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Skewness preference across countries

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Prospect theory implies that assets with positively skewed returns should be traded at premium to assets with negative skewness. We hypothesize that in the integrated financial markets this concept should also hold for the entire country equity portfolios. This article examines the linkages between the country-level expected returns and past skewness. We evidence a robust negative relationship between skewness and future returns. The phenomenon is most significant within large, liquid, developed, and open stock markets. Additional sorts on skewness can improve performance of both cross-country value and momentum strategies. The study is based on the sorting and cross-sectional tests conducted within a sample of 78 country equity markets for years 1999-2014.

JEL Classifications: G11, G12, G15

Keywords: Skewness preference, country-level effects, inter-market effects, asset pricing, international markets

Introduction

In this paper we aim to examine the cross-sectional links between past skewness and the expected returns at the country level. In other words, the study attempts to examine the country-level parallel of the cross-sectional pattern observed across individual stocks.

The concept of skewness in asset pricing is introduced in the seminal paper by Kraus and Litzenberger (1976). The authors suggest that expected returns depend on skewness of return distribution and, according to their empirical findings, investors prefer positive coskewness within their market portfolios. Kraus and Litzenberger have expanded the capital asset pricing model to account for the effect of systematic skewness valuation. Further research has also confirmed investors' preference not only for coskewness but also for idiosyncratic, i.e. diversifiable, skewness (Boyer et. al., 2010; Barberis and Huang, 2008). This observation proves difficult to explain on the grounds of the classical paradigm; the arrival of behavioural finance, however, has offered a fresh perspective on the problem. First, Barberis and Huang (2008) indicate that investors with cumulative prospect theory preferences are willing to pay more for stocks with greater idiosyncratic skewness. According to prospect theory (Kahneman and Tversky, 1979), investors overvalue small and undervalue large probabilities. As a result, large payoffs with small probabilities appear overly attractive and investors prefer stocks displaying high positive skewness.

Introducing skewness as an additional factor in the asset pricing model has proven effective not only for CAPM (Kraus and Litzenberger, 1976) but also for the Fama-French three factor model (Harvey and Siddique, 2000). These findings have been confirmed not only for US market (Dittmar, 2002; Barberis and Huang, 2008; Kapadia, 2006), but also for China (Chen et al., 2010), India (Naryan and Ahmed, 2014) and Russia

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(Teplova and Mikova, 2011). Finally, Barberis et al. (2014) researched 46 international equity markets and reported similar findings in the majority of the markets. On the indices level, however, skewness preference was only initially investigated by Harvey (2000)., and analysed in individual equity options (Boyer and Vorkink, 2013) and bonds (Yang et al., 2010).

In our study we aim to investigate the skewness preference on a new global level by examining for the first time the linkages between the expected returns on stock market indices and the skewness of past returns distribution. Contrary to the majority of the past research, we investigate no stock-level data but base our research on a broad range of country-level indices from 78 equity markets. To develop our hypothesis, we adopt a simple model of the international investor who allocates his investments across various country equity markets. The investor prefers right-skewed return distributions to the left-skewed return distributions, and consequently, bases his distribution predictions (with respect to skewness) on historical performance.

This model bears two testable implications. First, the past skewness should be negatively related with the future returns. In practice, country equity markets with past positive skewness of return distributions should lose to markets with negative skewness. The second implication relates to the market development: if skewness is priced in the stock-market indices, then the natural underlying assumptions should indicate that the prices in these markets are determined rather globally than locally. In other words, the magnitude of the impact of skewness should go hand in hand with market integration. As the international investor needs to be allowed to allocate capital freely across the markets, we expect the effect of skewness preference to be stronger across liquid, developed and large markets, where prices are determined globally, rather than across illiquid, undeveloped and small markets, where prices are determined largely by the local investor. We scrutinise this hypothesis in our study.

The motivation behind this study is twofold: firstly, we want to provide fresh, out-of-sample evidence on the phenomenon of skewness preference; secondly, and more importantly, we aim to provide new tools for international investors. The stock-level market participants have access to ample economic literature on cross-sectional return patterns, as proved by Harvey et al. (2015) who has recently reviewed 315 asset-pricing factors from tier-one academic journals. In contrast with this so-called "factor zoo", the tools made available to country-level investors - who construct their strategies based on exchange traded funds (ETFs) or stock index futures - are astonishingly modest. The current academic literature on inter-market anomalies is focused almost exclusively on the most prominent factors of value (Macedo, 1995; Kim, 2012; Zaremba, 2015a), size (Keppler and Encinosa, 2011) or momentum (Bhorjaj and Swaminathan, 2006; Balvers and Wu, 2006). This shortage of useful tools is particularly striking given the recent unprecedented proliferation of country-level investment vehicles: e.g. futures, index funds and ETFs. While these new products have provided investors with an easy access to international markets, these structural changes call for a new set of tools for the global investor.

Our research investigates the performance of 78 country stock markets within the sample period between the years1999 and 2014. The objective of the asset pricing tests applied within this study is to explain returns on portfolios from sorts on skewness. These returns are evaluated using cross-sectional asset pricing models. The principal findings can be summarized as follows: (1) skewness of past excess returns is strongly and negatively related to expected returns; (2) this phenomenon is more pronounced across large, liquid and developed markets, (3) the effect of skewness can be efficiently combined with value and momentum so as to improve performance of these strategies.

Data sources and sample description

This research uses monthly returns on international stock market indices derived from 78 countries[1]. All source data are obtained from the Bloomberg database. To ascertain a

[1] For the detailed list see Table A1 in the Appendix.

consistent return computation methodology across the countries, we adopt MSCI indices which are widely tracked capitalization-weighted global equity benchmarks and additionally serve as the basis for numerous futures contracts and over 650 exchanged traded funds (ETFs) throughout the world[1]. The selection of MSCI is also aimed at aligning our research with the investment practice, as the indices are constructed and managed with a view to being fully investable from the perspective of the international institutional investor (MSCI, 2014a) and cover approx. 85% of all stock market capitalizations in the given countries (MSCI, 2014b). Where the MSCI index is unavailable, Dow Jones is our second index of choice, and STOXX the third. A detailed description of the sample along with a full list of the examined countries is presented in Table A1 in the Appendix.

We use a monthly time-series of returns, accounting and market. As it is argued by Waszczuk (2014), the discrete-time asset pricing theory provides no information on the interval of expected returns (Fama, 1998).; We therefore adopt the monthly interval, which is also wide use in similar studies. The reasons are twofold. On the one hand, the monthly interval offers a sufficient number of observations to ensure the test's power. On the other hand, it prevents excessive exposure to micro-structure issues (de Moor and Sercu, 2013). Lower frequency could be adequate for estimating cost of capital, but less so for testing asset pricing models where shorter time intervals markedly improve their quality. In practice, it is rarely used - typically in analysing macroeconomic data, as in Avramov and Chordia's investigation into the Consumption CAPM model (2006).

We compute the returns based on capitalization-weighted net total return indices, i.e. on an after-tax basis (accounting for the country-specific dividend tax rates) and subsequently adjust them for corporate actions or cash distributions to investors[2]. The sample period for returns runs from January 1999 to December 2014, as available, and includes both existing and discontinued markets, for which it is possible to compute: skewness, capitalization, book-to-market ratio (B/M), and momentum in month t, turnover at the end of month t-1 and return in month t[3]. The sample size varies across time and averages 57. The initial market and accounting data are collected in local currencies and subsequently converted into USD at the end-of-day interbank nominal exchange rate sourced from Bloomberg. To comply with the USD approach, excess returns are computed over the one month benchmark US T-Bill rate.

Research methods

In this article we research the performance of various portfolios from sorts on skewness. In each *t*-1 month, all stock market indices are ranked against the skewness calculated based on their past 24-month performance under the following formula (Doane and Seward, 2011):

$$\hat{a} = \frac{n^2}{(n-1)(n-2)} \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{x})^3}{\hat{s}^3} \quad (1)$$

[1] Data from http://www.msci.com/products/indexes (accessed 1st November 2014).

[2] To test the robustness of our results, we reexamined the sample based on gross returns, but identified no major differences. The detailed results are available at request.

[3] Following for example of Fama and French (2012), Asness *et al.* (2013) or Zaremba (2015a) we calculate momentum as the excess return in months *t*-12 to *t*-2.

where $\hat{a}$ is skewness, n - the sample size equal 24, x_i - an i-month excess log return, $\bar{x}$ - an average 24-month excess log return, and $\hat{s}^2$ - the sample variance.

Next, we define the 20th, 40th, 60th and 80th percentiles as breakpoints and thus create five subgroups. To form portfolios, the markets in the respective groups are weighted for capitalization. We use the 12-month turnover as a liquidity proxy.. We subsequently add differential portfolios - effectively synthetic zero-investment portfolios - that form long/short portfolios: 100% long in the quintile of markets with the highest skewness, and 100% short in the quintile of markets with the lowest metric.

Additionally, to account for market integration and investment accessibility potentially varying across countries, we study the capitalization-weighted portfolios having initially sorted countries on additional variables. Subsequently, we test the strategies on the specific subsets of the entire sample assuming that large, liquid and developed markets be more integrated and easily accessible. Within this approach, we test the strategies separately within: large and small markets (divided by median capitalization on a monthly basis), liquid and illiquid markets (divided by median turnover), and developed and emerging markets (classified according to the MSCI classification in the given month), including frontier markets within the emerging market group. Finally, we measure performance across open and closed countries. For each month we sort countries based on their KAOPEN indices (Chinn & Ito, 2008) - measuring the country's *de jure* degree of capital account openness.

In the end, we are also interested whether the skewness effect interacts with the popular country-level value and momentum strategies that are discussed, for example, by Asness *et al.* (2013) or Zaremba (2015a). To this end, every month we initially divide markets by their B/M or momentum. To compute the country-level B/M ratios, we weigh the stock-level data according to the index methodology. The lagged book values from month t-4 are applied to avoid a look-ahead bias.[1] Considering the momentum, following Zaremba (2015a), we adopt the cumulative excess returns in months t-12 to t-2. Next, within the separate subsets we form five skewness portfolios according to the above procedure. This additional examination is inspired by the stock-level observations of Jacobs *et al.* (2015), who finds that additional simultaneous sorts by skewness substantially improve the performance of momentum strategies.

Examining multi-country international portfolios requires an appropriate asset pricing model. The model should comply with the perspective of the international investor, motivated to invest in foreign indices-based instruments as e.g. ETFs or futures contracts. In this article we use two models. To begin with, we employ a country-level CAPM model (Sharpe, 1964). In this approach, proposed by Zaremba (2015a), the global market portfolio comprises all the country portfolios within the capitalization weighted sample. According to CAPM, asset returns depend solely on the market portfolio as described by the following regression:

$$R_{i,t}=\alpha_i + R_{f,t} + \beta_{rm,i} \times (R_{m,t} - R_{f,t}) + \varepsilon_{i,t} \quad (2)$$

where $R_{i,t}$, $R_{m,t}$ and $R_{f,t}$ are returns on the analysed asset i, market portfolio and risk-free returns at time t, and a_i and $\beta_{rm,i}$ are regression parameters. a_i intercept measures the average abnormal return (so called Jensen-alpha). The risk free rate is, again, one-month benchmark US T-Bill rate.

Furthermore, we attempt to consider other cross-sectional asset pricing effects, such as value, size and momentum. We apply, however, no global stock-level asset pricing factors as it contradicts the assumption that investors allocate money to index-based vehicles. Therefore, apart from the country-level CAPM model, we test whether the skewness-

[1] The index-level B/M values are sourced from Bloomberg.

based portfolios expand the frontier for the US stock-level investor, and take advantage of the four-factor model by Carhart (1997), described with the following regression:

$$R_{i,t} = \alpha_i + R_{f,t} + \beta_{r,m,i} \cdot (R_{m,t} - R_{f,t}) + \beta_{S,M,B,i} \cdot SMB_t + \beta_{H,M,L,i} \cdot HML_t + \beta_{W,M,L,i} \cdot WML_t + \varepsilon_{i,t} \qquad (3)$$

where: $\beta_{r,m,i}$, $\beta_{S,M,B,i}$, $\beta_{H,M,L,i}$, $\beta_{W,M,L,i}$, and α_i are the model estimated parameters; $\beta_{r,m,i}$ is analogous, but not equal, to CAPM beta. $\beta_{S,M,B,i}$, $\beta_{H,M,L,i}$, $\beta_{W,M,L,i}$ are measures of exposure to SMB_t (small minus big), HML_t (high minus low), and WML_t (*winners minus losers*) risk factors, which are defined as the returns on the zero-cost arbitrage portfolios. SMB_t is the difference in returns on diversified portfolios between small and large caps at time t while HML_t is, in general, the difference between returns on portfolios of diversified value (high book-to-market) and growth (low book-to-market) stocks. Finally, WML_t covers momentum returns measured by returns on the so-called winner and loser portfolios, which were used in the initial studies on this anomaly (Jegadeesh & Titman, 1993). The WML_t (winners minus losers) denotes the difference between returns on the diversified winner and loser portfolios in the preceding year. In other words, SMB_t, HML_t, and WML_t are returns on zero-cost market-neutral long or short portfolios formed based on size, value, and momentum characteristics. All the factor returns are based on the US stock-level data[1].

Following Fama and French (2012), all the regression parameters are estimated using the OLS regressions, in line with remarks of Cochrane (2001), who regards this method as typically more robust than for example GLS. Furthermore, t-statistics corresponding to the parameters are estimated using the bootstrap standard errors (10.000 replications), so as to avoid any distributional assumption. To estimate whether the intercepts in a portfolio group statistically differ from 0, we adopt the common GRS test statistic, as suggested by Gibbons *et al.* (1989). While the test's null hypothesis assumes that all the intercepts (five) equal 0, the alternative hypothesis assumes the opposite.

The GRS test statistic weaknesses indicate significant outperformance of some portfolio sets, irrespective of either the structure or monotonicity of the returns. To test whether the excess return are systematically fluctuating in synchrony with the underlying variable, we additionally carry out a monotonic relation (MR) test which is a simulation-based test - first introduced and precisely described by Patton and Timmerman (2010) - assuming a no monotonic patter in excess returns, and an alternative hypothesis to the contrary. . Every MR test in this study is based on 10,000 random draws and applied to both excess returns and intercepts from the asset-pricing models.

Finally, in order to ensure the correctness of our results, we perform a series of robustness checks.

Net versus gross returns. In addition to our basic net approach (i.e. with the returns adjusted for taxes on dividends) we repeat the calculations using gross returns(i.e. returns unadjusted for taxes on dividends). The alternative methods reflects the standpoint of the institutional investor who can avoid dividend tax.

Alternative weighting schemes. In addition to the capitalization-weighted portfolios, we supplement our research with equal-weighted and liquidity-weighted portfolios where we use the cumulative turnover in months t-12 to t-1 as the liquidity proxy.

Alternative currencies. In addition to US dollar-approach, we re-examine all the computations using the euro and Japanese yen. As we identify no qualitative differences, for brevity, we report no results.

[1] The stock level data come from Andrea Frazzini's data library: http://www.econ.yale.edu/~af227/data_library. htm (accessed 26th May 2015).

Performance in sub-periods. We examine the portfolio performance across various subsets of the main sample. We use three types of division. First, we arbitrarily halve our sample by the date of March 31, 2007. Within the division, so as to nullify the impact of the arbitrary cut-off date, we employ two more dates marking important market events: the Dow Jones peak on October 11, 2007, and the Lehman Brothers bankruptcy on the September 16, 2008.

Secondly, we investigate returns under various market conditions, i.e. in both bull and bear markets, at times of high or low volatility, as well as with regard to market liquidity, credit risk, and term spread. We define bull and bear market period as the months when the returns on the market portfolio are either positive or negative. For the remaining sub-periods, we employ representative metrics and re-examine portfolio performance within the subsamples when the metrics at the end of month t-1 depart from their medians. As the representation of the general liquidity we use the 3-month US$ TED spread, i.e. the difference between the 3-month US$ Libor rate and the yield on the US benchmark 3-month T-bill. The expected market volatility is represented by the VIX volatility index, a common measurement of the implied volatility of index options. BBB spreads of US 10-year corporate bonds over 10-year benchmark treasury bonds is a credit risk proxy. Finally, the term-spread risk is the difference between the yields of 10 and 2-year benchmark US treasury bonds.

Thirdly, we examine the returns on the strategies at the times of high and low investor sentiment by calculating the mean returns in month t where a given investor sentiment indicator varies from the median at the end of month *t*-1. We use four different sentiment measurements: the market-level investor sentiment index of Baker and Wurgler (2006) (BW)[1], the State Street Investor Confidence Index (SSIC)[2], the Sentix Economic Indices Global Aggregate Overall Index (Sentix)[3], and the Weighted Manufacturing and Non-Manufacturing Composite Purchasing Managers' Index (PMI).[4]

Subsamples of the examined countries. As we indicate in the introduction, we examine the performance of portfolios from sorts on skewness within the subsets of our entire sample of 78 countries. The divisions - based on size, liquidity, openness, and development - additionally inform on the robustness of the results.

Results and discussion

In Table 1 we report the performance of the portfolios from sorts on skewness. Beginning with the capitalization weighted portfolios, we find a significant relationship between the past skewness of a return distribution and the expected returns. The returns on the negatively skewed markets generate abnormally high excess returns. Consequently, the excess returns and intercepts from asset pricing models of the zero-portfolios show high absolute values which are both negative and significantly different from 0. The impact of skewness is not explained by value, size and momentum effects. Furthermore the MR tests confirm the decreasing monotonicity of returns and alphas. Finally, the null-hypothesis from the GRS tests is strongly rejected.

Although the abnormal returns on the liquidity-weighted zero-portfolios are somewhat smaller, they are sufficiently high to confirm the relationship between skewness and excess

[1] The data on the BW index, from the http://people.stern.nyu.edu/jwurgler/, are only available for the period ended December 2010. As a result, in the case of this metric we base our analysis on a shortened study period.

[2] http://www.statestreet.com/ideas/investor-confidence-index.html (accessed 11th October 2015)

[3] https://www.sentix.de/index.php/en/sentix-Economic-News (accessed 11th October 2015)

[4] https://www.markit.com/product/pmi, https://www.instituteforsupplymanagement.org/ismreport/ mfg rob.cfm (accessed 11th October 2015)

returns. Again, the zero-portfolios display both negative and significant abnormal returns; the GRS hypothesis is rejected and the MR tests indicate monotonicity.

TABLE 1. PERFORMANCE OF PORTFOLIOS FROM SORTS ON SKEWNESS

	Low	2	3	4	High	High-Low	MR	GRS
				Capitalization-weighted portfolios				
Mean	**1.53****	0.29	0.16	0.67	0.51	**-1.22****	**3.3**	
	(3.06)	*(0.56)*	*(0.26)*	*(1.13)*	*(0.93)*	***(-2.84)***		
Standard deviation	6.70	7.53	7.21	8.25	7.43	6.72		
α CAPM	**0.97****	-0.30	-0.41	0.03	-0.08	**-1.23****	**3.4**	**0.5**
	(3.63)	*(-0.76)*	*(-1.25)*	*(0.13)*	*(-0.23)*	***(-2.64)***		
α four-factor model	**1.21****	-0.20	-0.23	0.32	0.03	**-1.37****	**1.6**	**0.1**
	(3.81)	*(-0.44)*	*(-0.66)*	*(0.71)*	*(0.10)*	***(-2.93)***		
				Liquidity-weighted portfolios				
Mean	0.73	0.13	0.04	0.16	0.06	**-0.77****	**5.1**	
	(1.64)	*(0.31)*	*(-0.03)*	*(0.28)*	*(0.13)*	***(-2.81)***		
Standard deviation	6.00	5.88	6.03	6.01	5.92	4.02		
α CAPM	0.28	-0.30	-0.43	-0.31	-0.41	**-0.77****	**5.1**	**3.0**
	(0.99)	*(-1.02)*	*(-1.54)*	*(-1.05)*	*(-1.38)*	***(-2.58)***		
α four-factor model	**0.40***	-0.23	-0.30	-0.17	-0.34	**-0.83****	**3.3**	**3.0**
	(1.81)	*(-1.09)*	*(-1.40)*	*(-0.64)*	*(-1.26)*	***(-2.67)***		
				Equal-weighted portfolios				
Mean	0.71	0.58	0.36	0.43	0.37	**-0.44***	46.7	
	(1.52)	*(1.26)*	*(0.85)*	*(0.98)*	*(0.95)*	***(-1.84)***		
Standard deviation	6.14	5.90	5.76	5.92	5.31	3.31		
α CAPM	0.22	0.11	-0.12	-0.06	-0.07	**-0.41***	45.3	64.5
	(0.80)	*(0.45)*	*(-0.46)*	*(-0.22)*	*(-0.23)*	***(-1.71)***		
α four-factor model	0.31	0.18	-0.03	0.04	0.05	-0.36	56.0	62.4
	(1.17)	*(0.81)*	*(-0.12)*	*(0.19)*	*(0.28)*	*(-1.59)*		

Note: The *Low* to *High* columns refer to portfolios formed on past skewness. *High-Low* is the zero-investment portfolio with a long position in the *High* portfolio and a short position in the *Low* portfolio. *R* is an average monthly excess net log return. *MR* and *GRS* columns represent *p*-values for the test of monotonic relation by Patton and Timmerman (2010) and for the test of mean-variance spanning by Gibbons *et al.* (1989). Asterisks * and ** represent values significantly different from 0 at 10% and 5% levels correspondingly. All statistics significantly different than 0 at 10% level and p-values for *MR* and *GRS* test rejected at least at 10% level are typed in bold. Numbers in brackets are *t*-stats.

Finally, although the examination of equally weighted portfolios does not contradict the earlier observations, it lacks statistical significance. While CAPM alpha remains negative, it significantly differs from 0 only at the 10% level. Also, neither GRS nor MR tests hypotheses can be rejected in our view, however, the performance of the equally weighted portfolios are of less importance than the capitalization or liquidity-weighted groups, as it may be markedly distorted by the so-called diversification returns (Willenbrock, 2011).[1]

Strikingly impressive is the performance of the country selection strategies based on size. In our view, the absolute alphas outperform any other inter-market cross-sectional strategy. Adam Zaremba, in a series of working papers (2015a, 2015b, 2015c), examined a

[1] An interesting feature of the results presented in Table 1 is that while the equally-weighted and liquidity-weighted zero-investment portfolios deliver significant negative raw and risk-adjusted returns, almost no coefficient on the high and low portfolios is significant. This may result from the volatility of the examined portfolios. The systematic risk of the dollar-neutral is substantially reduced because the portfolio assumes simultaneous long and short positions in the correlated markets.

number of country-level cross-sectional anomalies based on the quintile portfolios formed analogously to our approach in this study. The strategies stemmed from value, size, momentum, quality and volatility effects. None of these strategies, however, produced abnormal returns on zero-cost portfolios as high as the skewness-based approach presented in this research.

Furthermore, the outcomes in Table 1 provide interesting insights into the low-risk anomaly Ang (2014, p.332). While the majority of stocks display positive skewness, the indices turn negative (Albuquerque, 2012). In the case of positive skewness, higher volatility indicates a longer right tail, what is desired by investors led by the prospect theory preference (Kahneman and Tversky, 1979). This may explain the low-risk anomaly on the stock level. On the other hand, higher volatility with negative skewness points to a longer left tail, which according to prospect theory is undesired. In this case, higher volatility does not translate to positive implications for investors. This may explain why no low risk anomaly is observable at the index level (Zaremba, 2015c).

TABLE 2. PERFORMANCE OF PORTFOLIOS FROM SORTS ON SKEWNESS - ROBUSTNESS CHECK WITH GROSS RETURNS.

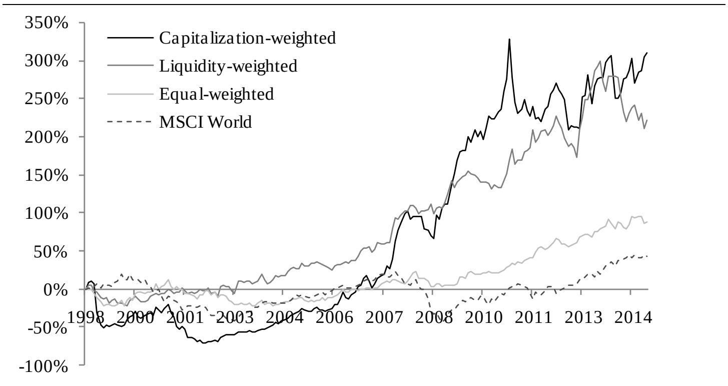
	Low	2	3	4	High	High-Low	MR	GRS
				Capitalization-weighted portfolios				
Mean	**1.52*****	0.34	0.29	0.46	0.24	**-1.50*****	**3.4**	
	(2.83)	*(0.62)*	*(0.55)*	*(0.75)*	*(0.48)*	***(-3.34)***		
Standard deviation	6.86	7.47	7.04	8.42	7.40	6.87		
α CAPM	**1.12*****	-0.08	-0.09	-0.02	-0.19	**-1.52*****	**3.5**	**0.6**
	(3.91)	*(-0.18)*	*(-0.29)*	*(0.01)*	*(-0.58)*	***(-3.41)***		
α 4-factor model	**1.03*****	-0.18	-0.19	0.01	-0.23	**-1.48*****	**3.1**	**0.6**
	(3.38)	*(-0.45)*	*(-0.53)*	*(0.08)*	*(-0.58)*	***(-3.24)***		
				Liquidity-weighted portfolios				
Mean	**1.02*****	0.40	0.39	-0.04	0.08	**-1.02*****	**2.3**	
	(2.41)	*(1.01)*	*(0.81)*	*(-0.12)*	*(0.16)*	***(-3.95)***		
Standard deviation	5.76	5.80	5.84	6.21	6.00	4.00		
α CAPM	**0.71*****	0.10	0.08	-0.39	-0.28	**-1.06*****	**2.2**	**0.1**
	(2.63)	*(0.36)*	*(0.26)*	*(-1.40)*	*(-1.02)*	***(-3.86)***		
α 4-factor model	**0.56*****	-0.09	-0.07	**-0.52****	-0.41	**-1.04*****	**1.6**	**0.1**
	(2.66)	*(-0.52)*	*(-0.33)*	***(-2.13)***	*(-1.55)*	***(-3.72)***		
				Equal-weighted portfolios				
Mean	**0.77***	0.64	0.57	0.35	0.46	**-0.41***	44.7	
	(1.65)	*(1.31)*	*(1.34)*	*(0.75)*	*(1.15)*	***(-1.85)***		
Standard deviation	6.17	6.08	5.77	6.05	5.39	3.43		
α CAPM	0.42	0.30	0.22	-0.02	0.16	**-0.38***	40.5	45.1
	(1.52)	*(1.11)*	*(0.93)*	*(-0.04)*	*(0.72)*	***(-1.67)***		
α 4-factor model	0.23	0.11	0.09	-0.15	0.07	**-0.27**	52.0	61.5
	(0.90)	*(0.52)*	*(0.40)*	*(-0.55)*	*(0.33)*	***(-1.17)***		

Note: The *Low* to *High* columns refer to portfolios formed on past skewness. *High-Low* is the zero-investment portfolio with a long position in the *High* portfolio and a short position in the *Low* portfolio. *R* it an average monthly excess gross log return. *MR* and *GRS* columns represent *p*-values for the test of monotonic relation by Patton and Timmerman (2010) and for the test of mean-variance spanning by Gibbons *et al.* (1989). Asterisks * and ** represent values significantly different from 0 at 10% and 5% levels, correspondingly. All statistics significantly different than 0 at 10% level and p-values for MR and GRS test rejected at least at 10% level are typed in bold. Numbers in brackets are *t*-stats.

Finally, we report (Table 2) the re-exanimated performance of the portfolios formed on past skewness under the gross returns approach. The robustness check brings no qualitative difference in results. Similarly to the net approach, the hypotheses of both the GRS and MR tests are rejected within the weighting schemes based on capitalization and liquidity. Moreover, the returns on zero-investment capitalization-weighted and liquidity-weighted portfolios slightly outperform the net approach.

The returns on the zero-investment portfolios from sorts on skewness remain relatively stable over time. While the relatively short period of the examination prevents any reliable testing within the subperiods, a simple graphical analysis yields interesting insights. Figure 1 displays cumulative returns on the dollar-neutral portfolios formed on skewness. One dollar invested in these portfolios would have steadily increased over time.

FIGURE 1. CUMULATIVE RETURNS ON ZERO-PORTFOLIOS FROM SORTS ON SKEWNESS



Source: Bloomberg database.

Note: The detailed procedure of formation of the zero-portfolios is described in the II Section. "MSCI World" represents cumulative returns on MSCI World Net Total Return Index.

Furthermore, Table 3 supplies additional information on the performance within the subperiods. For brevity, we report only on the raw returns. Within nearly every subperiod, the quantile portfolios of the country equity indices with the most negative historic skewness outperform the quantile portfolios of the most positively skewed markets. Although, due to the relatively short time series of the subsamples, some negative returns approximate zero, we observe a clear return pattern. Across the 72 subsample-portfolio combinations, only once the mean return is historically positive (the equal-weighted portfolio in bear markets).

TABLE 3. PERFORMANCE OF ZERO-INVESTMENT PORTFOLIOS FORMED ON SKEWNESS IN THE SUBPERIODS OF THE FULL SAMPLE

	Capitalization-weighted portfolios		Liquidity-weighted portfolios		Equal-weighted portfolios	
	R	*t*-stat	R	*t*-stat	R	*t*-stat
Subperiods						
First half	-0.69	*(-0.91)*	-0.59	*(-1.42)*	-0.15	*(-0.41)*
Second half	**-1.78*** **	***(-2.95)***	**-0.96** **	***(-2.33)***	**-0.74*** **	***(-2.62)***
Pre 2007 peak	-0.92	*(-1.26)*	**-0.73***	***(-1.77)***	-0.24	*(-0.66)*
Post 2007 peak	**-1.58** **	***(-2.52)***	**-0.82** **	***(-1.97)***	**-0.68** **	***(-2.31)***
Pre Lehman	**-1.17***	***(-1.70)***	**-0.78** **	***(-2.03)***	-0.25	*(-0.71)*
Post Lehman	**-1.29** **	***(-1.97)***	**-0.75***	***(-1.66)***	**-0.73** **	***(-2.45)***
Market conditions						
Bull Mkt	**-1.88*** **	***(-2.89)***	**-0.99** **	***(-2.28)***	**-1.13*** **	***(-3.91)***
Bear Mkt	-0.31	*(-0.43)*	-0.47	*(-1.31)*	0.52	*(1.34)*
High Vol	-0.81	*(-1.03)*	**-0.85***	***(-1.91)***	-0.19	*(-0.46)*

TABLE 3. PERFORMANCE OF ZERO-INVESTMENT PORTFOLIOS FORMED ON SKEWNESS IN THE SUBPERIODS OF THE FULL SAMPLE

	Capitalization-weighted portfolios		Liquidity-weighted portfolios		Equal-weighted portfolios	
	R	*t*-stat	R	*t*-stat	R	*t*-stat
Low Vol	**-1.63*****	***(-2.80)***	**-0.68***	***(-1.81)***	**-0.69*****	***(-2.68)***
High Term	**-1.56*****	***(-2.58)***	**-0.81***	***(-1.87)***	-0.47	*(-1.48)*
Low Term	-0.87	*(-1.14)*	**-0.72***	***(-1.84)***	-0.41	*(-1.13)*
High Credit	**-1.74****	***(-2.47)***	**-0.91***	***(-1.79)***	-0.36	*(-0.94)*
Low Credit	-0.97	*(-1.53)*	**-0.70****	***(-1.96)***	-0.48	*(-1.56)*
High Ted	**-1.34***	***(-1.77)***	**-0.75****	***(-2.00)***	-0.42	*(-1.12)*
Low Ted	**-1.10***	***(-1.77)***	**-0.78***	***(-1.75)***	-0.46	*(-1.52)*
Investor sentiment						
High BW	-0.27	*(-0.27)*	**-0.83***	***(-1.90)***	-0.30	*(-0.61)*
Low BW	**-2.82*****	***(-4.50)***	**-0.84***	***(-1.71)***	-0.31	*(-0.95)*
High Sentix	**-2.29*****	***(-3.50)***	**-0.91****	***(-2.10)***	**-0.75****	***(-2.49)***
Low Sentix	**-1.56****	***(-2.53)***	**-0.99****	***(-1.98)***	-0.52	*(-1.61)*
High SSIC	-0.64	*(-0.83)*	-0.47	*(-1.01)*	-0.17	*(-0.42)*
Low SSIC	**-1.79*****	***(-2.98)***	**-1.06*****	***(-2.99)***	**-0.70*****	***(-2.84)***
High PMI	**-1.63****	***(-2.37)***	**-0.85****	***(-2.19)***	**-0.94*****	***(-2.89)***
Low PMI	-0.81	*(-1.17)*	-0.68	*(-1.56)*	0.07	*(0.19)*

Note: *R* it the average monthly net log return on the zero-investment portfolio formed on skewness. Numbers in brackets are *t*-stats. Asterisks * and ** represent values significantly different from 0 at 10% and 5% levels, correspondingly. All statistics significantly different than 0 at 10% level are typed in bold.

TABLE 4. PERFORMANCE OF PORTFOLIOS FROM DOUBLE SORTS ON SKEWNESS AND SIZE, LIQUIDITY OR DEVELOPMENT

	Raw excess returns		Global country-level CAPM			US stock-level four-factor model		
	R	MR	α	MR	GRS	α	MR	GRS
Large markets	**-1.08**** ***(-2.02)***	**6.9**	**-1.09**** ***(-2.09)***	**6.7**	**4.0**	**-1.42***** ***(-2.72)***	**2.5**	**1.1**
Small markets	0.09 *(0.15)*	52.9	0.12 *(0.35)*	59.8	62.2	0.11 *(0.36)*	46.1	48.7
Liquid markets	**-0.79*** ***(-1.92)***	**3.9**	**-0.91**** ***(-2.17)***	**3.2**	**8.4**	**-0.98*** ***(-2.27)***	**1.9**	**3.5**
Illiquid markets	**-1.25**** ***(-2.16)***	61.2	**-1.13*** ***(-1.75)***	57.5	66.0	-1.11 *(-0.41)*	71.5	51.5
Developed markets	**-0.94**** ***(-2.56)***	10.9	**-0.96***** ***(-2.71)***	**8.7**	**9.8**	**-0.88**** ***(-2.38)***	15.6	**8.5**
Emerging markets	**-0.98*** ***(-1.84)***	76.2	-0.89 *(-1.50)*	80.2	93.8	-0.93 *(-1.53)*	73.8	93.1
Open countries	**-1.06**** ***(-2.21)***	**10.0**	**-1.00**** ***(-2.36)***	**8.2**	19.8	**-1.07**** ***(-2.43)***	**9.7**	26.1
Close countries	**-1.15**** ***(-2.35)***	16.7	**-1.05*** ***(-1.78)***	25.0		**-1.00*** ***(-1.75)***	18.5	33.3

Note: *R* it the average monthly net log return on the zero-investment portfolio formed on skewness. *MR* and *GRS* columns represent *p*-values for the test of monotonic relation by Patton and Timmerman (2010) and for the test of mean-variance spanning by Gibbons *et al.* (1989). Asterisks * and ** represent values significantly different from 0 at 10% and 5% levels, correspondingly. All statistics significantly different than 0 at 10% level and p-values for MR and GRS test rejected at least at 10% level are typed in bold. Numbers in brackets are *t*-stats.

Table 4 presents performance of skewness-based strategies, which include initial sorts on size, liquidity, development, and openness. The results to some extend support out initial assumptions, but still prove largely inconclusive. The effect of skewness seems more stable among the open and integrated markets. For the large, liquid, developed, and open markets the returns are in all cases abnormally negative and significantly different from zero.

All the GRS tests' hypotheses are rejected at least at 10% level and the MR tests confirm monotonicity in returns. On the other hand, none of this observation is confirmed within the small, illiquid, closed and emerging countries. Literally no p-value corresponding to the MR or GRS tests stays below 10%. One observation of the emerging markets distorts the picture: although the asset pricing tests' hypotheses are rejected for the large, liquid, open, and developed countries, and accepted in their opposites, the sheer scale of the excess and abnormal returns on the zero-investment portfolios exceeds sometimes the second group. For example, within the illiquid markets, the intercept from the CAPM model equals 1.13% while within the liquid group it reaches 0.91%. In other words, the impact of skewness within the sample becomes more pronounced within the large, developed, liquid, and open markets, which allows for easy access of international investors. However, within the illiquid, small and emerging markets where the prices are determined locally rather than internationally, the impact of skewness on cross-country variation in stock returns is statistically insignificant. The reason may be the larger volatility of the small and undeveloped markets. Once the study be reproduced based on new data and a longer time series, the skewness-return relation may also be proven for smaller markets, which would correspond with the findings of Harvey (2000) who having dismissed the impact of other risk factors, identified skewness in both the emerging and developed markets. This, however, once controlled for market or total volatility risk, makes the effect more pronounced in the emerging markets.

Finally, Table 5 presents performance of portfolios from sorts on skewness within the subsets of: value (high B/M), growth (low B/M), as well as up (high past returns) and down (low past returns) markets.

TABLE 5. PERFORMANCE OF PORTFOLIOS FROM DOUBLE SORTS ON SKEWNESS AND B/M RATIO OR MOMENTUM

	Raw excess returns		Global country-level CAPM			US stock-level four-factor model		
	R	MR	α	MR	GRS	α	MR	GRS
Growth markets	-0.27 *(-0.65)*	67.0	-0.22 *(-0.48)*	71.2	79.9	-0.29 *(-0.63)*	74.1	76.7
Value markets	**-1.64**** ***(-2.98)***	**4.4**	**-1.53**** ***(-2.81)***	10.1	20.0	**-1.59**** ***(-2.74)***	11.1	15.1
Up markets	-0.67 *(-1.27)*	13.9	-0.64 *(-1.25)*	20.6	36.3	-0.69 *(-1.28)*	19.2	38.7
Down markets	**-1.14**** ***(-2.62)***	14.5	**-1.09**** ***(-2.26)***	21.1	**4.4**	**-1.16**** ***(-2.39)***	12.2	**3.1**

Note: *R* is the average monthly net log return on the zero-investment portfolio formed on skewness. *MR* and *GRS* columns represent *p*-values for the test of monotonic relation by Patton and Timmerman (2010) and for the test of mean-variance spanning by Gibbons *et al.* (1989). Asterisks * and ** represent values significantly different from 0 at 10% and 5% levels, correspondingly. All statistics significantly different than 0 at 10% level and p-values for MR and GRS test rejected at least at 10% level are typed in bold. Numbers in brackets are *t*-stats.

Two interesting patterns emerge: (1) the skewness-based strategies perform much better in the value markets than in the growth markets. While the mean excess returns and intercepts from the factor models prove significantly negative and display higher absolute values than the single sort portfolios, across the growth markets both the excess returns and alphas only insignificantly depart from zero. (2) skewness impacts more the down markets rather than the up markets. Here, however, the abnormal returns in absolute terms remain below the single-sorted portfolios, which may stem from the lower return dispersion within the smaller sample. In contrast, the alphas in the up markets effectively approximate zero. Summing up, the skewness effect is markedly stronger in value and down markets; hence, the sorts on skewness may be combined with the value and momentum strategies to enhance performance.

Concluding remarks

In our study, we have examined performance of portfolios from sorts on skewness. The past skewness proves strongly, positively related with the future returns. In line with our expectations, this is particularly significant for large, liquid and developed markets. The observation provides not only fresh, sample-based evidence supporting the theory of skewness preference but also new tools for the global investor, which may be also employed for country selection strategies or performance evaluation by asset managers with the international mandate.

The results, however, bear two important limitations. Firstly, the study period spans over the years of the global financial crisis, which may affect the findings. Secondly, our research takes no account of the transaction costs which are largely investor-specific.

Further research on the issues addressed in this article can be pursued in a number of directions. First, the impact of transaction costs requires further investigation. Second, it may prove interesting to test alternative metrics closely related to skewness, as systematic coskewness (Harvey and Siddique, 2000) or idiosyncratic skewness (Boyer et al., 2010). Third, while in our study we assumed investors decide based on past skewness, alternative investigations could consider measures that help forecast the future skewness: Jacobs et al. (2015) research reviews a number of such indicators as, for instance, the maximum daily return proposed and used by Bali et al. (2011, and 2015, respectively). Fourth, supplementing the analysis with investigations of higher moments could yield valuable results. The stock-level observations suggest that although investors display kurtosis-averse behaviour, this does not contradict the skewness effect, as evidenced by Dittmar (2002), showing both co-skewness and co-kurtosis as significantly priced factors. It would be interesting to verify whether similar phenomena exist in the cross-country universe. At last, further research could also investigate the impact of skewness on different asset classes.

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Appendix

TABLE A1. RESEARCH SAMPLE

ID	Country	Index provider	Start	End	R	SD	Skew	Kurt	Obs
1	Argentina	MSCI	1998-12-31	2014-12-31	0.50	12.14	-0.70	2.61	192
2	Australia	MSCI	1998-12-31	2014-12-31	0.77	6.51	-0.87	2.44	192
3	Austria	MSCI	1998-12-31	2014-12-31	0.14	8.27	-1.59	6.91	192
4	Bahrain	MSCI	2006-01-31	2014-12-31	-1.75	7.39	-1.23	3.94	107
5	Bangladesh	MSCI	2009-11-30	2014-12-31	0.17	8.72	-1.17	3.60	61
6	Belgium	MSCI	1998-12-31	2014-12-31	0.15	7.07	-2.08	10.13	192
7	Brazil	MSCI	2000-12-31	2014-12-31	0.84	10.47	-0.78	1.86	168
8	Bulgaria	MSCI	1998-12-31	2014-12-31	0.76	6.16	-0.99	3.72	192
9	Canada	MSCI	2005-05-31	2014-12-31	-0.98	11.38	-1.79	8.76	115
10	Chile	MSCI	1998-12-31	2014-12-31	0.73	6.45	-0.73	2.76	192
11	China	MSCI	1998-12-31	2014-12-31	0.62	8.76	-0.15	2.11	192
12	Colombia	MSCI	1998-12-31	2014-12-31	1.44	9.17	-0.55	1.13	192
13	Croatia	MSCI	2002-05-31	2014-12-31	0.41	8.06	-0.29	4.07	151
14	Cyprus	Dow Jones	2004-12-31	2014-12-31	-3.32	22.82	-3.99	30.59	120
15	Czech Rep.	MSCI	1998-12-31	2014-12-31	1.08	8.33	-0.46	1.77	192
16	Denmark	MSCI	1998-12-31	2014-12-31	0.82	6.21	-1.07	3.52	192
17	Egypt	MSCI	1998-12-31	2014-12-31	1.25	9.72	-0.14	1.65	192
18	Estonia	MSCI	2002-05-31	2014-12-31	0.77	9.53	-0.63	5.78	151
19	Finland	MSCI	1998-12-31	2014-12-31	0.26	9.70	-0.42	1.69	192
20	France	MSCI	1998-12-31	2014-12-31	0.29	6.31	-0.70	1.26	192
21	Germany	MSCI	1998-12-31	2014-12-31	0.33	7.29	-0.75	1.87	192
22	Greece	MSCI	1998-12-31	2014-12-31	-0.85	10.53	-0.77	2.01	192
23	Hong Kong	MSCI	1998-12-31	2014-12-31	0.70	6.45	-0.36	1.44	192
24	Hungary	MSCI	1998-12-31	2014-12-31	0.23	10.57	-1.15	4.25	192
25	Iceland	Dow Jones	2007-01-31	2014-12-31	-2.40	24.01	-7.82	69.78	95
26	India	MSCI	1998-12-31	2014-12-31	1.08	8.94	-0.40	1.00	192
27	Indonesia	MSCI	1998-12-31	2014-12-31	1.25	10.87	-0.47	2.59	192
28	Ireland	MSCI	1998-12-31	2014-12-31	-0.28	7.13	-1.13	2.59	192
29	Israel	MSCI	1998-12-31	2014-12-31	0.60	6.85	-0.52	1.44	192
30	Italy	MSCI	1998-12-31	2014-12-31	-0.06	7.05	-0.50	0.81	192
31	Japan	MSCI	1998-12-31	2014-12-31	0.19	5.02	-0.20	0.20	192
32	Jordan	MSCI	1998-12-31	2014-12-31	0.33	6.27	-0.55	4.45	192
33	Kazakhstan	MSCI	2005-11-30	2014-12-31	0.86	12.54	1.81	10.34	109
34	Kenya	MSCI	2002-05-31	2014-12-31	2.01	8.31	-0.83	3.48	151
35	Kuwait	MSCI	2006-01-31	2014-12-31	-0.23	6.98	-0.43	1.72	107
36	Latvia	STOXX	2011-02-28	2014-12-31	-0.48	6.19	-0.57	0.43	46
37	Lebanon	MSCI	2002-05-31	2014-12-31	0.71	8.49	0.65	4.02	151
38	Lithuania	MSCI	2008-05-31	2014-12-31	0.33	8.50	0.22	8.79	79
39	Luxemburg	STOXX	2011-02-28	2014-12-31	-0.94	7.92	-0.79	2.08	46
40	Malaysia	MSCI	1998-12-31	2014-12-31	1.05	6.15	0.46	3.61	192
41	Malta	Dow Jones	2004-12-31	2014-12-31	0.33	6.33	-0.43	1.24	120
42	Mexico	MSCI	1998-12-31	2014-12-31	1.09	7.21	-0.89	3.16	192
43	Morocco	MSCI	1998-12-31	2014-12-31	0.34	5.58	0.06	1.15	192
44	Mauritius	MSCI	2002-05-31	2014-12-31	1.64	7.08	-1.12	7.06	151
45	Netherlands	MSCI	1998-12-31	2014-12-31	0.26	6.40	-1.06	2.70	192
46	New Zealand	MSCI	1998-12-31	2014-12-31	0.63	6.51	-0.82	1.43	192

TABLE A1. RESEARCH SAMPLE

ID	Country	Index provider	Start	End	R	SD	Skew	Kurt	Obs
47	Nigeria	MSCI	2002-05-31	2014-12-31	0.94	9.78	-0.96	7.35	151
48	Norway	MSCI	1998-12-31	2014-12-31	0.70	8.26	-1.24	4.47	192
49	Oman	MSCI	2006-01-31	2014-12-31	0.07	6.85	-1.92	7.32	107
50	Pakistan	MSCI	2002-05-31	2014-12-31	1.39	9.60	-2.80	19.30	151
51	Peru	MSCI	1998-12-31	2014-12-31	1.37	8.53	-0.88	3.76	192
52	Philippines	MSCI	1998-12-31	2014-12-31	0.35	7.78	-0.52	1.39	192
53	Poland	MSCI	1998-12-31	2014-12-31	0.53	10.02	-0.55	1.26	192
54	Portugal	MSCI	1998-12-31	2014-12-31	-0.29	6.79	-0.83	1.84	192
55	Qatar	MSCI	1999-06-30	2008-05-30	0.46	8.47	-0.88	2.62	107
56	Romania	MSCI	2005-11-30	2014-12-31	0.01	13.04	-1.72	7.04	109
57	Russia	MSCI	1998-12-31	2014-12-31	1.11	11.67	-0.13	2.13	192
58	Serbia	MSCI	2008-05-31	2014-12-31	-1.84	15.63	-1.45	6.45	79
59	Saudi Arabia	MSCI	2012-08-31	2014-12-31	-2.28	12.51	-0.13	-0.95	28
60	Singapore	MSCI	1998-12-31	2014-12-31	0.78	7.00	-0.94	4.23	192
61	Slovenia	MSCI	2002-05-31	2014-12-31	0.46	6.93	-0.47	2.29	151
62	South Africa	MSCI	1998-12-31	2014-12-31	1.01	7.56	-0.68	0.93	192
63	South Korea	MSCI	1998-12-31	2014-12-31	0.90	9.22	-0.09	0.60	192
64	Spain	MSCI	1998-12-31	2014-12-31	0.35	7.29	-0.55	1.61	192
65	Sri Lanka	MSCI	2002-05-31	2014-12-31	1.24	9.30	0.99	5.06	151
66	Sweden	MSCI	1998-12-31	2014-12-31	0.62	7.93	-0.57	1.82	192
67	Switzerland	MSCI	1998-12-31	2014-12-31	0.44	4.72	-0.64	0.75	192
68	Taiwan	MSCI	1998-12-31	2014-12-31	0.34	7.80	-0.08	0.66	192
69	Thailand	MSCI	1998-12-31	2014-12-31	0.34	7.80	-0.08	0.66	192
70	Trinidad and Tobago	MSCI	2008-11-30	2014-12-31	0.62	3.01	-0.20	2.77	73
71	Tunisia	MSCI	2004-05-31	2014-12-31	0.73	5.18	0.16	3.45	127
72	Turkey	MSCI	1998-12-31	2014-12-31	0.89	14.61	-0.30	1.73	192
73	Ukraine	MSCI	2006-05-31	2014-12-31	-2.57	13.50	-0.70	1.48	103
74	United Arab Emirates	MSCI	2006-01-31	2014-12-31	-0.45	10.70	-0.70	1.64	107
75	United Kingdom	MSCI	1998-12-31	2014-12-31	0.30	4.87	-0.63	2.09	192
76	USA	MSCI	1998-12-31	2014-12-31	0.37	4.45	-0.75	1.45	192
77	Venezuela	MSCI	2000-12-31	2007-12-31	1.07	13.22	0.10	4.94	84
78	Vietnam	MSCI	2006-11-30	2014-12-31	-0.13	11.82	0.43	1.89	97

Note: In the table *ID* is a running number; *Start* and *End* refer to the first and last observations in the sample period; *R* to mean monthly return, *SD* - standard deviation of returns, *Skew* - skewness, *Kurt* - kurtosis, while *Obs.* - number of observation. *R* and *SD* are expressed in percentage terms.