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Does Beta Explain Global Equity Market Volatility – Some Empirical Evidence

Radosław Kurach[1]

ABSTRACT The purpose of this study is to assess the diversification benefits resulting from international asset allocation. In this study, we examine Capital Asset Pricing Model (CAPM) in its international context (ICAPM) using the monthly equity returns for 26 countries (18 developed and 8 emerging markets) between July 1996 and June 2011 and adopting the US investor's perspective. We verify the beta-return trade-off employing two approaches: the unconditional trade-off and the conditional relationship. In this latter case, we find the country beta to be a significant variable explaining the cross-country variation of returns. Next, we test the degree of market integration in the light of the ICAPM. The results of this test indicate that country-idiosyncratic risks are generally not priced. In the subsidiary outcomes of our verification procedure, we argue that country betas are time-varying and that currently, global factors are the dominant source of equity market volatility. Consequently, the opinion regarding emerging market assets and their role in global portfolio management should be reconsidered. The results of the entire study may provide essential implications for fund managers because the decreasing international diversification gains have been identified.

KEY WORDS: international CAPM; country betas; time-varying betas; equity markets integration; diversification gains

JEL Classification: G11, G12, G15

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Introduction

The position of the CAPM in finance is unique for several reasons.

CAPM is a mandatory topic in every academic course on financial markets. The general conclusion of CAPM implies that the expected return for any security is positively related to the risk carried by this asset. This relationship is represented by the following equation:

$$E(R_i) = R_f + \beta_i [E(R_m) - R_f)] , \quad (1)$$

where $E(R_i)$ is the expected return on asset i, R_f is a risk-free return, $E(R_m)$ is the expected return on the market portfolio, and the expression $[E(R_m) - R_f)]$ is known as the market risk premium. The trade-off between risk and return was recognized in finance before Sharpe (1964), Lintner (1965) and Mossin (1966) developed the concept of CAPM. The key contribution of this model, therefore, lies in the employed measure of risk represented by $\beta_i = \text{cov}(R_i, R_m) / \text{var}(R_m)$. The theory distinguishes two types of risk: idiosyncratic and systematic. The first type of risk is connected with events that are specific to a company and that affect the returns of a single security. Events such as introducing a new product, hiring a well-respected manger or damage to a factory are examples. The second type of risk represents the risk that is common for all compa-

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nies and that leads to broader market volatility. It is crucially important to understand that idiosyncratic risk can be eliminated by holding a diversified portfolio. Hence, in the CAPM world, the expected return on any security is related only to the portion of the total risk that is generated by the common risk factor. Rational and risk-averse investors should a hold diversified portfolio with no idiosyncratic risk, so the unsystematic component should not be priced.

CAPM is also one of the most debatable financial models because of its rigid assumptions and diverse empirical record. Well-known early CAPM empirical verifications are Douglas (1969), Black, Jensen and Scholes (1972) and, finally, the seminal work by Fama and MacBeth (1973).

Contrary to the CAPM assumptions, Douglas (1969) found the idiosyncratic component to be a significant factor that affected the expected returns. Black Jensen and Scholes (1972) decided to utilize monthly data on the combined portfolios' returns rather than on the individual equities. In their approach, one obtains more precise beta estimates because most of the firm-specific risk is diversified while holding the asset portfolio. It is also worth underlining that monthly data are less noisy, which supports the stability of the estimates. In Black et al.'s study, the positive and linear relationship between beta and the expected return was confirmed. Fama and MacBeth (1973) also rejected the significance of a squared beta and idiosyncratic volatility while confirming the linear relationship between beta and the average return.

Since the beginning of the eighties, the extensive research devoted to other factors affecting average returns has been conducted. Banz (1981) described the phenomenon that is currently recognized as the "size effect". He found that the market value of equity capital better describes the cross-sectional average return volatility than beta. Higher returns were observed in small-capitalization companies rather than in large-cap stocks. Later, Fama and French (1992) suggested extending the CAPM to a three-factor model, adding market capitalization and book-to-market value variables.

The empirical results have not been unanimous, and even the possibility of testing CAPM is not clear. Roll (1977) questioned whether CAPM can be verified because the market portfolio should contain all types of investment assets, making it unobservable. Finally, Pettengill, Sundaram and Mathur (1995) argued that many studies fail to capture the beta-return relationship because of the improper use of realized returns to test a relationship described in terms of expected returns. The problem of using realized returns for CAPM verification was previously known; However, the standard defense was to argue that rational investors are, on average, right; thus, a long time series should properly reflect expectations (Elton, Gruber, Brown & Goetzman, 1995, p. 339). Pettengill et al. (1995) state that this argument is not enough. When the realized returns are employed in an up market in which the risk premium is positive, the relationship between beta and the asset return should also be positive. However, if the realized market return falls below the risk-free rate, the high-beta assets should experience larger downward swings than the low-beta assets. In any other case, no risk-averse investor would be willing to hold low-beta assets. The CAPM equation assumes that there is a positive risk premium, which is true in the long run. An empirical verification, however, needs higher frequency data, in which the market return may be sometimes negative. This requirement is why Pettengill et al. (1995) argue that in empirical tests, the beta-return relationship should have a conditional form. After implementing this idea, they found beta to be a significant factor in explaining the realized returns for US stocks.

Many of the existing CAPM empirical studies have been conducted in a local context focusing on the US market. As the era of financial deregulation and free capital flows began in the seventies, and a decade later the process of political and economic transition began in Latin America and then in Central and Eastern Europe, the importance of adding a dimension to reflect international investing increased. Literature devoted to the international CAPM (ICAPM) has emerged, and the results of these considerations may have vital meaning. In the case of ICAPM, the systematic risk is related to global fluctuations, while the idiosyncratic factor represents country-specific factors such as political stability or the general governance level. If ICAPM holds, the country-specific risk is not priced.

In fact, the verification of the validity of ICAPM or another asset pricing model provides an opportunity to answer questions about the stock market integration process. Jappelli and Pagano (2008) argue that the law of one price holds in an integrated financial market.

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Assets that generate identical cash flows should be priced the same irrespective of the domicile of the issuer and the asset holder. Adjusting this definition to the equities sector, under perfect integration, stocks carrying the same level of non-diversifiable risk should be priced the same everywhere around the globe.

The literature recognizes many potential benefits as well as some threats associated with the process of financial integration (Agénor, 2003). In the light of the definition in use and focusing on the equity market, the opportunity to diversify country risk results in a lower cost of capital. This lower cost of capital further increases the number of productive investments and enhances economic growth. Households also benefit from international investing possibilities by diversifying their country risk and smoothing their consumption relative to the fluctuations in their income (Baele, Ferrando, Hördahl, Krylova, & Monnet, 2004). Conversely, the segmented market creates an arbitrage opportunity for global investors. Summing up, the question of market integration is truly relevant.

Similarly to the single market case, the empirical studies verifying CAPM in its international form are not unanimous. Korajczyk and Viallet (1989) employ data on a large number of assets traded in the United States, Japan, the United Kingdom and France and find multifactor models to be superior to CAPM in both its domestic and its international forms. Harvey and Zhou (1993), using data from 16 OECD countries and Hong Kong, identify the mean-variance efficiency of the Morgan Stanley Capital International (MSCI) World Equity Index. However, a careful analysis of the residual diagnostics exhibits a significant departure from normality. Applying the alternative distributions to the error terms, these authors find that the positive beta-average return trade-off was still valid. Another ICAPM-supporting study was presented by Fletcher (2000), who applies the conditional approach of Pettengill et al. (1995) to the data from monthly returns between January 1970 and July 1998 for the MSCI equity indices from 18 developed markets. The conditional beta-average return relationship is recognized, as is the January effect. Finally, Shyh-Wei and Nai-Chuan (2007) argue that country betas may be sensitive to volatility regime changes.

Some observations lead us to believe that equity markets are becoming more integrated. A rising correlation in the business cycles between various countries has been well documented (Fidrmuc & Korhonen, 2006; Kose, Otrok, & Whiteman, 2003), so the variation in local returns could possibly be more determined by the global output fluctuations, and the international diversification gains should be diminishing. The growing number of investors holding internationally diversified portfolios should also cut the country-idiosyncratic expected risk premiums. For example, in the first half of 2005 for the first time in history, foreign investors generated over 40 percent of trade in the Warsaw Stock Exchange – the Polish stock market ("Foreign investors increase their presence", 2005).

On the other hand, "emerging equity markets", in the common understanding, are considered relatively risky because they carry additional political, economic and currency risks. They certainly aren't for those who value safety and security above all else. An investor in emerging markets should be willing to accept volatile returns - there is a chance for large profit at the risk of large losses. An upside to emerging markets is that their performance is generally less correlated with developed markets. As such, they can play a role in diversifying a portfolio (and thus reducing overall risk). ("MSCI Emerging Markets Index", n.d.).

This statement reveals the belief that there still exist local markets that are very different from the well-recognized and developed markets, thus providing some extra investment opportunities. The hypothesis of market integration definitely needs empirical verification.

In this paper, we would like to make a few contributions to the existing ICAPM literature proving that "beta really works", as we demonstrate that global market fluctuations are the dominant source of volatility for local equity markets. Consequently, our verification strategy is based on two pillars.

First, we create a dataset consisting of the well-developed and the emerging market economies for the 1996-2011 period to assess the usefulness of the beta measure for global asset allocation. Employing the testing approach of Pettengill et al. (1995), we document the conditional relationship between beta and returns over the last 15 years, which holds even during the subperiod covering the recent global financial crisis. Moreover, we provide a deeper insight into the estimation results and assess the potential of international diversification gains.

Secondly, we separately estimate for every country the degree of equity market integration to verify whether the country idiosyncratic risk is priced by the investors. We find little evidence in favor of market segmentation, which brings us to the conclusion that the common understanding of an "emerging stock market" may be a little bit outdated.

Last but not least, along the way, we document the time-varying behavior of the country betas and formulate some recommendations for future research.

The paper is organized as follows. In section 2, we discuss the methodology employed in this study, while section 3 contains the data description. The empirical results are presented in section 4, leaving section 5 for the concluding comments and suggestions for further research.

Methodology

Many empirical studies that verify CAPM validity use the general three-step research framework as proposed by Fama and MacBeth (1973). First, the equity betas are estimated, and the relative ranking of companies respective to the estimated betas is created. The equities are then split into *n* portfolios, of which the first portfolio consists of the lowest beta equities, the next lowest beta firms are placed in the second portfolio, while the last *n*-th portfolio groups the riskiest stocks in terms of market risk. The portfolios are created to diversify the firms' idiosyncratic risk and to obtain more reliable estimates of the portfolios' betas. In the international context, we can skip this stage, using data on country portfolios, not single equities, as an input. Hence, we start from the second step, in which the portfolio (country indices) betas β_c are OLS estimated against the market (World Index) returns from the following regression:

$$(R_{ct} - R_{ft}) = \beta_c (R_{Wt} - R_{ft}) + \varepsilon_{ct}, \tag{2}$$

where R_{ct} is the return on country index *c* in period *t*, R_{ft} is the worldwide risk-free rate in period *t*, R_{Wt} is the return on the world market portfolio proxy in period *t*, and ε_{ct} represents the random error term, normally i.i.d. Following Fama and MacBeth (1973), in the last step of the procedure, the obtained estimates of β_c are used in the cross-section (cross-country) regressions estimated by OLS separately for each period *t*:

$$R_{ct} = \hat{\gamma}_{0t} + \hat{\gamma}_{1t}\beta_c + \mu_{ct}, \tag{3}$$

where μ_{ct} is the random error term. The estimates $\hat{\gamma}_{1t}$ are then averaged across periods to verify whether they are statistically higher than zero. Fama and MacBeth (1973) suggest employing the following *t* statistics:

$$t(\bar{\hat{\gamma}}_j) = \frac{\bar{\hat{\gamma}}_j \sqrt{T}}{s(\hat{\gamma}_j)}, \tag{4}$$

where $\bar{\hat{\gamma}}_j$ is the period-by-period average of the regression coefficient estimates, $s(\hat{\gamma}_j)$ is the analogically standard deviation, and *T* is the number of analyzed periods.

Pettengill et al. (1995) argue that this last step needs reconsideration because the realized, not the expected, returns are used. The assumption of a positive risk-return trade-off requires the market return to be higher than the risk-free rate. As we mentioned before, when using realized returns, the return on the market portfolio frequently falls below the risk-free rate. No matter whether the risk-return trade-off holds in terms of expected returns, investors must be aware that there exists a nonzero probability of a negative risk premium in terms of the realized returns. In such a case, low-beta assets should generate lower losses than high-beta securities. If this conclusion is not accurate, no risk-averse investor would be eager to keep low-beta assets because they would be always inferior to the high-beta assets. This concern is why Pettengill et al. (1995) test the following conditional beta-return relationship instead of the unconditional form (_unconditional 3):

$$R_{ct} = \hat{\gamma}_{0t} + \hat{\gamma}_{2t}\delta\beta_c + \hat{\gamma}_{3t}(1-\delta)\beta_c + \mu_{ct}, \tag{5}$$

where δ is a dummy variable that equals one if the market risk premium is positive and zero otherwise Hence, γ_2 is the market risk premium when the market return exceeds the risk-free rate (up market), while γ_3 defines the market risk premium when the market return falls below the risk-free rate (down market). The hypotheses to be tested are then the following:

$$\begin{aligned} H_0 &: \bar{\hat{\gamma}}_2 = 0 \\ H_a &: \bar{\hat{\gamma}}_2 > 0 \\ H_0 &: \bar{\hat{\gamma}}_3 = 0 \\ H_a &: \bar{\hat{\gamma}}_3 < 0 \end{aligned}, \tag{6}$$

Similarly to Fama and MacBeth (1973), the above hypotheses should be verified using a *t* test (_tstat 4).

Pettengill et al. (1995) state that the conditional relationship (_conditional 5) is not a sufficient condi-

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tion for a positive risk-return trade-off, To guarantee a situation in which an investor is positively rewarded for holding riskier assets, the average market risk premium should be positive, and the market risk premium in up and down markets should be symmetrical. The condition regarding the average risk premium is verified using *t* tests (_tstat 4), while the symmetry of premiums is tested by the following hypotheses:

$$H_0 : \bar{\hat{\gamma}}_2 - \bar{\hat{\gamma}}_3 = 0,$$
$$H_a : \bar{\hat{\gamma}}_2 - \bar{\hat{\gamma}}_3 \neq 0 \quad (7)$$

which employ the standard two population *t*-test. One should remember to reverse the sign of $\hat{\gamma}_{3t}$ and reestimate the mean value.

To test the degree of local market integration with the rest of the world, the law of one price is applied. Markets are perfectly integrated when the assets carrying the same level of risk are priced the same across countries. If ICAPM is the appropriate asset valuation model, only the world market risk should be priced. To verify the hypothesis of perfect integration, Korajczyk (1995) and Levine and Zervos (1998) suggest estimating the following equation separately for every country:

$$(R_{ct} - R_{ft}) = \alpha_c + \beta_c (R_{Wt} - R_{ft}) + \varepsilon_{ct}, \quad (8)$$

Under perfect integration, the assessment of the pricing error intercept α_c should be equal to zero for every country. Conversely, if the estimate of α_c is significantly different from zero, it indicates the existence of country-idiosyncratic factors affecting the asset valuation in country *c*; hence, the market segmentation is identified.

Data description

This empirical study covers the monthly log returns between July 1997 and June 2011 for 26 counties: 18 developed and 8 emerging markets. The availability of a long time series was the main determinant for the chosen sample. The country stock returns (R_{ct}) are approximated by the MSCI country equity US dollar indices, while the MSCI World Equity USD Index is used to represent the world market portfolio (R_{Wt}) variable. Therefore, because we employ the USD denominated indices, our results will reflect the perspective of the US investor. We decided to employ the 3-month US Treasury Bill rate as a proxy for the global risk-free rate (R_{ft}). The yearly T-bill rates are converted to monthly frequency, assuming continuous compounding. All of the time series used in this study have been obtained from Reuters Datastream.

The basic descriptive statistics for the equity indices along with the beta OLS estimates are presented in Table 1.

A quick analysis of the data presented in Table 1 reveals two basic stylized facts.

In the long run, all of the emerging markets offer a higher average return and are more risky in terms of the standard deviation than the world market portfolio proxy. The emerging markets usually also carry a higher level of global market risk, and we can find the highest values for the country betas in the emerging market subsample (Turkey, Russia, and Hungary).

Another interesting conclusion arises after a careful study of the R^2 parameters for the estimated regressions. In our case, the interpretation of this statistic is straightforward and very meaningful. A higher determinant coefficient indicates less country idiosyncratic risk and lower diversification gains from international investing. Hence, one may find emerging markets quite attractive for global asset allocation.

The results presented in Table 1 should, however, be treated with caution. Being aware of the conclusions from empirical studies that report that the country beta may be time-varying, we applied the Chow stability test to the obtained estimates. As a rule of thumb, we decided to establish the breakpoint in the middle of our sample. The results rejected the hypothesis of no break in thirteen cases (Austria, Belgium, Czech Republic, Denmark, Hungary, India, Ireland, Norway, Poland, South Africa, Switzerland, the UK, and the USA) at the 1% significance level, four cases (Brazil, France, Greece, and the Netherlands) at the 5% significance level, two cases (Germany and Portugal) at the 10% significance level, while in only seven cases (Finland, Italy, Japan, Russia, Spain, Sweden, and Turkey), the null could not be rejected. Therefore, the separate estimation of the betas for the two subperiods is justified.

After splitting the initial sample period into halves, the estimation results (Table 2) exhibit two other interesting phenomena. First of all, consistent with the results of the Chow test, the beta coefficients for many countries are highly time-varying. Secondly, the determination coefficients increased for all of the investigat-

Table 1. Summary statistics: July 1996 - June 2011

Country	Mean	σ	β	R^2
Austria	0.464	8.113	1.089	0.546
Belgium	0.240	7.643	1.118	0.651
Denmark	0.796	7.192	1.076	0.675
Finland	0.591	9.903	1.366	0.579
France	0.456	6.927	1.155	0.846
Germany	0.407	7.277	1.190	0.813
Greece	-0.066	10.475	1.126	0.352
Ireland	0.040	8.027	1.172	0.650
Italy	0.286	7.643	1.162	0.705
Japan	-0.207	6.030	0.701	0.404
Netherlands	0.301	7.220	1.209	0.855
Norway	0.591	9.276	1.338	0.631
Portugal	0.253	7.057	0.908	0.504
Spain	0.585	7.587	1.132	0.675
Sweden	0.651	8.605	1.384	0.783
Switzerland	0.550	5.753	0.920	0.775
UK	0.302	6.113	1.020	0.848
USA	0.407	5.593	0.977	0.927
Brazil	0.880	11.950	1.500	0.476
Czech Rep.	0.880	9.153	1.025	0.376
Hungary	0.870	12.219	1.562	0.494
India	0.732	10.016	1.087	0.355
Poland	0.429	10.758	1.363	0.487
Russia	1.232	16.347	1.665	0.312
South Africa	0.532	9.022	1.102	0.451
Turkey	0.722	15.793	1.760	0.376
World	0.314	5.513	-	-

Note: The table presents summary statistics calculated for the monthly dollar returns for the MSCI equity indices of 26 countries: 18 developed (placed at the upper part of the table) and 8 emerging economies (placed below). The final row of the table reports the statistics for the MSCI World Dollar Equity Index. The sample period covers 15 years (180 months) between July 1996 and June 2011. The monthly mean returns and standard deviations are reported in percentage points. All beta parameters that are OLS estimated with respect to the MSCI World Dollar Equity Index are significant at the 1% level. The last column presents the coefficients of determination for the estimated regressions (4).

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Table 2. Summary statistics: July 1996 - December 2003, January 2004 - June 2011

	July 1996 - December 2003				January 2004 - June 2011			
Country	**Mean**	**σ**	**β**	**R^2**	**Mean**	**σ**	**β**	**R^2**
Austria	0.333	4.664	0.356	0.155	0.596	10.517	1.667	0.858
Belgium	0.327	5.332	0.676	0.433	0.152	9.437	1.466	0.826
Denmark	0.639	5.945	0.818	0.501	0.953	8.285	1.279	0.809
Finland	1.133	10.327	1.381	0.475	0.048	9.487	1.354	0.700
France	0.521	6.234	1.070	0.793	0.391	7.593	1.222	0.887
Germany	0.211	6.817	1.111	0.714	0.603	7.742	1.252	0.895
Greece	0.475	10.715	0.815	0.155	-0.607	10.262	1.372	0.609
Ireland	0.692	6.026	0.861	0.546	-0.611	9.613	1.416	0.738
Italy	0.681	7.636	1.134	0.592	-0.108	7.672	1.185	0.8169
Japan	-0.542	6.543	0.719	0.306	0.128	5.485	0.687	0.538
Netherlands	0.247	6.446	1.113	0.804	0.356	7.954	1.285	0.895
Norway	0.154	6.913	0.903	0.457	1.029	11.175	1.681	0.769
Portugal	0.296	6.827	0.772	0.344	0.210	7.317	1.015	0.662
Spain	0.718	6.989	1.052	0.605	0.451	8.178	1.194	0.730
Sweden	0.401	8.199	1.344	0.722	0.902	9.032	1.415	0.834
Switzerland	0.459	5.614	0.901	0.693	0.641	5.918	0.934	0.848
UK	0.354	5.124	0.874	0.783	0.251	6.993	1.136	0.904
USA	0.536	5.747	1.067	0.927	0.278	5.465	0.906	0.941
Brazil	0.016	12.022	1.240	0.285	1.744	11.882	1.701	0.688
Czech Rep.	0.203	8.501	0.671	0.166	1.556	9.762	1.305	0.592
Hungary	0.884	10.058	1.048	0.288	0.856	14.112	1.966	0.662
India	0.200	9.890	0.685	0.129	1.264	10.168	1.403	0.642
Poland	-0.179	10.091	1.014	0.269	1.037	11.411	1.637	0.700
Russia	1.516	19.784	1.695	0.194	0.949	12.078	1.641	0.629
South Africa	-0.097	8.884	0.830	0.232	1.161	9.164	1.315	0.693
Turkey	0.359	18.020	1.760	0.260	1.085	13.293	1.752	0.590
World	0.295	5.185	-	-	0.334	5.852	-	-

Note: Each of the sample subperiods covers 7,5 years (90 months). All beta parameters are significant at the 1% level.

Table 3. Unconditional beta-return relationship

	July 1997 - June 2011	July 1997 – Dec. 2003	Jan. 2004 - June 2011
$\bar{\hat{\gamma}}_1$	0.006301 (0.9102)	0.006038 (0.5511)	0.006564 (0.7698)

Note: The table reports the OLS mean estimates ($\bar{\hat{\gamma}}_1$) of the market risk premium from equation (3). The one-tail t statistics (4) are in parentheses. For every sample period, the separate set of beta estimates obtained for this period is used.
*, ** and ***: the coefficient is significant at the 10%, 5% and 1% levels, respectively.

Table 4. Conditional beta-return relationship

	July 1997 - June 2011	July 1997 – Dec. 2003	Jan. 2004 - June 2011
N	102	46	56
$\bar{\hat{\gamma}}_2$	0.0467 (6.9678)***	0.0605 (5.1708)***	0.0353 (4.8589)***
N	78	44	34
$\bar{\hat{\gamma}}_3$	-0.0465 (-4.3077)***	-0.0509 (-3.5057)***	-0.0407 (-2.4993)***
$\bar{\hat{\gamma}}_2 - \bar{\hat{\gamma}}_3 = 0$	0.015306	0.517018	0.346610
$R_W - R_f$	0.001335 (0.3248)	0.001318 (0.3409)	0.001352 (0.3099)

Note: The table reports the OLS mean estimates ($\bar{\hat{\gamma}}_2$ and $\bar{\hat{\gamma}}_3$) of the market risk premiums from equation (5) in up and down market months, respectively. The one-tail t statistics (4) are in parentheses. For every sample period, the separate set of beta estimates obtained for this period is used. N in the upper row is the number of up-market months, whereas N in the lower row indicates the number of down-market months. The results of the t test as to whether $\bar{\hat{\gamma}}_2 - \bar{\hat{\gamma}}_3 = 0$ are presented in the bottom part of the table. The last row reports the world market risk premium and the one-tail t test (in parentheses) indicates whether this premium is significantly higher than zero.
*, ** and ***: the coefficient is significant at the 10%, 5% and 1% levels, respectively.

ed markets. This observation confirms that the local equity market fluctuations are becoming more global and responding less to country-idiosyncratic shocks.

Empirical results

The relationship between beta and the returns is examined both in unconditional (_unconditional 3) and conditional form (_conditional 5). We estimate these equations for the entire sample period and separately for the two subperiods. Tables 3 and 4 present the summarized results:

As we can see, the flat (unconditional) relationship does not hold for the entire sample period or for any of the examined subperiods. The estimates of the γ_1 coefficient are not statistically significant. This result is no longer surprising when we take a quick look at the number of down market months reported in Table 4, which in every case is a large share of the overall number of months. The significant and positive γ_1 would indicate that high-beta markets perform better independent of the global conditions. However, this case is not ours.

The estimates reported in Table 4 exhibit the opposite story. The conditional relationship is valid any time at a 1% significance level, which is a strong support for beta as a global investing risk measure. Compared to a low-beta country, a higher beta describes a market that gains more during a global bull market but also suffers more under bearish global conditions. Therefore, beta may identify the aggressive and defensive markets for

Table 5. Time-varying betas proof

	Jan. 2004 - June 2011
$\bar{\hat{\gamma}}_1$	0.0031 (0.2852)
N	56
$\bar{\hat{\gamma}}_2$	0.0011 (0.0892)
N	34
$\bar{\hat{\gamma}}_3$	0.006381(-0.3115)

Note: The table reports the OLS mean estimates ($\bar{\hat{\gamma}}_1$, $\bar{\hat{\gamma}}_2$ and $\bar{\hat{\gamma}}_3$) of the market risk premiums from equations (3) and (5), respectively. The monthly returns from the January 2004 - June 2011 sample are regressed by the beta estimates for July 1997 - December 2003. The one-tail t statistics (4) are in parentheses. N in the upper row is the number of up-market months, whereas N in the lower row indicates the number of down-market months.
*, ** and ***: the coefficient is significant at the 10%, 5% and 1% levels, respectively.

international asset allocation. A similar argument was presented by Fletcher (2000); therefore we need to distinguish the contribution of our study. Fletcher (2000), verifying the conditional beta-return relationship, analyzed the period from January 1970 to July 1998 for 18 developed markets. His results were not as evident as ours because he observed in one of the examined subperiods a lack of statistical significance at the 5% level for γ_2. As we updated the sample period, our results became more robust despite our adding 8 emerging markets, which are still perceived by many investors as being less correlated with global fluctuations. Actually, these results can be easily explained if we examine the estimates of R^2 presented in Table 2. An increase of the coefficient values indicates that global shocks explain over half of the variation of the local returns. In this case, beta must be a meaningful measure of risk.

We also did not reject the null hypothesis on premiums symmetry (_hypotheses2 7), which is favorable for the conditional CAPM. On the contrary, the estimations of the global risk premium are the only controversial estimates. For the entire sample and for both of the subperiods, the premiums are positive, but statistically insignificant. The annualized values are, respectively 1.61%. 1.59%. and 1.63%. However, we do not consider these results to be crucial for verifying the validity of the CAPM after analyzing the standard deviation of the world portfolio returns. Compared to the results obtained by Fletcher (2000), who analyzed data ending in July 1998, in our case, the standard deviation for the MSCI world monthly returns is over one percentage point higher. In the last fifteen years, we witnessed events that were manifested in large market swings, *i.e.*, the Asian crisis (1997-98), the Russian default (1998), the dotcom bubble bursting (2000) and, finally, the unprecedented global financial crisis that started in approximately 2007. The higher volatility of the world returns explain why the global risk premium estimates are not statistically significant.

Lastly, in this part, we decided to focus on the time-varying behavior of beta. We estimated equations (_unconditional 3) and (_conditional 5) for the entire sample period using betas from Table 1, being aware that in many cases the Chow test rejected the hypothesis of coefficient stability. Using estimates that are, to some extent, inappropriate, we still received highly statistically significant results in the conditional beta relationship case. However, global managers may face the following challenge: how reliable are the past beta estimates when the investment decisions are oriented toward the future? If investors are rational, they should be, on average, right, and the "true" beta for the investment period should be uncovered. This assumption is very strong. However, contrary to CAPM predictions, the investors may form their expectations in a naive way by extrapolating from the past. We decided to verify equations (_unconditional 3) and (_conditional 5) by regressing the returns from the second subperiod using the betas estimated in the first subperiod.

Table 6. Pricing errors

	α_c
Brazil	0.0120 (1.7409)*
Czech Rep.	0.0114 (1.7562)*
Ireland	-0.0107 (-2.0924)**

Note: The table reports the significant OLS estimates of pricing errors α_c from equation (8). The sample period starts January 2004 and ends June 2011.
*, ** and ***: the coefficient is significant at the 10%, 5% and 1% levels, respectively.

The results (Table 5) of this example are evident and confirm the time-varying behavior of country betas because the lack of statistical significance applies both to the conditional and the unconditional relationships. Betas estimated on the past data cannot explain cross-country variation in the long investment horizon. Hence, an investor that does not at least temporarily update these estimates eliminates an important investment indicator.

The second research target focused on the potential country-risk premiums required by the investors. Again, we estimated equation (_integration 8) for the entire sample period as well as for both of the subperiods. Out of 78 regressions (26 countries times 3 estimation periods), we found significant pricing errors in only three cases and only for the second estimation subperiod (Table 6).

Therefore, the investigated equity markets appear to be highly integrated.

Conclusions

Our research confirms the positive beta-return tradeoff and integration of local equity markets. These results may have serious practical implications. At the same time, these results pose a few new questions requiring further in-depth research.

We note the cross-country as well as the time-series variation of beta. It is tempting to verify the possible determinants leading to the observed differences. In one of the early studies regarding the time-variation of equity betas, Fabozzi and Francis (1978) estimate the betas of US securities using a random coefficient model. They also list the possible explanations for the systematic risk time-dependence phenomenon. First, microeconomic factors such as changes in the dividend payouts or leverage may influence beta over time. Second, macroeconomic conditions, namely business cycle fluctuations and inflation variability, are noted. The third group consists of political factors, *e.g.*, labor legislation, pollution-control legislation and elections. Last, but not least, the financial market conditions (bull and bear markets, credit crunches) may also be important for beta determination. The importance of macroeconomic factors is further verified by Andersen, Bollerslev, Diebold, and Wu (2005), while Liodakis, Brar, Crenian and Dowle (2003) focus their attention on the micro fundamentals of the analyzed companies. The research on country beta variation has primarily investigated this phenomenon in a time series context. Wdowinski (2004) estimate the model of Poland's beta with real and monetary factors and find the monetary factors to be relatively more powerful in explaining the country's systematic risk. However, the cross-country variation of betas, in our opinion, deserve more attention. These differences cannot be explained by only macroeconomic factors, which are becoming more global as we noted before. Rather, we suggest analyzing the importance of market liquidity and depth. Global capital flows on less-deep markets may result in higher volatility reflected in higher beta estimates.

The problem of proper country beta estimation when the time-variation of country systematic risk is identified is still debatable. Again, there exists a group of studies supportive of the Kalman-filter technique, but most of these studies are conducted using single stocks or industry portfolios (Bulla & Mergner 2008; Faff, Hillier & Hillier, 2000; He & Kryzanowski 2008).

We have delivered very few arguments against equity market integration. This finding should be compared with the beta estimation results for the second subperi-

od (Table 2), which reveal that over half of the local variance is explained by the global market portfolio fluctuations, even in the case of emerging markets. There are several reasons for an increase in financial market interdependence, and these reasons can be classified into two broad groups: fundamental and non-fundamental reasons. The fundamental group of linkages describes channels of spreading market impulses via changes in the foreign trade volume or responses to global shocks such as an oil price increase. The non-fundamental interconnections may be the result of financial intermediaries operating globally (Valdés, 1997), or they may have their roots in information asymmetries and coordination problems (Dornbusch, Park & Claessens, 2001). Forbes and Rigobon (2002) argue that these latter interconnections can only, but not always, be observed during time of crisis, thereby constituting a phenomenon recognized as contagion. Rising global interconnections lead us to formulate the final conclusion that the potential diversification gains from international investing have been substantially reduced over recent years. Some empirical studies even found that cross-industry diversification was more effective than the cross-country pattern in terms of portfolio risk reduction (Baca, Garbe, & Weiss, 2000; Brooks and Del Negro 2002; Baele et al., 2004). Currently, emerging markets differ from developed ones mainly in terms of their beta risk. Global investors should, therefore, use emerging markets assets to adjust their portfolio beta rather than diversifying country-idiosyncratic risk.

Finally, one should keep in mind that the presented results reflect the US investor's perspective. It would be quite interesting to discover if the same conclusions hold when the returns are denominated in different currencies, especially if we adopt the emerging markets perspective. We hope to develop this issue in further research.

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