensitive to the global financial crisis, then risk aversion increased due to the stagnation after the debt crisis. In Pakistan, the beta response to the global crisis was moderate, followed by a consistent increase in risk aversion due to political instability, corruption, terrorism (the war in Afghanistan) and stagflation.

The Durbin-Watson test for autocorrelation of first-order residuals from linear regression provides reasonable grounds for rejecting the null hypothesis about the lack of autocorrelation. The average value of the d-statistic is 0.13 with a minimum of 0.04 and a maximum of 0.24. The p-value estimated on the basis of the implementation of the d statistics is on average $3.9 * 10^{-33}$ with a spread from $5.1 * 10^{-39}$ (South Africa) to $6.9 * 10^{-32}$ (Philippines). At the level of the significance level assumed in the research, $\alpha = 0.05$, in all examined cases, we reject the null hypothesis of the lack of autocorrelation in support of the alternative hypothesis with positive autocorrelation (grouping of positive or negative deviations from the trend). This is a signal that beta coefficients are not stable in the short term.

The presence of beta autocorrelation in the time series does not bias the estimators of the linear trend regression coefficients. However, the autocorrelation results in bias in the estimator of the variance of the residual (underestimating the variance in the case of positive autocorrelation). As a consequence, regression tests, including the significance tests used above, are uncertain. In order to take into account the autocorrelation of residuals and, at the same time, to test the difference stationarity of the beta series, we used the ADF test.

Difference stationarity (DS) of the beta time series:
The results of the ADF test for the time series of beta coefficients are presented in Table 5. In 4 emerging markets (Argentina, Egypt, Mexico and South Africa), the test statistic examining the existence of unit root has a lower value (average -3.83, min.-4.15 for Egypt, max -3.433 for Argentina) than the critical value (- 3.43) and we reject[6] the hypothesis that there is unit root in these markets.

In the remaining 20 cases, we have no grounds to reject the unit root hypothesis. The mean value of the t-test statistic is -2.10 (min. -3.08 for Pakistan, max. -1.45 for Taiwan). Therefore, we do not exclude that there is a random walk in the beta time series in 83% of the markets surveyed.

The ADF test has low power. It is characterized by a low probability of avoiding the acceptance the null hypothesis, despite its falsity, i.e. avoiding a II type error. As a rule, the lack of grounds for rejecting the null hypothesis only allows for the null hypothesis to occur. In the time series there is an observable equivalence of the deterministic and stochastic trends in finite trials (Faust, 1996). It is practically impossible to distinguish whether a given process is non-stationary deterministically (in the mean) or stochastically (in the variance). Thus, the lack of grounds to reject the unit root hypothesis results in the possibility of unit root or a deterministic trend.

For 14 emerging markets (58%) there were basics at the significance level of $\alpha = 0.05$ for rejecting the null hypothesis of irrelevance of the coefficients for the delayed variables, i.e. there is an autocorrelation (tested with a maximum of 5 lags). The autocorrelation with 2 lags (3 periods, i.e., a quarter in undifferentiated series) dominates, which occurs in Brazil, China, Czech Republic, Egypt, Peru, Philippines, Qatar and UAE (8 markets). Therefore, the use of the ADF test improved the correctness of inference in 14 cases as compared to the tests which did not take into account the occurrence of autocorrelation.

5. Conclusions

The beta coefficients for most of the 24 emerging market in 2005-2021 are not stable in the medium-term (over a dozen years) and short-term (several years) at the significance level of $\alpha = 0.05$. The following statistical evidence supports the instability:

1) 63% of medium-term instability confirmed by the Chow test,
2) 92% of medium-term instability events confirmed by a statistically significant linear beta deterministic trend over time,

[6]*The comparison of the statistic value and the critical value of the test is made in the left negative tail of the distribution. The software used in the study does not present asymptotic p-value probabilities for the regression coefficient δ tested with the ADF test.*

3) 100% of short-term instability confirmed by a statistically significant first-order autocorrelation of residuals from the beta deterministic linear trend model,
4) 83% of short- or medium-term instability in which the existence of a unit root in the series of beta cannot be ruled out.

The following arguments against the instability of the tested beta coefficients are:

1) 96% of cases of medium-term stability (in the order of several years) confirmed by the Cusum test,
2) the low power of the ADF test, which too often indicates the existence of a unit root even though it actually does not exist.

The evidence against beta instability is less important because of:

1) possible low power of the Cusum test, because the test did not reject the stability hypotheses in cases where the instability was indicated by the Chow test giving grounds for rejecting the null hypothesis,
2) the lack of grounds for rejecting the null hypothesis in the ADF test may confirm the existence of a unit root or a deterministic trend, but both cases do not falsify the main hypothesis of the article about beta instability.

The considered tests indicate the instability of the time series of beta coefficients in most of the emerging markets studied.

It cannot be ruled out (hypothesized) that the beta coefficient is stable in the long term. However, in the medium (over a dozen years) and short term (several years), beta is unstable. Lesser stability (well below 50% of cases) may result from the occurrence of specific conditions during the period covered by the study, the absence of instability-generating events, or the compensation of the effects of events that increase and decrease risk aversion.
The significant level of beta instability demonstrated by the study prompts a rethinking of the foundations of the theory of finance. The valuation theory develops in two ways. Classic finance is based on the assumption of rationality of investors and efficiency of the markets. Behavioral finance highlights the irrationality of investors and the inefficiency of the markets. A better explanation of reality and more effective forecasting of the future may follow the synthesis of the ideas of classical and behavioral finance into a general theory.

The nature of the instability of the beta coefficient may depend on the time scale of the test (short[7], medium and long term). The sought theory should be based on a method that is easily scalable in terms of time and enables the identification of

[7] The subject of the study was not a high frequency series. Modern science of finance, in connection with advances in computing and telecommunications, also deals with volatility in ultra-short periods of time

fundamental events that generate variability. The outlined theoretical and methodological directions are the subject of scientific research in the research project in which the author participates.

References:

Amihud, Y., Christensen, B.J., Mendelson, H. 1992. Further evidence on the risk-return relationship. Working Paper, Stanford University.

Attiya, Y.J., Eatzaz, A. 2011. Asset Pricing Behaviour with Dual-Beta in Case of Pakistani Stock Market. The Pakistan Development Review, 50(2).

Baesel, J.B. 1974. On the Assessment of Risk: Some Further Considerations. Journal of Finance, 29(5).

Basu, S. 1983. The relationship between earnings yield, market value, and return for NYSE common stocks: further evidence. Journal of Financial Economics, 12.

Batsirai, W.M, Nicholas, E. 2013. Stability od beta coefficients on Zimbabwe Stock Exchance after currency reform: Chow approach. International Journal of Business, Economics and Law, 3(1).

Black, F., Jensen, M.D., Scholes, M. 1972. The Capital Asset Pricing Model: Some Empirical Tests. In: Studies in the Theory of Capital Markets. Jensen, M.C., ed. New York: Praeger.

Blume, M. 1971. On The Assessment of Risk. The Journal of Finance, 3.

Blume, M. 1975. Betas and their regression tendencies. Journal of Finance, 3.

Bos, T., Newbold, P. 1984. An Empirical Investigation of the Possibility of Stochastic Systematic Risk in the Market Model. The Journal of Business, 57(1).

Braun, P.A., Nelson, D.B., Sunier, A.M. 1995. Good News, Bad News, Volatility and Beta. Journal of Finance, 50.

Breeden, D. 1979. An intertemporal asset pricing model with stochastic consumption and investment opportunities. Journal of Financial Economics, 7.

Breeden, D.T., Gibbons M.R., Litzenberger, R.H. 1989. Empirical tests of the consumption-based CAPM. Journal of Finance, 44.

Brooks, R.D., Faff, R.W., Ariff, M. 1998. An Investigation into the Extent of Beta in Stability in the Singapore Stock Market. Pacific-Basin Finance Journal, 6.

Bruner, R.F., Eaders, K.M., Harris, R.S., Higgins, R.C. 1998. Best Practices in Estimating the Cost of Capital: Survey and Synthesis. Financial Practice and Education, 8(1).

Byrka-Kita, K. 2004. Weryfikacja przydatności modelu wyceny aktywów kapitałowych (CAPM) w procesie szacowania kosztu kapitału własnego na polskim rynku kapitałowym, Zeszyty Naukowe Uniwersytetu Szczecińskiego nr 389. Finanse. Rynki Finansowe, Ubezpieczenia. nr 2, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin.

Chan, L.K.C., Lakonishok, J. 1993. Are the Reports of Beta's Death Premature? The Journal of Portfolio Management, 19(4).

Chan, L.K.C., Hamao, Y., Lakonishok, J. 1991. Fundamentals and Stock Returns in Japan. Journal of Finance, 46(5).

Chow, G.C. 1960. Tests of Equality Between Sets of Coefficients in Two Linear Regressions. Econometrica, 28.

Cwynar, W. 2010. Zmienność – dobra, czy zła? Analiza polskiego rynku kapitałowego. Finansowy Kwartalnik Internetowy e-Finanse, 6(2).

Das, S. 2008. Testing the Stability of Beta over Market Phases: An Empirical Study in the Indian Contex. Working Paper Series, No.1031389. International Management Institute, New Delhi.
Deb, S.G., Misra, S. 2011. Are Equity Betas Stable? Evidence from Indian Equity Market. The IUP Journal of Applied Finance, 174.
Dębski, W., Feder-Sempach, E. 2012. Beta Coeffients of Polish Blue Chip Companies in the Period of 2005-2011. Folia Oeconomica Stetinesia, No. 2.
Dębski, W., Feder-Sempach, E., Świderski, B. 2011. Are beta parameters stable on Warswa Sock Exchange? In: Feder-Sempach, E. Ryzyko inwestycyjne. Analiza polskiego rynku akcji. CeDeWu.pl Wydawnictwa Fachowe.
Dharmaratne, D.G., Harris, S.A. 2006. Measuring the risk and performance in plantation sector using CAPM based Jensen's alpha. Sabaragamuwa University Journal, 6(1).
Dickey, D.A., Fuller, W.A. 1979. Distribution of the Estimators for Autoregressive Time Series With a Unit Root. Journal of the American Statistical Association, 74.
Dickey, D.A., Fuller, W.A. 1981. Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. Econometrica, 49.
Dimson, E. 1979. Risk measurement when shares are subject to infrequent trading. Journal of Financial Economics, 7.
Eisenbeiss, M., Kauermann, G., Semmler, W. 2007. Estimating Beta-Coefficients of German Stock Data: A Non-Parametric Approach. The European Journal of Finance, 13(6).
Elton, E.J., Gruber, M.J. 1998. Nowoczesna teoria portfelowa i analiza papierów wartościowych. WIG PRESS, Warszawa.
Fabozzi, F.J., Francis, J.C. 1977. Stability Tests for Alphas and Betas Over Bull and Bear Market Conditions. Journal of Finance, 32.
Faff, R. 2001. A Multivariate Test of a Dual-Beta CAPM: Australian Evidence. The Financial Review, 36.
Faff, R.W., Hillier, D., Hillier, J. 2000. Time Varying Beta Risk: An Analysis of Alternative Modelling Techniques. Journal of Business Finance Accounting, 27(5-6).
Fama, E., French, K. 1993. Common risk factors in stock and bond returns. Journal of Financial Economics, 33.
Fama, E., French, K. 2004. The CAPM: theory and evidence. Journal of Economic Perspectives, 18.
Fama, E., French, K. 1992. The cross section of expected stock returns. Journal of Finance, 47.
Fama, E., MacBeth, J. 1973. Risk, return, and equilibrium: empirical tests. Journal of Political Economy, 81.
Faust, J. 1996. Near observational equivalence and theoretical size problems with unit root tests. Econometric Theory, 12.
Ferson, W., Locke, D.H. 1998. Estimating the cost of capital through time: an analysis of the sources of error. Management Science, 44.
Fisher, L., Kamin, J.H. 1985. Forecasting Systematic Risk: Estimates of "Raw" Beta that Take Account of the Tendency of Beta to Change and the Heteroskedasticity of Residual Returns. Journal of Financial and Quantitative Analysis, 20(2).
Fletcher, J. 2000. On the Conditional Relationship Between Beta and Return in International Stock Returns. International Review of Financial Analysis, 9(3).
Gajdka, J., Brzeszczyński, J. 2007. Estymacja parametru β przy użyciu modeli klasy ARCH. Zeszyty Naukowe Uniwersytetu Szczecińskiego. Finanse, Rynki Finansowe, Ubezpieczenia, 6()1. Rynek kapitałowy, skuteczne inwestowanie.

George, T., Bainy, G. 2012. An empirical analysis of stationarity of beta in Indian stock market. At: www.abhinavjournal.com.
Graham, J.R., Harvey, C. 2001. The theory and practice of corporate finance: evidence from the field. Journal of Financial Economics 60, 187-243.
Hallman, L. 2017. The Rolling Window Method: Precisions of Financial Forecasting, Degree Project in Mathematics, Kth Royal Institute of Technology School of Engineering Sciences. Retrieved from: https://kth.diva-portal.org/smash/get/diva2:1089425/FULLTEXT01.pdf.
Harish, S.N., Mallikarjunappa, T. 2019. An Examination of the Beta Stability in the Indian Capital Market. At: http://www.aims-international.org/aims12/12A-CD/PDF/K372-final.pdf.
Ibbotson, R.G, Kaplan, P.D., Peterson, J.D. 1997. Estimates of Small-Stock Betas Are Much Too Low. Journal of Portfolio Management.
Jajuga, K., Jajuga, T. 1998. Inwestycje. Instrumenty finansowe, ryzyko finansowe, inżynieria finansowa. PWN, Warszawa.
Jarque, C.M., Bera, A.K. 1981. Efficient tests for normality, homoscedasticity and serial independence of regression residuals: Monte Carlo evidence. Economics Letters, 7(4).
Jensen, M.C. 1968. The performance of mutual funds in the period 1945-1964. Journal of Finance.
Kandel, S., Stambaugh, R.F. 1995. Portfolio Inefficiency and the Cross-section of Expected Returns. The Journal of Finance, 50(1).
Koller, T., Goedhart, M., Wessels, D. 2005. Valuation: Measuring and Managing the Value of Companies, 4th ed. John Wiley & Sons.
Koustubh, K.R. 2010. Stability of Beta Over Market Phases: An Empirical Study on Indian Stock Market. International Research Journal of Finance and Economics, 50.
Kurach, J. 2013. Does Beta Explain Global Equity Market Volatility – Some Empirical Evidence. Contemporary Economics, 7(2).
Letkowski, D. 2013. Badanie stabilności współczynnika beat akcji indeksu WIG20. Retrived from: http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-742dc0c2-2ba9-41ad-bf97-6eebc42f48c5/c/6_D.Letkowski_Badanie_stabilnosci_wspolczynnika....pdf.
Levy, R.A. 1971. On the Short term -Stationarity of Beta Coefficients. Financial Analysts Journal, 27(6).
Lie, F., Brooks, R., Faff, R. 2000. Modelling the Equity Beta Risk of Australian Financial Sector Companies. Australian Economic Papers, 39(3).
Lin, W.T., Chen, Y.H., Boot, J.C.G. 1992. The dynamic and stochastic instability of betas: Implications for forecasting stock returns. Journal of Forecasting, 11(6).
Lintner, J. 1965. The Valuation of Risk Assets and Selection of Risky Investments in Stock Portfolio and Capital Budgets. Review of Economics and Statistics, 47(1).
Lintner, J. 1965. Security Prices, Risk, and Maximal Gains from Diversification. The Journal of Finance, 20.
Lucas, R.E. 1978. Asset prices in an exchange economy. Econometrica, 76.
Maddala, G.S. 2006. Ekonometria, Wydawnictwo Naukowe. PWN, Warszawa.
Maddala, G.S. 2008. Ekonometria (Econometrics). Wyd. Naukowe PWN, Warszawa.
Malkiel, B., Xu, Y. 2006. Idiosyncratic Risk and Security Returns. Working Paper, University of Texas at Dallas, Richardson.
Markowitz, H. 1958. Portfolio Selection. John Wiley & Sons.
Marsh, P.R. 1979. Equity rights and efficiency of the UK stock market. Journal of Finance, 34.

Mazurkiewicz, A. 2002. Analiza stabilności i wrażliwości oszacowań współczynników beta przy wykorzystaniu metody opartej o przedziały kwantylowe. In: Tarczyński W. (ed.). Rynek kapitałowy. Skuteczne inwestowanie. Część II, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin.
Merton, R.C. 1980. On estimating the expected return on the market. An Exploratory Investigation. Journal of Financial Economics, 8.
Merton, R.C. 1973. An Intertemporal Capital Asset Pricing Model. Econometrica, 41(5).
Mohamad, S. Annuar. M.D., Nassir, J. 1994. The Stability and Predictability of Betas: Evidence from the Kuala Lumpur Stock Exchange Pertanika J. Soc. Sci. & Hum, 2(1).
Mossin, J. 1966. Equilibrium in a Capital Asset Market. Econometrica, 34(2).
Odabaşı, A. 2003. An investigation of beta instability in the Instanbul Stock Exchange. Retrieved from: http:// odabasi.boun.edu.tr/research/BetaInstability-ISE.pdf.
Pastor, L., Stambaugh, R. 1999. Costs of equity capital and model mispricing. Journal of Finance, 54.
Piontek, K. 2008. Modelowanie finansowych szeregów czasowych z warunkową wariancją. Prace Naukowe Akademii Ekonomicznej we Wrocławiu, 890.
Pfaff, B. 2006. Analysis of Integrated and Cointegrated Time Series with R. Springer.
Ploberger, W., Kramer, W. 1992. The Cusum Test with Ols Residuals. Econometrica, 60.
Reilly, F., Brown, K. 2003. Investment analysis portfolio management (7th ed.). Thomson, South-Westernz.
Roll, R. 1997. A critique of the asset pricing theory's test, part I: on past and potential testability of theory. Journal of Finance Economics, 4.
Rosenberg, B., Reid, J., Lanstein, R. 1985. Persuasive evidence of market inefficiency. Journal of Portfolio Management, 11.
Said, E., Dickey, D.A. 1984. Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order. Biometrika, 71.
Sarma, J., Sarmah, P. 2008. Stability of Beta: An Empirical Investigationinto Indian Stock Market. The ICFAI Journal of Financial Risk Management, 5(3).
Scholes, M., Williams, J. 1977. Estimating beta from non-synchronous data. Journal of Financial Economics, 5.
Sharpe, W.F., Cooper, G.M. 1972. Risk-Return Classes of New York Stock Exchange. Common Stocks. Financial Analysts Journal, 28(2).
Sharpe, W.F. 1963. A Simplified Model of Portfolio Analysis. Management Science, 9(2).
Sharpe, W.F. 1964. Capital asset prices: A theory of market equilibrium under risk. Journal of Finance, 19(3).
Sharpe, W.F., Alexander, G.J., Bailey, J.V. 1999. Investments, 6th edition. Prentice Hall, New Jersey.
Simon, D.S, Pagini, M.L., Decourt, R.F. 2002. An analysis of the beta coefficient's stationarity regarding brazilian public comapanies traded between 2002 and 2011. Retrieved from: http://www.furb.br/_upl/files/especiais/anpcont/2013/EnglTrack_3.pdf?20140713074329
Singh, R. 2008. Beta Estimation in the Indian Stock Market: Stability, Stationarity and Computational Considerations. Decision, 35(2), Jul-Dec.
Stattman, D. 1980. Book values and stock returns. The Chicago MBA, 4(1).
Stefanescu, R., Nistor, C., Dumitriu, R. 2009. Asymmetric Responses of CAPM–Beta to the Bull and Bear Markets on the Bucharest Stock Exchange. Annals of the University of Petrosani, 9(4).
Sunder, S. 1980. Stationarity of Market Risk: Random Coefficients Tests for Individual Stocks. The Journal of Finance, 35(4).

Tarczyński, W. 2009. O pewnym sposobie wyznaczania współczynnika beta na polskim rynku kapitałowym. Zeszyty Naukowe Uniwersytetu Szczecińskiego, No 561.

Terceño, A., Glòria Barberà-Mariné, M., Vigier, H., Laumann, Y. 2011. Stability of Beta Coefficients of Sector and Subsector Portfolios in an Uncertain Environment. Computer Science and Information Systems, 11(2).

Tofallis, C. 2008. Investment volatility: A critique of standard beta estimation and a simple way forward. European Journal of Operational Research, 187.

Treynor, J.L. 1961. Market Value, Time, and Risk. SSRN.

Treynor, J.L. 1965. How to Rate Management of Investment Funds. Harvard Business Review, 44(4).

Treynor, J.L., Mazuy, F. 1966. Can mutual funds outguess the market? Harvard Business Review, 45(4)

Vasicek, O.A. 1973. A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas. Journal of Finance, 8(5).

Wells, C. 1995. The Kalman Filter in Finance. Advanced Studies in Theoretical and Applied Econometrics. Springer 1996 edition.

Witkowska, D. 2008. Badanie stabilności współczynnika beta oszacowanego na podstawie prób o różnej długości. Rynek kapitałowy skuteczne inwestowanie. Studia i prace Wydziału Nauk Ekonomicznych i Zarządzania, No 9. Uniwersytet Szczeciński, Szczecin.

Wright, S., Mason, R., Miles, D. 2003. A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the UK. In: London, Smithers & Co Ltd report to the UK Regulators and the Office for Fair Trading.

Ye, Y. 2017. The Stability of Beta Coefficient in China's Stock Market. Journal of Service Science and Management, 10.

Zarzecki, D. Byrka-Kita, K. 2005. Procedura szacowania kosztu kapitału własnego uwzględniająca specyfikę rynków wschodzących. Przegląd Organizacji, No 2.

Zeileis, A., Leisch, F., Hornik, K., Kleiber, Ch. 2002. Strucchange: An R package for testing for structural change in linear regression models. Journal of Statistical Software, 7(2).

Zivot, E., Wang, J. 2006. Modeling Financial Time Series with S-PLUS®. Second Ed. Springer, New York**.**

Appendix:

Table 1. *Beta regression*

Market	Beta (slope)				Alfa (y-intercept)				Residual std. error	Multiple R squared	Degrees of freedom	F statistic	Durbin-Watson test	
	Value	Std. error	t-value	p-value	Value	Std. error	t-value	p-value					d-value	p-value
MSCI.Argentina	1,5026	0,1728	8,6933	1,48E-15	-0,00618	0,00784	-0,78732	0,43206	0,10920	0,28034	194	75,5731	2,1211	0,8001
MSCI.Brasil	1,5202	0,1182	12,8593	8,99E-28	-0,00462	0,00536	-0,86056	0,39054	0,07468	0,46015	194	165,3604	1,9035	0,2455
MSCI.Chile	0,9088	0,0867	10,4876	1,13E-20	-0,00357	0,00393	-0,90824	0,36488	0,05474	0,36182	194	109,9889	1,9847	0,4532
MSCI.China	1,0981	0,0824	13,3302	3,34E-29	0,00199	0,00374	0,53311	0,59457	0,05204	0,47807	194	177,6948	1,8816	0,1996
MSCI.Colombia	1,2375	0,1147	10,7893	1,47E-21	-0,00363	0,00520	-0,69766	0,48622	0,07246	0,37502	194	116,4098	1,8831	0,2026
MSCI.Czech.Republic	0,8504	0,0682	12,4675	1,38E-26	-0,00468	0,00310	-1,51312	0,13188	0,04309	0,44482	194	155,4393	2,2417	0,9545
MSCI.Egypt	1,0629	0,1224	8,6848	1,56E-15	-0,00006	0,00555	-0,01165	0,99071	0,07732	0,27995	194	75,4253	2,0169	0,5433
MSCI.Greece	1,5813	0,1277	12,3802	2,54E-26	-0,0245	0,0058	-4,2331	3,55E-05	0,0807	0,4414	194	153,2692	2,1988	0,9175
MSCI.Hungary	1,1683	0,0822	14,2054	7,31E-32	-0,0030	0,0037	-0,8031	0,4229	0,0520	0,5098	194	201,7925	2,0092	0,5217

MSCI.India	1,0148	0,0751	13,5051	9,83E-30	0,0049	0,0034	1,4271	0,1552	0,0475	0,4846	194	182,3876	2,1588	0,8658
MSCI.Indonesia	0,9183	0,0790	11,6230	4,84E-24	0,0029	0,0036	0,8040	0,4224	0,0499	0,4105	194	135,0931	1,7524	0,0399
MSCI.Korea	0,8527	0,0579	14,7220	1,97E-33	0,0023	0,0026	0,8695	0,3856	0,0366	0,5277	194	216,7383	2,2790	0,9746
MSCI.Malaysia	0,4750	0,0461	10,2987	4,04E-20	-0,0003	0,0021	-0,1308	0,8961	0,0291	0,3535	194	106,0639	2,0921	0,7382
MSCI.Mexico	1,2245	0,0711	17,2111	6,52E-41	-0,0030	0,0032	-0,9313	0,3528	0,0449	0,6043	194	296,2216	2,0838	0,7189
MSCI.Pakistan	0,5690	0,1339	4,2493	3,33E-05	-0,0025	0,0061	-0,4119	0,6809	0,0846	0,0851	194	18,0562	2,0309	0,5822
MSCI.Peru	1,1360	0,1084	10,4812	1,18E-20	0,0006	0,0049	0,1296	0,8970	0,0685	0,3615	194	109,8545	2,1154	0,7888
MSCI.Philippines	0,6817	0,0723	9,4288	1,29E-17	0,0018	0,0033	0,5356	0,5929	0,0457	0,3142	194	88,9018	2,1078	0,7728
MSCI.Poland	1,0267	0,0686	14,9767	3,34E-34	-0,0052	0,0031	-1,6804	0,0945	0,0433	0,5362	194	224,3004	2,4033	0,9977
MSCI.Qatar	0,8463	0,0887	9,5357	6,43E-18	-0,0044	0,0040	-1,1000	0,2727	0,0561	0,3191	194	90,9290	2,4751	0,9996
MSCI.Russia	1,5386	0,1014	15,1755	8,34E-35	-0,0056	0,0046	-1,2116	0,2272	0,0641	0,5428	194	230,2951	1,7423	0,0342
MSCI.South.Africa	0,6550	0,0531	12,3360	3,45E-26	0,0038	0,0024	1,5749	0,1169	0,0335	0,4396	194	152,1770	2,4110	0,9980
MSCI.Taiwan	0,8472	0,0584	14,4952	9,63E-33	0,0009	0,0027	0,3565	0,7219	0,0369	0,5199	194	210,1118	2,2648	0,9680
MSCI.Turkey	0,9494	0,1019	9,3192	2,65E-17	0,0014	0,0046	0,2947	0,7686	0,0644	0,3092	194	86,8479	2,2848	0,9769
MSCI.UAE	1,1328	0,1054	10,7523	1,88E-21	-0,0073	0,0048	-1,5184	0,1305	0,0666	0,3734	194	115,6112	2,0503	0,6347
Mean	**1,0332**		**11,7503**	**1,38674E-06**				**0,438702975**		**0,4089**		**145,6059**		
Min	**0,4750**		**4,2493**	**6,51826E-41**				**3,5542E-05**		**0,0851**		**18,0562**		
Max	**1,5813**		**17,2111**	**3,32816E-05**				**0,9907**		**0,6043**		**296,2216**		
Standard devation	**0,2959**		**2,7453**	**6,65055E-06**				**0,2736**		**0,1118**		**62,2925**		
Significance level			<	0,05			<	0,05					<	0,05

Source: *Own estimation.*

Table 2. *Chow and Cusum tests*

Market	Chow test			Cusum test	
	Break point date	sup. F	sup. F p-value	Value	p-value
MSCI.Argentina	2007-1	6,54304	0,37766	0,49146	0,64596
MSCI.Brasil	2008-9	10,80302	0,07784	0,76595	0,17043
MSCI.Chile	2010-10	15,64461	0,01000	0,77986	0,15663
MSCI.China	2008-8	32,04279	0,00000	0,80298	0,13566
MSCI.Colombia	2012-11	16,87510	0,00579	0,84319	0,10458
MSCI.Czech.Republic	2009-3	21,93656	0,00057	0,80379	0,13497
MSCI.Egypt	2009-7	10,37322	0,09246	0,66709	0,29696
MSCI.Greece	2009-9	7,41292	0,28138	0,78959	0,14752
MSCI.Hungary	2013-1	19,54988	0,00173	0,50050	0,62536
MSCI.India	2009-4	34,48846	0,00000	0,62496	0,36719
MSCI.Indonesia	2009-6	28,19075	0,00003	0,82314	0,11926
MSCI.Korea	2008-7	15,68399	0,00982	0,66693	0,29721
MSCI.Malaysia	2008-9	17,76494	0,00388	0,58223	0,44827
MSCI.Mexico	2010-2	12,41147	0,04019	1,10650	0,01383
MSCI.Pakistan	2009-1	10,51782	0,08728	0,42672	0,79045
MSCI.Peru	2009-10	20,61080	0,00106	0,65567	0,31501
MSCI.Philippines	2019-4	6,16280	0,42674	0,51362	0,59561
MSCI.Poland	2007-2	10,96880	0,07280	0,61635	0,38273
MSCI.Qatar	2009-4	43,03714	0,00000	0,41395	0,81682
MSCI.Russia	2009-4	8,79435	0,17042	0,97939	0,03937
MSCI.South.Africa	2007-2	24,84151	0,00015	0,82251	0,11975
MSCI.Taiwan	2008-8	11,81722	0,05145	0,44996	0,74001
MSCI.Turkey	2008-3	15,23487	0,01197	0,37946	0,88050
MSCI.UAE	2009-0	15,55694	0,01039	0,48000	0,67214
Mean		**>0,05**	**0,18200**	**>0,05**	**0,40741**
Min		**>0,05**	**0,05145**	**>0,05**	**0,10458**
Max		**>0,05**	**0,42674**	**>0,05**	**0,88050**
Mean		**<=0,05**	**0,00637**	**<=0,05**	**0,02660**
Min		**<=0,05**	**0,00000**	**<=0,05**	**0,01383**
Max		**<=0,05**	**0,04019**	**<=0,05**	**0,03937**
Significance level		<	0,05	<	0,05

Source: *Own estimation.*

Table 3. *Instability obtained for Chow test*

Id	Country	Instability	Causes	p-value for F
1	Chile	2010	scandal in the judiciary	0,00999624
2	China	2008	global financial crisis	0,00000467
3	Colombia	2012	start of government negotiations with the FARC	0,00579060
4	Czech Republic	2009	global financial crisis	0,00057391
5	Hungary	2013	incompatibility of constitutional reforms with the norms and values of the European Union.	0,00172651
6	India	2009	global financial crisis	0,00000142
7	Indonesia	2009	global financial crisis	0,00002989
8	Korea	2008	global financial crisis	0,00982431
9	Malaysia	2008	global financial crisis	0,00388420
10	Mexico	2010	corruption scandals	0,04018751
11	Peru	2009	global financial crisis	0,00106049
12	Qatar	2009	global financial crisis	0,00000002
13	South Africa	2007	the crisis of political leadership	0,00014702
14	Turkey	2008	global financial crisis	0,01196810
15	UAE	2009	global financial crisis	0,01038965

Source: *Own study.*

Table 4. *Linear trend regression*

	a (y-intercept)				b (slope)				Residual	Multiple	Degrees		Durbin-Watson test	
Market	Value	Std. error	t-value	p-value	Value	Std. error	t-value	p-value	std. error	R squared	of freedom	F statistic	d-value	p-value
MSCI.Argentina	1,91285	0,10547	18,13663	1,09E-41	-0,0042	0,001051	-3,99488	9,60E-05	0,69061	0,085361	171	15,95906	0,122585	3,86E-36
MSCI.Brasil	1,99486	0,07079	28,17912	3,70E-66	-0,00527	0,000706	-7,46142	4,14E-12	0,463547	0,245609	171	55,67277	0,157492	6,86E-35
MSCI.Chile	1,03646	0,04768	21,73864	4,34E-51	-0,00086	0,000475	-1,81459	0,07134	0,312196	0,018892	171	3,292722	0,113881	1,87E-36
MSCI.China	1,57611	0,06008	26,23165	7,81E-62	-0,00378	0,000599	-6,30974	2,31E-09	0,39343	0,188854	171	39,81285	0,080017	1,07E-37
MSCI.Colombia	1,21029	0,07311	16,55502	2,34E-37	-0,00029	0,00073	-0,39639	0,69231	0,47870	0,00092	171	0,15712	0,11663	2,35E-36
MSCI.Czech.Republic	1,03912	0,04920	21,12046	1,59E-49	-0,00310	0,00049	-6,31319	2,27E-09	0,32216	0,18902	171	39,85639	0,12220	3,74E-36
MSCI.Egypt	1,44596	0,08049	17,96438	3,19E-41	-0,00498	0,00080	-6,20270	4,04E-09	0,52705	0,18367	171	38,47349	0,17206	2,24E-34
MSCI.Greece	1,51480	0,11245	13,47030	1,18E-28	0,00239	0,00112	2,13201	0,034434	0,73635	0,02589	171	4,54546	0,07335	6,09E-38
MSCI.Hungary	1,60185	0,05543	28,89975	1,04E-67	-0,00713	0,00055	-12,89930	5,03E-27	0,36294	0,49317	171	166,39198	0,09912	5,41E-37
MSCI.India	1,55615	0,05736	27,12905	7,52E-64	-0,00688	0,00057	-12,02899	1,53E-24	0,37560	0,45834	171	144,69659	0,05806	1,64E-38
MSCI.Indonesia	1,28929	0,05015	25,71080	1,21E-60	-0,00598	0,00050	-11,95650	2,46E-24	0,32836	0,45534	171	142,95795	0,10422	8,31E-37
MSCI.Korea	0,96886	0,03697	26,20682	8,90E-62	-0,00181	0,00037	-4,92094	2,01E-06	0,24208	0,12405	171	24,21561	0,14414	2,30E-35
MSCI.Malaysia	0,63509	0,02286	27,78335	2,70E-65	-0,00223	0,00023	-9,79979	2,83E-18	0,14968	0,35964	171	96,03580	0,14432	2,33E-35
MSCI.Mexico	1,38244	0,04273	32,35095	8,48E-75	-0,00284	0,00043	-6,67362	3,33E-10	0,27981	0,20663	171	44,53714	0,21805	8,91E-33
MSCI.Pakistan	0,29446	0,06090	4,83550	2,94E-06	0,00379	0,00061	6,23834	3,36E-09	0,39874	0,18539	171	38,91690	0,10955	1,30E-36

MSCI.Peru	1,52084	0,05672	26,81443	3,79E-63	-0,00555	0,00057	-9,81291	2,61E-18	0,37138	0,36025	171	96,29318	0,14392	2,25E-35
MSCI.Philippines	0,78296	0,03015	25,97186	3,05E-61	-0,00135	0,00030	-4,49238	1,29E-05	0,19740	0,10556	171	20,18144	0,24410	6,88E-32
MSCI.Poland	1,23007	0,04668	26,34870	4,24E-62	-0,00358	0,00047	-7,69330	1,09E-12	0,30569	0,25713	171	59,18690	0,08403	1,51E-37
MSCI.Qatar	1,21832	0,07400	16,46332	4,20E-37	-0,00597	0,00074	-8,08770	1,07E-13	0,48456	0,27668	171	65,41086	0,06493	2,96E-38
MSCI.Russia	1,81634	0,05914	30,71239	1,68E-71	-0,00447	0,00059	-7,58729	2,01E-12	0,38725	0,25186	171	57,56694	0,11655	2,33E-36
MSCI.South.Africa	0,85243	0,04609	18,49603	1,18E-42	-0,00216	0,00046	-4,71115	5,08E-06	0,30178	0,11488	171	22,19497	0,04443	5,07E-39
MSCI.Taiwan	1,02006	0,02669	38,21673	1,13E-85	-0,00302	0,00027	-11,33491	1,44E-22	0,17477	0,42901	171	128,48026	0,20451	3,04E-33
MSCI.Turkey	1,35962	0,06222	21,85143	2,26E-51	-0,00491	0,00062	-7,90831	3,09E-13	0,40742	0,26780	171	62,54144	0,10571	9,42E-37
MSCI.UAE	1,30765	0,04203	31,11334	2,55E-72	-0,00423	0,00042	-10,08576	4,59E-19	0,27520	0,37299	171	101,72262	0,22149	1,17E-32
Mean				**signific. <0**	-0,00417		**>0,05**	**0,38183**						**3,87E-33**
Min				**signific. <0**	-0,00713		**>0,05**	**0,07134**						**5,07E-39**
Max				**signific. <0**	-0,00135		**>0,05**	**0,69231**						**6,88E-32**
Mean							**<=0,05**	**0,00157**						
Min							**<=0,05**	**5,03E-27**						
Max							**<=0,05**	**0,03443**						
Significance level							<	0,05					<	0,05

Source: *Own estimation.*

Table 5. *ADF of beta's series*

	Trend: a1 (y-intercept)				Trend: a2 (slope)				Coefficient on the lagged variable: delta				Residual	Degrees	Adjusted	H0: delta=0		H0: delta=a2=0		H0: delta=a2=a1=0	
Market	Value	Std. error	t-value	p-value	Value	Std. error	t-value	p-value	Value	Std. error	t-value	p-value	std. error	of freedom	R squared	Value	Crit. value	Value	Crit. value	Value	Crit. value
MSCI.Argentina	0,1443	0,0694	2,0794	0,0392	0,0001	0,0004	0,3492	0,7274	-0,1101	0,0321	-3,4326	0,0008	0,2336	159	0,0751	-3,4326	-3,43	6,7269	6,49	4,5430	4,75
MSCI.Brasil	0,0562	0,0759	0,7413	0,4596	0,0002	0,0004	0,6842	0,4949	-0,0557	0,0350	-1,5918	0,1134	0,1799	159	0,0571	-1,5918	-3,43	2,9172	6,49	2,0028	4,75
MSCI.Chile	0,0511	0,0325	1,5714	0,1181	0,0001	0,0002	0,7735	0,4404	-0,0688	0,0277	-2,4867	0,0139	0,1014	159	0,0519	-2,4867	-3,43	3,6455	6,49	2,4606	4,75
MSCI.China	0,0668	0,0379	1,7642	0,0796	-0,0003	0,0002	-1,4812	0,1405	-0,0386	0,0222	-1,7394	0,0839	0,1023	159	0,0583	-1,7394	-3,43	1,8896	6,49	1,3910	4,75
MSCI.Colombia	0,0044	0,0398	0,1116	0,9112	0,0008	0,0003	3,0872	0,0024	-0,0697	0,0281	-2,4765	0,0143	0,1447	159	0,1445	-2,4765	-3,43	7,2172	6,49	4,8232	4,75
MSCI.Czech. Republic	0,0271	0,0363	0,7484	0,4553	0,0002	0,0002	0,7685	0,4433	-0,0598	0,0302	-1,9762	0,0499	0,1096	159	0,0752	-1,9762	-3,43	3,7625	6,49	2,5543	4,75
MSCI.Egypt	0,1841	0,0599	3,0751	0,0025	-0,0005	0,0004	-1,3731	0,1717	-0,1458	0,0351	-4,1495	0,0001	0,2026	159	0,1431	-4,1495	-3,43	8,7715	6,49	5,8943	4,75
MSCI.Greece	0,0704	0,0450	1,5648	0,1196	0,0000	0,0003	0,0612	0,9513	-0,0398	0,0212	-1,8820	0,0617	0,1959	159	0,0494	-1,8820	-3,43	1,8048	6,49	1,2195	4,75
MSCI.Hungary	0,0748	0,0461	1,6236	0,1064	-0,0003	0,0003	-1,0084	0,3148	-0,0555	0,0262	-2,1193	0,0356	0,1071	159	0,0660	-2,1193	-3,43	2,5768	6,49	1,7363	4,75
MSCI.India	0,0204	0,0342	0,5980	0,5507	0,0001	0,0002	0,3381	0,7357	-0,0354	0,0203	-1,7438	0,0831	0,0865	159	0,0365	-1,7438	-3,43	3,4387	6,49	2,4744	4,75
MSCI.Indonesia	0,0500	0,0396	1,2633	0,2083	-0,0001	0,0002	-0,5611	0,5755	-0,0555	0,0283	-1,9561	0,0522	0,0958	159	0,0342	-1,9561	-3,43	2,6672	6,49	1,8144	4,75
MSCI.Korea	0,0516	0,0306	1,6852	0,0939	0,0000	0,0001	0,2328	0,8162	-0,0719	0,0311	-2,3139	0,0220	0,0772	159	0,0641	-2,3139	-3,43	3,0492	6,49	2,0661	4,75
MSCI.Malaysia	0,0242	0,0222	1,0890	0,2778	0,0000	0,0001	-0,1982	0,8431	-0,0553	0,0322	-1,7181	0,0877	0,0531	159	0,0405	-1,7181	-3,43	2,1677	6,49	1,4973	4,75
MSCI.Mexico	0,1914	0,0617	3,0999	0,0023	-0,0001	0,0002	-0,5746	0,5663	-0,1653	0,0431	-3,8364	0,0002	0,1231	159	0,1193	-3,8364	-3,43	8,4779	6,49	5,7183	4,75
MSCI.Pakistan	-0,0056	0,0220	-0,2530	0,8006	0,0006	0,0002	2,7360	0,0069	-0,0849	0,0275	-3,0834	0,0024	0,1274	159	0,0640	-3,0834	-3,43	5,8145	6,49	3,8782	4,75
MSCI.Peru	0,0339	0,0521	0,6511	0,5159	0,0001	0,0003	0,3807	0,7039	-0,0482	0,0314	-1,5353	0,1267	0,1280	159	0,1105	-1,5353	-3,43	2,6319	6,49	1,8254	4,75
MSCI.Philippines	0,1002	0,0374	2,6794	0,0082	-0,0002	0,0002	-0,9340	0,3517	-0,1294	0,0428	-3,0264	0,0029	0,0907	159	0,0625	-3,0264	-3,43	4,6552	6,49	3,1142	4,75
MSCI.Poland	0,0211	0,0345	0,6120	0,5414	0,0002	0,0002	0,9725	0,3323	-0,0439	0,0259	-1,6959	0,0919	0,0858	159	0,0077	-1,6959	-3,43	3,7193	6,49	2,5178	4,75
MSCI.Qatar	0,0187	0,0318	0,5887	0,5569	0,0000	0,0002	0,0270	0,9785	-0,0378	0,0206	-1,8306	0,0690	0,1206	159	0,0337	-1,8306	-3,43	2,2889	6,49	1,6538	4,75
MSCI.Russia	0,1133	0,0561	2,0211	0,0449	-0,0002	0,0002	-0,9981	0,3198	-0,0644	0,0285	-2,2554	0,0255	0,1285	159	0,0038	-2,2554	-3,43	2,5706	6,49	1,7147	4,75
MSCI.South.Africa	0,0251	0,0170	1,4745	0,1423	0,0002	0,0001	1,8206	0,0705	-0,0761	0,0195	-3,9046	0,0001	0,0585	159	0,1027	-3,9046	-3,43	10,0760	6,49	6,8747	4,75
MSCI.Taiwan	0,0470	0,0414	1,1351	0,2581	-0,0001	0,0002	-0,4604	0,6459	-0,0557	0,0383	-1,4532	0,1482	0,0753	159	0,0580	-1,4532	-3,43	1,3618	6,49	0,9386	4,75
MSCI.Turkey	0,0479	0,0405	1,1841	0,2382	0,0000	0,0002	-0,0331	0,9736	-0,0591	0,0274	-2,1550	0,0327	0,1212	159	0,0070	-2,1550	-3,43	3,0021	6,49	2,1034	4,75
MSCI.UAE	0,1667	0,0604	2,7589	0,0065	-0,0006	0,0003	-1,9625	0,0515	-0,1242	0,0421	-2,9490	0,0037	0,1260	159	0,0581	-2,9490	-3,43	4,3562	6,49	2,9110	4,75
Mean															<-3,43	**-3,8308**					
Min															<-3,43	**-4,1495**					
Max															<-3,43	**-3,4326**					
Mean															>-3,43	**-2,0994**					
Min															>-3,43	**-3,0834**					
Max															>-3,43	**-1,4532**					
Significance level			<	0,05			<	0,05			<	0,05									

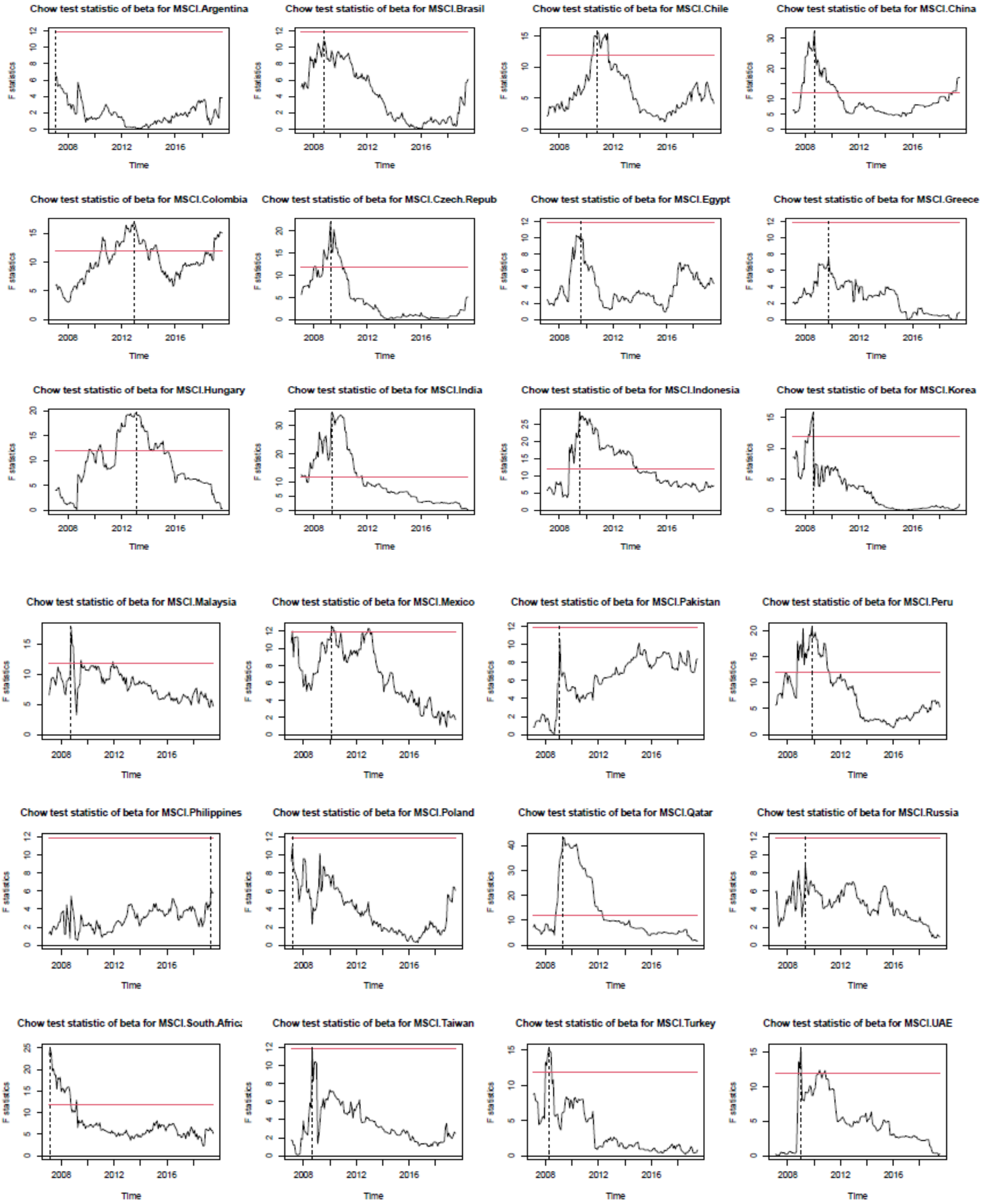
Source: *Own estimation.*

Table 6. *ADF beta time series lags*

Market	Coefficient on the lagged variable: gamma1				Coefficient on the lagged variable: gamma2				Coefficient on the lagged variable: gamma3				Coefficient on the lagged variable: gamma4				Coefficient on the lagged variable: gamma5			
	Value	Std. error	t-value	p-value	Value	Std. error	t-value	p-value	Value	Std. error	t-value	p-value	Value	Std. error	t-value	p-value	Value	Std. error	t-value	p-value
MSCI.Argentina	0,1816	0,0766	2,3693	0,0190	0,0758	0,0779	0,9729	0,3321	-0,0308	0,0779	-0,3959	0,6927	-0,0172	0,0776	-0,2223	0,8244	-0,0094	0,0769	-0,1220	0,9031
MSCI.Brasil	0,0290	0,0811	0,3570	0,7216	-0,1687	0,0800	-2,1076	0,0366	-0,1352	0,0799	-1,6924	0,0925	-0,0816	0,0784	-1,0409	0,2995	-0,1053	0,0786	-1,3402	0,1821
MSCI.Chile	0,0577	0,0784	0,7361	0,4628	-0,1435	0,0781	-1,8380	0,0679	0,0352	0,0790	0,4450	0,6569	0,1250	0,0767	1,6297	0,1052	-0,0173	0,0769	-0,2249	0,8224
MSCI.China	0,0749	0,0747	1,0034	0,3172	0,1875	0,0736	2,5475	0,0118	-0,0601	0,0744	-0,8081	0,4202	0,1078	0,0739	1,4589	0,1466	-0,1042	0,0741	-1,4052	0,1619
MSCI.Colombia	-0,2426	0,0758	-3,2009	0,0017	-0,1463	0,0778	-1,8809	0,0618	-0,2212	0,0762	-2,9038	0,0042	0,0413	0,0769	0,5378	0,5915	-0,0801	0,0742	-1,0798	0,2819
MSCI.Czech. Republic	0,0523	0,0802	0,6526	0,5149	-0,1838	0,0787	-2,3347	0,0208	0,1487	0,0798	1,8645	0,0641	-0,1336	0,0784	-1,7041	0,0903	-0,0211	0,0791	-0,2661	0,7905
MSCI.Egypt	0,0963	0,0761	1,2655	0,2075	0,2827	0,0764	3,6986	0,0003	-0,1204	0,0770	-1,5638	0,1199	0,1432	0,0763	1,8776	0,0623	0,1503	0,0771	1,9506	0,0529
MSCI.Greece	-0,0494	0,0773	-0,6384	0,5241	-0,0862	0,0776	-1,1111	0,2682	-0,0035	0,0778	-0,0452	0,9640	0,0824	0,0771	1,0689	0,2867	0,2324	0,0768	3,0266	0,0029
MSCI.Hungary	0,0181	0,0763	0,2377	0,8124	-0,0130	0,0743	-0,1746	0,8616	0,1307	0,0743	1,7589	0,0805	0,2393	0,0744	3,2186	0,0016	-0,0566	0,0768	-0,7363	0,4626
MSCI.India	0,1031	0,0761	1,3556	0,1771	-0,0778	0,0765	-1,0168	0,3108	-0,0822	0,0766	-1,0734	0,2847	0,0315	0,0762	0,4132	0,6800	0,0640	0,0757	0,8458	0,3989
MSCI.Indonesia	0,1328	0,0731	1,8175	0,0710	0,0449	0,0735	0,6107	0,5423	0,0655	0,0737	0,8888	0,3754	0,0369	0,0740	0,4987	0,6187	-0,0938	0,0730	-1,2846	0,2008
MSCI.Korea	-0,2050	0,0676	-3,0318	0,0028	-0,0586	0,0682	-0,8595	0,3913	-0,0033	0,0684	-0,0488	0,9612	0,0392	0,0678	0,5783	0,5639	0,0717	0,0664	1,0798	0,2819
MSCI.Malaysia	0,1289	0,0779	1,6561	0,0997	-0,0536	0,0782	-0,6858	0,4939	-0,0237	0,0783	-0,3024	0,7627	-0,0491	0,0748	-0,6569	0,5122	-0,1451	0,0742	-1,9553	0,0523
MSCI.Mexico	0,0266	0,0788	0,3381	0,7358	-0,1415	0,0786	-1,8007	0,0736	0,1910	0,0792	2,4117	0,0170	0,0366	0,0772	0,4734	0,6366	0,0551	0,0763	0,7223	0,4712
MSCI.Pakistan	0,1173	0,0767	1,5285	0,1284	0,0053	0,0768	0,0693	0,9448	-0,1180	0,0758	-1,5563	0,1216	0,0945	0,0763	1,2385	0,2174	0,0666	0,0761	0,8748	0,3830
MSCI.Peru	-0,0679	0,0771	-0,8809	0,3797	-0,2742	0,0764	-3,5888	0,0004	0,1142	0,0793	1,4401	0,1518	-0,0240	0,0754	-0,3177	0,7511	-0,0419	0,0752	-0,5565	0,5787
MSCI.Philippines	0,0169	0,0807	0,2097	0,8342	0,2148	0,0785	2,7356	0,0069	-0,0344	0,0790	-0,4347	0,6643	-0,0495	0,0775	-0,6393	0,5236	0,1053	0,0761	1,3838	0,1684
MSCI.Poland	-0,0628	0,0791	-0,7943	0,4282	0,0246	0,0789	0,3113	0,7560	-0,0035	0,0789	-0,0445	0,9646	-0,0098	0,0767	-0,1284	0,8980	-0,0289	0,0763	-0,3795	0,7048
MSCI.Qatar	-0,0524	0,0786	-0,6672	0,5056	0,1841	0,0786	2,3426	0,0204	-0,0789	0,0796	-0,9917	0,3228	-0,0212	0,0777	-0,2725	0,7856	0,0455	0,0774	0,5879	0,5574
MSCI.Russia	0,0357	0,0778	0,4595	0,6465	0,0910	0,0771	1,1807	0,2395	-0,0309	0,0772	-0,4000	0,6897	-0,0185	0,0768	-0,2406	0,8101	0,1078	0,0765	1,4081	0,1610
MSCI.South.Africa	-0,0283	0,0748	-0,3785	0,7055	-0,0368	0,0740	-0,4978	0,6193	-0,0568	0,0741	-0,7671	0,4442	0,0675	0,0738	0,9148	0,3617	0,0095	0,0733	0,1299	0,8968
MSCI.Taiwan	-0,1273	0,0813	-1,5648	0,1196	-0,0693	0,0794	-0,8729	0,3840	-0,1513	0,0779	-1,9433	0,0537	0,0197	0,0777	0,2541	0,7997	-0,1384	0,0763	-1,8150	0,0714
MSCI.Turkey	0,0349	0,0723	0,4826	0,6300	-0,0867	0,0724	-1,1990	0,2323	0,0199	0,0725	0,2737	0,7846	-0,0235	0,0716	-0,3284	0,7430	-0,0264	0,0715	-0,3691	0,7126
MSCI.UAE	-0,0544	0,0808	-0,6730	0,5019	0,1708	0,0802	2,1294	0,0348	-0,0382	0,0802	-0,4767	0,6343	0,0598	0,0804	0,7441	0,4579	0,0625	0,0791	0,7892	0,4312
Significance level			<	0,0500			<	0,05			<	0,05			<	0,05			<	0,05

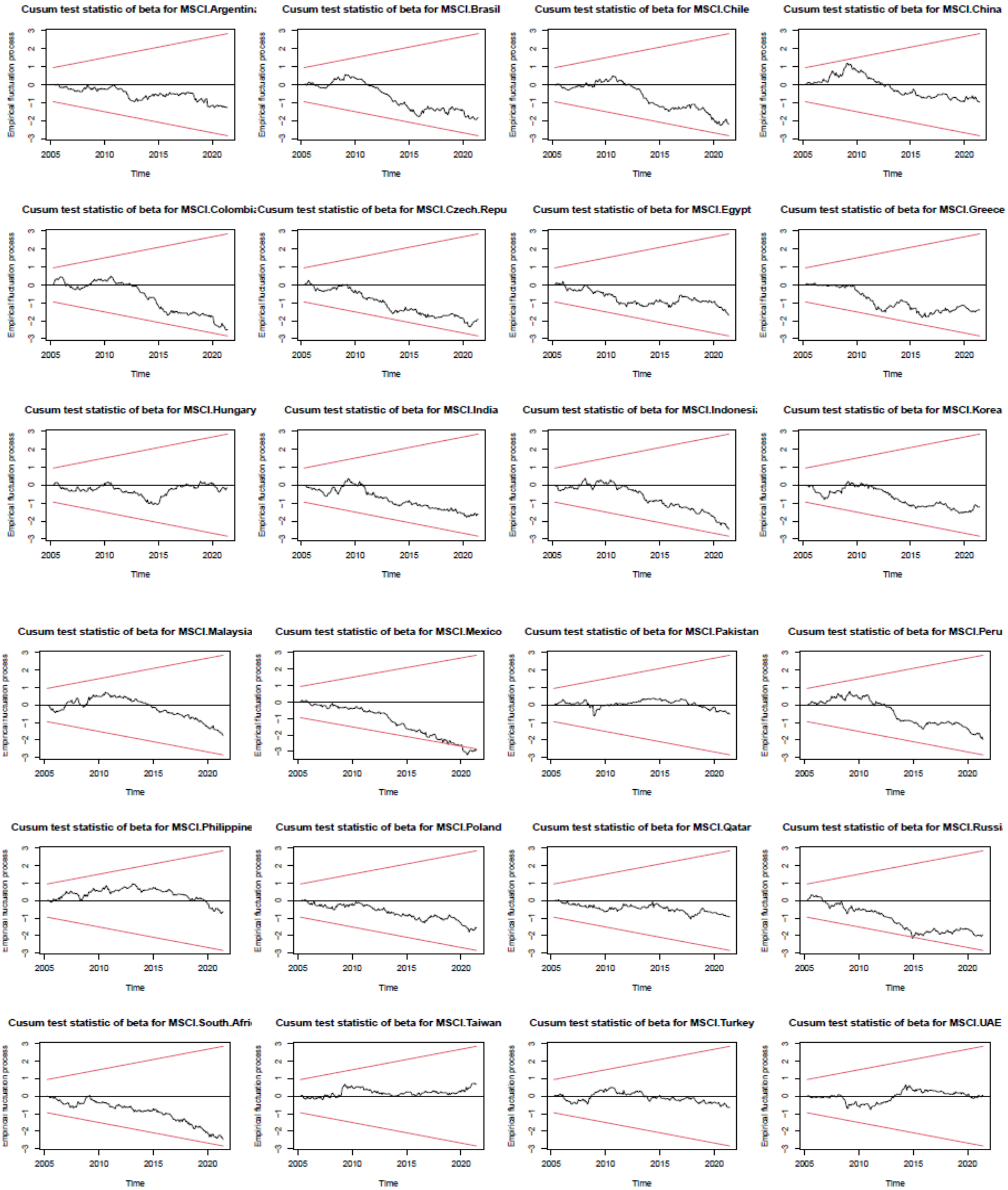
Source: *Own estimation.*

Figures. 1-24*. Chow test statistics*



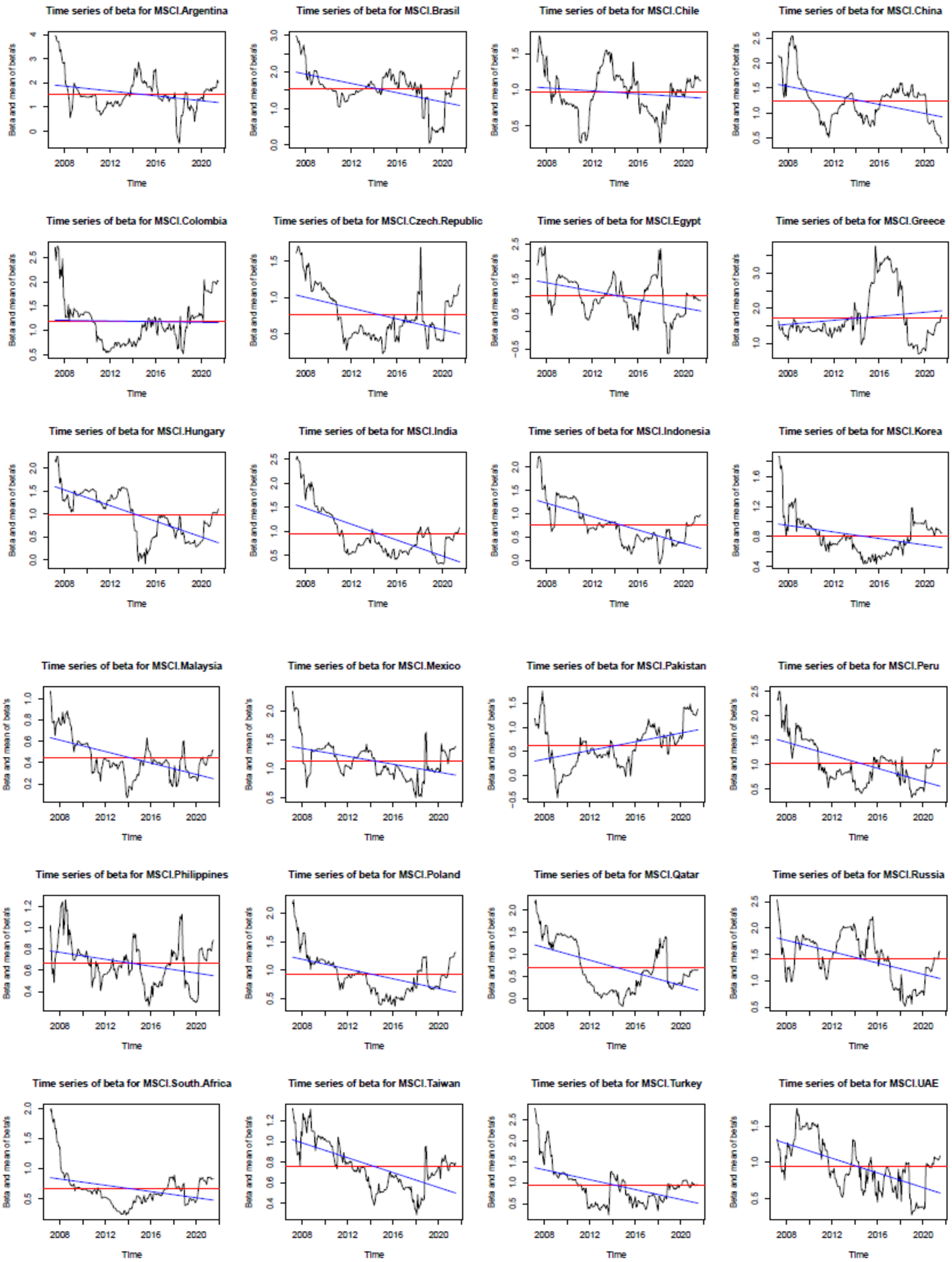
Source: *Own estimation.*

Figures 25-48. *Cusum test statistics*



Source: *Own estimation.*

Figures 49-72. *Time series of beta*



Source: *Own estimation.*