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Higher co-moments and asset pricing on emerging stock markets by quantile regression approach

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Abstract: This paper investigates the role of the third and fourth moments which impact on weekly stock return for the all twenty-five emerging stock markets (featured by MSCI - Morgan Stanley Capital International) during the period from April 2005 to November 2017. We employ the traditional CAPM combined with co-skewness and co-kurtosis representing nonlinear shape in risk measurement to estimate return generating under quantile regression in descending order by sorting equally weighted portfolios. The findings show that three of premium including market premium, co-skewness premium and co-kurtosis premium has influenced stock return in each country by 1%; 5%; 10% significance level with five-quantile regression approach. Then, our models with higher co-moments have better explanation for securities in emerging markets rather than traditional CAPM. Importantly, the investors should add more co-skewness securities and eliminate co-kurtosis (or less this factor) to generate more returns among 25 developing markets.

JEL Classifications: G11, G12, G14

Keywords: Co-skewness, co-kurtosis, return, all emerging stock markets
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1. Introduction and literature review

This research found the evidences about the impact of third and fourth co-moment on pricing assets. There are some researches from the past to examine the first and second moment on constructing investing portfolios such as Markowitz (1952), Sharpe (1964) and Lintner (1965). Investors have a first look at the link between risk and return through the Capital asset pricing model. This is also considered as the foundation for effective portfolio theory. As a result, the CAPM model has widely applied in the investment, risk management and become the core content of university curriculums. Scientists have further extended this model by adding variables such as value, size, value-at-risk… Based on these studies, more specific measurement of the relationship between the systemic risk and the return on investment portfolios were made. In particular, Fama & French (2008) pointed out the failure of practical application of Sharpe (1964) and Lintner (1965). The authors added two factors as SMB and HML to examine the association between size and value in influencing the return of equity.

Besides the first and second factors, the researchers attached higher co-moments to CAPM model (as Kraus & Litzenberger, 1976) to show the influence of skewness on valuation. This study showed that the consistency between the prediction of the return through the tertiary factor on the traditional CAPM model namely the intercept of the third risk premium equal to the compensation of the risk-free rate. In addition, the authors also referred the inconsistency between the traditional model and the intercept coefficient that traditional theory can be attributed to misspecification of the capital asset pricing model by omission of systematic skewness. Harvey & Siddique, 2000 built equity portfolios on various criteria such as industry, size, book-to-market ratios, co-skewness with market portfolio (which the authors defined co-skewness as the component of an asset of skewness related to the market portfolio of skewness) and momentum using both monthly holding periods. By adding these variables to the traditional CAPM, the authors provided evidences to back up their research by pointing out that the market tends to outperform with 5% each year when the correlation is positive skewness and underperform 2.81% per year with negative skewness.

Most current researches studied higher co-moments in considering the risk-adjusted performance on The US equity securities (Moreo & Rodriguez, 2009). Another study on the impact of higher co-moments was conducted by Kostakis (2012) in the UK stock market as well as compared to the experimental results between the original CAPM and the extended CAPM model. Regarding the emerging stock market, there were quite a number of studies looking at the correlation between skewness and kurtosis. However, these researches have only just concluded to consider the interrelationship between the return of emerging market and the global stock market (Bekaert,1996) or skewness-coefficient measurement becoming criteria in building effective portfolios (Canela, 2007). Based on these research gaps, we conducted a measure of the impact of higher co-moments on returns through the expansion of the CAPM model.

3. Research model and data

3.1. Research model

By adding more factors in the traditional CAPM, we are followed many previous researches such as Kraus & Litzenberger (1976); Harvey & Siddique (2000); Dittmar (2002); Barone Adesi, Gagliardini, & Urga (2004) to estimate two more nonlinearity factors listing co-skewness and co-kurtosis in the research model below:

$$R_{i,t} - r_{f,t} = \beta_{0,i} + \beta_{1,i}\left[R_{M,t} - r_{f,t}\right] + \beta_{2,i}\left[R_{M,t} - \bar{R}_{M,t}\right]^2 + \beta_{3,i}\left[R_{M,t} - \bar{R}_{M,t}\right]^3 + \varepsilon_{i,t} \quad (1) \qquad (1)$$

where it represents $R_{i,t}$; $r_{f,t}$ and $R_{M,t}$ are constructed by weekly stock return from one national index for each Emerging market, the London Interbank Offering Rate demonstrating for risk-free rate by Kostakis, Muhammad, & Siganos (2012) and the Market return building up all emerging markets (called MSCI Emerging markets), respectively. These co-efficient indicators are known as proxies of market premium ($\beta_{1,i}$), the square of market exceeding return ($\beta_{2,i}$), the cube of ones ($\beta_{3,i}$).

It is also known as another model, which is valid of Stochastic Discount Factor (SDF) called 'M' included quadratic and cubic market returns as follows:

$$M_{t+1} = 1 + \tilde{b}R_{m,t+1} + \tilde{c}R_{m,t+1}^2 + \tilde{d}R_{m,t+1}^3 \quad (2)$$

In order to define the non-linear functional form for central asset, this model is more clear explanation for expectation of return in the next following period:

$$\begin{aligned} E_t(R_{t+1}) - R_t^f &= -\left(1 + R_t^f\right)\tilde{b}Cov\left(R_{m,t+1}, R_{t+1}\right) \\ &- \left(1 + R_t^f\right)\tilde{c}Cov\left(R_{m,t+1}^2, R_{t+1}\right) \\ &- \left(1 + R_t^f\right)\tilde{d}Cov\left(R_{m,t+1}^3, R_{t+1}\right) \end{aligned} \quad (3)$$

One of the most important variables in our main research model in (1) is premium for co-skewness (or co-kurtosis). We refer to the previous calculation by Kostakis, Muhammad & Siganos (2012) to define co-skewness and co-kurtosis hereinafter:

$$CSK_i = \frac{E\left[\varepsilon_{i,t}\varepsilon_{m,t}^2\right]}{\sqrt{E\left[\varepsilon_{i,t}^2\right]}E\left[\varepsilon_{m,t}^2\right]} \quad (4)$$

$$CKT_i = \frac{E\left[\varepsilon_{i,t}\varepsilon_{m,t}^3\right]}{\sqrt{E\left[\varepsilon_{i,t}^2\right]}E\left[\varepsilon_{m,t}^3\right]} \quad (5)$$

It denotes that $\varepsilon_{i,t}$ is the residual elements collecting from CAPM regression. In addition, $\varepsilon_{m,t}$ is the deviation between market return in week t from the benchmark of average value from the previous date (t – 1) to date (t). Moreover, Kraus & Litzenberger (1976) calculate the degree of co-skewness and co-kurtosis as follows:

$$\text{Coskewness}_i = \frac{E\left[\{R_i - E(R_{i)}\}\{R_m - E(R_m\}^2\right]}{\{R_m - E(R_m)\}^3} \quad (6)$$

$$\text{Cokurtosis}_i = \frac{E\left[\{R_i - E(R_{i)}\}\{R_m - E(R_m\}^3\right]}{\{R_m - E(R_m)\}^4} \quad (7)$$

Then, we decided to use the method proposed by Kraus & Litzenberger (1976) to estimate these parameters. Finally, we mainly employ quantile regression corrected heteroscedasticity, and its regression method will help to fully considering effect of outliers to observe the entire distribution of return, not merely its conditional mean as OLS.

$$Q(\beta_q) = \sum_{i:return_i \geq risk\ factors_i'(\beta)}^{N} q|return_i - risk\ factors_i'(\beta)| + \sum_{i:return_i < risk\ factors_i'(\beta)}^{N} (1-q)|return_i - risk\ factors_i'(\beta)| \quad (8)$$

3.2. Research data

We collected weekly stock index data from 25 emerging markets, classified by MSCI, in the period from 2005 to 2017. In addition, the index of MSCI-EM is extracted to represent to emerging countries' market return portfolio. We apply logarithm return calculation by Miller (2013) to estimate return for these indexes. We employ the method by Kostakis, Muhammad, & Siganos (2012) to calculate risk-free rate as London Interbank Offering Rate for periodic week. All figures are collected from the Thomson Reuters. Afterward, we estimated the difference with the highest group and lowest one to calculate this premium for co-skewness and co-kurtosis with market. When it comes to premium of co-skewness and co-kurtosis from constructing the portfolio with equally weighted in descending-order level by Kraus & Litzenberger (1976).

4. Findings and results

By results presented in table 1 regarding descriptive statistics, the authors concluded that the differences and volatilities from these data are skewed and shaped in lepto-kurtosis. Most of variables are shown as left tail lying with negative value calculation. Interestingly, the mean of return is going around value 'zero'. Based on the regressed results, the market risk premium has significance level at 1% for all 25 emerging markets for five quantile levels. The top of high coefficient (over 0.5) lies in Brazil, China, Egypt, India, Indonesia, Korea, Philippines, Russia, Taiwan, which means that these stock return from the aforementioned markets are well explained by market factor. The lowest value comes from United Arab Emirates whereas the remaining figures are fluctuated over 0.3. Once again, market risk premium mainly contributes to stock return as the CAPM theory with the emerging markets testing scope. For two factors added into model, we recognize the unbalanced influence on stock returns for 25 emerging countries. The impact of co-skewness premium is less than the one of co-kurtosis. In particular, most co-skewness premium has positively affected to stock return with 24 over 53 coefficients (with five quantiles) at 1% significance level. Especially, Egypt, Qatar, Saudi Arabia, Thailand and

United Arab Emirates are the typical examples for explaining this element to national return, which means that the highest impact. However, for Mexico scope, this figure is in inverse relation. It is noticeable for investors when putting their money into this market, which could adversely generate negative return. When it comes to co-kurtosis premium, there are 67 coefficients over 89 parameters, which have significance level at 1%. Noticeably, most emerging markets' stock returns are explained by co-kurtosis premium with quite high ratio, 75% countries. Interestingly, this factor has two-side impact on stock returns of 25 regions. China, Egypt, Indonesia, Malaysia, Pakistan, Philippines, Qatar, Saudi Arabia, Taiwan, Thailand and United Arab Emirates experienced the negative parameters, which means that co-kurtosis premium causes negative effect on stock returns. Meanwhile, the remaining countries receives the coefficients ranging from 0.139 to 0.68 for same direction to stock returns. In terms of R^2, CAPM model expanded with higher co-moments can be explained from 3.7% to 47% for stock returns. To be more detail, our proposed model is less appropriate with Pakistan due to the lowest R^2. In contrast, Brazil has the highest value. To compared with the traditional CAPM model, this value of explanatory stands from 2% to 40% for listed securities (Jeald et. al., 2017).

5. Robustness

After individual regression by quantile approach, we employed panel data regression (with the total 25 emerging markets during 657 weeks) to ensure our higher co-moments have significance level for these countries. We approached by pooled-OLS, Fixed-effect model (FEM), Random-effect model (REM) and the test of errors in order to check robustness our aforementioned hypotheses. When testing for all samples of emerging stock markets, three factors including market risk premium, co-skewness and co-kurtosis premium also have significance level at 1% for three-regression approach. However, it is considerable to emphasize the positive effect of market as well as co-skewness on stock returns. However, it is shown that stock returns by these nations are negatively affected by co-kurtosis premium. After testing of Hausman test, we decide to choose Random Effect Model to estimate our research model. The result is not different among three-researched models (pooled-OLS, Fixed-effect model and random-effect model). According our tests, we defined that this method faces heteroscedasticity and serial correlation in first degree. Therefore, the quantile regression is the most appropriate solution for this phenomenon. In conclusion, our research model approaches the robustness for the total emerging markets.

6. Conclusion

Using higher co-moments as the independent variables, we conclude that co-skewness and co-kurtosis have significance level at ranging level from 1% to 10% besides market premium. These higher co-moments are risk factors influencing to stock returns on 25 emerging markets as MSCI classification. When adding into portfolios with securities from more co-skewness markets, the stock returns will be higher due to positive impact. This implies that the current portfolios are incurred by risks. Hence, the investors should be prudent to generate portfolios from negative co-skewness stock markets in developing markets. Finally, yet importantly, the co-kurtosis has different side with co-skewness. The higher co-kurtosis premium is added, the less return is generated. The international investor need to diversify with as low as possible kurtosis securities in emerging markets.

Interestingly, the expanded CAPM (with higher co-moments) will explain stock returns better than traditional one. In our further research, we are going to input more variables such as financial crisis, characteristics for each market, etc. in order to check stock return generation.

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Appendix

TABLE 1. DESCRIPTION STATISTICS FOR ALL DATA

Variable	Obs	Mean	Std. Dev.	Min	Max	Mean2	Skewness	Kurtosis
RMRF	657	0.000734	0.0319333	-0.22677	0.18445	0.003102	-0.8228328	10.8741
Brazil	657	0.001213	0.0356032	-0.22439	0.167507	0.00351	-0.3388773	7.49592
Colombia	657	0.000873	0.028631	-0.20609	0.087126	0.002779	-1.552683	12.55758
Czech	657	-0.00053	0.0310534	-0.30566	0.154801	0.001336	-1.537554	19.53333
Chile	657	0.00119	0.0241217	-0.21711	0.145669	0.001676	-1.213683	15.74788
China	657	0.00177	0.038143	-0.16372	0.149274	0.00191	-0.3051998	5.193385
Egypt	657	0.001546	0.0425797	-0.22071	0.193144	0.00362	-0.8329287	7.746489
Greece	657	-0.00247	0.0448372	-0.22553	0.174682	-9.4E-05	-0.5361047	5.310601
Hungary	657	0.000904	0.0337683	-0.26999	0.151037	0.001623	-1.011393	11.08158
India	657	0.002135	0.0303272	-0.17494	0.131594	0.004251	-0.4732632	6.53477
Indonesia	657	0.002226	0.0300781	-0.2341	0.114711	0.00397	-1.272566	11.26282
Korea	657	0.001085	0.0276649	-0.23024	0.169392	0.00297	-1.097871	13.83833
Malaysia	657	0.000716	0.0168638	-0.09815	0.065372	0.002022	-0.9004138	7.685709
Mexico	657	0.001723	0.0283027	-0.18024	0.18486	0.002752	-0.2068602	10.18273
Pakistan	657	0.002224	0.0302384	-0.20138	0.10826	0.00502	-1.335485	8.968902
Peru	657	0.002055	0.0377374	-0.34717	0.192975	0.002282	-1.144469	16.80231
Poland	657	0.000967	0.0273852	-0.17213	0.114895	0.002539	-0.7522393	6.886161
Philippines	657	0.001924	0.0277117	-0.20267	0.10958	0.003054	-0.9130487	9.451133
Qatar	657	-0.00068	0.0340681	-0.23035	0.119703	0.000785	-0.9087155	9.682564
Russia	657	0.001529	0.0424816	-0.27883	0.353316	0.002682	-0.153721	14.87231
Saudi Arabia	657	-0.00115	0.0376581	-0.23926	0.13751	0.001338	-1.302966	9.656281
South Africa	657	0.00194	0.025416	-0.09747	0.159806	0.003024	-0.0010146	7.367619
Taiwan	657	0.000538	0.0252864	-0.11373	0.093987	0.002308	-0.6914634	5.252421
Turkey	657	0.001872	0.0368439	-0.19386	0.15699	0.004273	-0.4929108	5.42868
Thailand	657	0.001047	0.0270157	-0.26774	0.106704	0.003278	-1.751413	18.36184
United AE	657	-0.0006	0.0288473	-0.21111	0.124802	0.000314	-1.369435	12.04062
Co-skewness	657	-0.00011	0.0195844	-0.11706	0.092628	0.001041	-0.9943512	9.75661
Co-kurtosis	657	-0.0006	0.0245798	-0.12463	0.211435	0.000143	0.3506985	14.19532

Note: We calculated total 18.396 observations for 25 emerging countries, estimated descriptive statistics to show that the return is distributed abnormally shape, and these returns could be generated by the skewness and kurtosis with the same co-movement in market.

Source: The authors.

TABLE 2. QUANTILE REGRESSION FOR INDIVIDUAL EMERGING MARKET (Q10, Q25, Q50, Q75 AND Q90) FOR RISK MARKET PREMIUM, CO-SKEWNESS PREMIUM AND CO-KURTOSIS PREMIUM ON STOCK RETURNS

Country		**Q10**			**Q25**			**Q50**	
	RMP	**CSKP**	**CKTP**	**RMP**	**CSKP**	**CKTP**	**RMP**	**CSKP**	**CKTP**
Brazil	0.752***	0.070	0.287***	0.826***	0.067	0.194***	0.746***	-0.02	0.328***
	[0.045]	[0.072]	[0.068]	[0.038]	[0.057]	[0.072]	[0.037]	[0.062]	[0.063]
		R^2=0.471			*R^2=0.442*			*R^2=0.412*	
Columbia	0.419***	0.188	0.232**	0.345***	0.160*	0.213***	0.342***	0.098*	0.204***
	[0.120]	[0.150]	[0.114]	[0.073]	[0.091]	[0.059]	[0.051]	[0.055]	[0.074]
		R^2=0.233			*R^2=0.197*			*R^2=0.168*	
Czech	0.595***	0.139	0.262**	0.494***	0.063	0.223***	0.467***	0.005	0.256***
	[0.104]	[0.098]	[0.115]	[0.041]	[0.071]	[0.050]	[0.052]	[0.078]	[0.073]
		R^2=0.350			*R^2=0.297*			*R^2=0.260*	
Chile	0.474***	0.130*	0.031	0.446***	0.141***	0.042	0.424***	0.097*	0.062
	[0.139]	[0.077]	[0.138]	[0.053]	[0.050]	[0.063]	[0.037]	[0.058]	[0.064]
		R^2=0.276			*R^2=0.237*			*R^2=0.222*	
China	0.698***	0.127	-0.67***	0.777***	0.239*	-0.79***	0.766***	0.100	-0.60***
	[0.109]	[0.154]	[0.227]	[0.095]	[0.125]	[0.163]	[0.081]	[0.111]	[0.129]
		R^2=0.110			*R^2=0.104*			*R^2=0.103*	
Egypt	1.029***	0.371***	-1.08***	0.840***	0.263***	-0.82***	0.643***	0.239**	-0.61***
	[0.170]	[0.139]	[0.163]	[0.108]	[0.078]	[0.078]	[0.086]	[0.101]	[0.091]
		R^2=0.193			*R^2=0.122*			*R^2=0.084*	
Greece	0.405***	0.006	0.686***	0.493***	0.219**	0.488***	0.539***	0.119	0.360***
	[0.124]	[0.105]	[0.187]	[0.123]	[0.091]	[0.172]	[0.053]	[0.085]	[0.086]
		R^2=0.228			*R^2=0.213*			*R^2=0.185*	
Hungary	0.554***	0.104	0.285**	0.541***	0.121*	0.286***	0.539***	0.217***	0.232***
	[0.099]	[0.125]	[0.122]	[0.066]	[0.069]	[0.073]	[0.052]	[0.052]	[0.072]
		R^2=0.298			*R^2=0.246*			*R^2=0.227*	
India	0.827***	0.026	-0.19	0.783***	-0.03	-0.10	0.729***	-0.00	-0.09
	[0.053]	[0.137]	[0.124]	[0.065]	[0.088]	[0.086]	[0.059]	[0.074]	[0.074]
		R^2=0.339			*R^2=0.332*			*R^2=0.316*	
Indonesia	0.830***	0.222*	-0.38**	0.637***	0.185	-0.15	0.573***	0.156	-0.05
	[0.100]	[0.131]	[0.153]	[0.080]	[0.127]	[0.125]	[0.061]	[0.110]	[0.090]
		R^2=0.312			*R^2=0.248*			*R^2=0.219*	
Korea	0.820***	0.054	-0.06	0.725***	-0.05	-0.05	0.665***	-0.02	-0.01
	[0.056]	[0.096]	[0.100]	[0.039]	[0.057]	[0.062]	[0.031]	[0.062]	[0.070]
		R^2=0.473			*R^2=0.444*			*R^2=0.404*	
Malaysia	0.480***	0.121*	-0.26***	0.413***	0.098**	-0.22***	0.398***	0.103***	-0.21***
	[0.056]	[0.070]	[0.049]	[0.028]	[0.042]	[0.045]	[0.029]	[0.027]	[0.038]
		R^2=0.291			*R^2=0.272*			*R^2=0.249*	
Mexico	0.616***	-0.22***	0.280***	0.560***	-0.15***	0.301***	0.456***	-0.14***	0.383***
	[0.073]	[0.044]	[0.082]	[0.041]	[0.047]	[0.064]	[0.031]	[0.054]	[0.056]
		R^2=0.433			*R^2=0.369*			*R^2=0.342*	
Pakistan	0.590***	0.173	-0.64***	0.376***	0.135	-0.31**	0.336***	0.093	-0.34***
	[0.185]	[0.129]	[0.228]	[0.107]	[0.099]	[0.132]	[0.052]	[0.064]	[0.073]
		R^2=0.069			*R^2=0.038*			*R^2=0.046*	
Peru	0.703***	0.173	-0.04	0.488***	0.133	0.183*	0.532***	0.214***	0.068
	[0.155]	[0.164]	[0.118]	[0.067]	[0.113]	[0.093]	[0.034]	[0.077]	[0.057]
		R^2=0.236			*R^2=0.204*			*R^2=0.182*	
Poland	0.481***	0.151*	0.266*	0.464***	0.177***	0.244**	0.488***	0.151***	0.194***
	[0.091]	[0.088]	[0.145]	[0.065]	[0.061]	[0.104]	[0.030]	[0.054]	[0.066]
		R^2=0.340			*R^2=0.314*			*R^2=0.294*	
Philippines	0.655***	0.215**	-0.22**	0.595***	0.153	-0.11*	0.589***	0.142**	-0.16*
	[0.099]	[0.102]	[0.100]	[0.052]	[0.106]	[0.069]	[0.042]	[0.071]	[0.083]
		R^2=0.253			*R^2=0.205*			*R^2=0.187*	
Qatar	0.737***	0.393***	-0.70***	0.518***	0.244***	-0.66***	0.404***	0.277**	-0.56***
	[0.139]	[0.116]	[0.172]	[0.118]	[0.069]	[0.143]	[0.070]	[0.108]	[0.110]
		R^2=0.122			*R^2=0.078*			*R^2=0.078*	
Russia	0.935***	0.111	0.256*	0.818***	0.153	0.178	0.738***	0.009	0.309***
	[0.107]	[0.102]	[0.154]	[0.086]	[0.117]	[0.195]	[0.069]	[0.091]	[0.104]

TABLE 2. QUANTILE REGRESSION FOR INDIVIDUAL EMERGING MARKET (Q10, Q25, Q50, Q75 AND Q90) FOR RISK MARKET PREMIUM, CO-SKEWNESS PREMIUM AND CO-KURTOSIS PREMIUM ON STOCK RETURNS

Country	**Q10**			**Q25**			**Q50**		
	RMP	**CSKP**	**CKTP**	**RMP**	**CSKP**	**CKTP**	**RMP**	**CSKP**	**CKTP**
		R^2=0.399			*R^2=0.322*			*R^2=0.281*	
Saudiarabia	0.895***	0.146	-1.17***	0.627***	0.350***	-0.93***	0.428***	0.334**	-0.68***
	[0.139]	[0.207]	[0.132]	[0.073]	[0.109]	[0.128]	[0.067]	[0.130]	[0.104]
		R^2=0.159			*R^2=0.118*			*R^2=0.081*	
Southafrica	0.622***	-0.05	0.112	0.522***	0.016	0.194***	0.528***	0.010	0.139***
	[0.055]	[0.087]	[0.079]	[0.046]	[0.062]	[0.064]	[0.032]	[0.052]	[0.035]
		R^2=0.411			*R^2=0.363*			*R^2=0.334*	
Taiwan	0.801***	0.081	-0.19**	0.732***	-0.05	-0.15*	0.689***	-0.05	-0.13*
	[0.050]	[0.073]	[0.076]	[0.043]	[0.071]	[0.089]	[0.049]	[0.064]	[0.073]
		R^2=0.438			*R^2=0.383*			*R^2=0.342*	
Turkey	0.865***	0.055	0.087	0.747***	0.090	0.177	0.665***	0.000	0.270***
	[0.084]	[0.101]	[0.109]	[0.070]	[0.143]	[0.137]	[0.036]	[0.132]	[0.071]
		R^2=0.303			*R^2=0.272*			*R^2=0.248*	
Thailand	0.715***	0.271**	-0.31**	0.658***	0.192**	-0.25***	0.626***	0.075	-0.16***
	[0.119]	[0.121]	[0.130]	[0.050]	[0.077]	[0.066]	[0.043]	[0.050]	[0.056]
		R^2=0.274			*R^2=0.265*			*R^2=0.221*	
Unitedae	0.535***	0.292**	-0.74***	0.370***	0.304***	-0.54***	0.350***	0.127*	-0.50***
	[0.095]	[0.147]	[0.131]	[0.044]	[0.100]	[0.073]	[0.045]	[0.071]	[0.062]
		R^2=0.121			*R^2=0.085*			*R^2=0.074*	

Note: This table reports the five-quantile regression results including τ = 0.1, 0.25, 0.5, 0.75 and 0.9 for the research model on equally-weighted portfolios. The above table is conducted for 65,700 observations (compatible with weekly collected data) of 25 emerging markets during 657 weeks. Portfolios are maintained in the research process to measure effects of co-skewness on stock returns. The risk factors are estimated by quantile regression on excess portfolio returns and risk free rate on the corresponding market, co-skewness as well as co-kurtosis risk factors. (*), (**), (***) reflected statistically significant of the corresponding coefficients at 10%, 5% and 1% level. Standard errors of the corresponding coefficients are reflected in square brackets. The last row reports R^2 of the model including these variables.
Source: The authors.

TABLE 2 (CONT). QUANTILE REGRESSION FOR INDIVIDUAL EMERGING MARKET (Q10, Q25, Q50, Q75 AND Q90) FOR RISK MARKET PREMIUM, CO-SKEWNESS PREMIUM AND CO-KURTOSIS PREMIUM ON STOCK RETURNS

Country	**Q75**			**Q90**		
	RMP	**CSKP**	**CKTP**	**RMP**	**CSKP**	**CKTP**
Brazil	0.692*** [0.045]	-0.01 [0.128]	0.340*** [0.083]	0.741*** [0.070]	-0.04 [0.190]	0.296** [0.140]
		R^2=0.396			*R^2=0.395*	
Columbia	0.317*** [0.056]	0.186*** [0.053]	0.177** [0.086]	0.260*** [0.088]	0.198* [0.101]	0.230* [0.125]
		R^2=0.152			*R^2=0.144*	
Czech	0.507*** [0.060]	0.030 [0.070]	0.250*** [0.053]	0.488*** [0.046]	0.047 [0.092]	0.320*** [0.073]
		R^2=0.262			*R^2=0.307*	
Chile	0.341*** [0.050]	0.037 [0.118]	0.128 [0.119]	0.297*** [0.058]	0.110 [0.118]	0.128 [0.119]
		R^2=0.203			*R^2=0.198*	
China	0.607*** [0.066]	-0.00 [0.131]	-0.43*** [0.132]	0.553*** [0.152]	-0.17 [0.125]	-0.42** [0.169]
		R^2=0.084			*R^2=0.054*	
Egypt	0.682*** [0.096]	0.158 [0.114]	-0.66*** [0.117]	0.657*** [0.071]	0.210 [0.132]	-0.58*** [0.111]
		R^2=0.081			*R^2=0.090*	
Greece	0.475*** [0.074]	0.202** [0.095]	0.431*** [0.122]	0.460*** [0.094]	0.318*** [0.105]	0.415*** [0.142]
		R^2=0.169			*R^2=0.156*	
Hungary	0.455*** [0.059]	0.194*** [0.073]	0.281*** [0.083]	0.632*** [0.095]	0.183 [0.112]	0.047 [0.108]
		R^2=0.234			*R^2=0.256*	
India	0.691*** [0.056]	0.006 [0.043]	-0.11 [0.076]	0.731*** [0.071]	-0.00 [0.067]	-0.07 [0.108]
		R^2=0.301			*R^2=0.296*	
Indonesia	0.537*** [0.061]	0.088 [0.120]	0.030 [0.091]	0.643*** [0.066]	0.185** [0.085]	-0.04 [0.112]

TABLE 2 (CONT). QUANTILE REGRESSION FOR INDIVIDUAL EMERGING MARKET (Q10, Q25, Q50, Q75 AND Q90) FOR RISK MARKET PREMIUM, CO-SKEWNESS PREMIUM AND CO-KURTOSIS PREMIUM ON STOCK RETURNS

Country		**Q75**			**Q90**	
	RMP	**CSKP**	**CKTP**	**RMP**	**CSKP**	**CKTP**
		R^2=0.228			*R^2=0.258*	
Korea	0.665*** [0.030]	-0.00 [0.088]	-0.01 [0.085]	0.638*** [0.049]	0.091 [0.061]	-0.00 [0.125]
		R^2=0.367			*R^2=0.367*	
Malaysia	0.424*** [0.031]	0.149** [0.069]	-0.23*** [0.060]	0.390*** [0.051]	0.132* [0.067]	-0.17*** [0.067]
		R^2=0.235			*R^2=0.245*	
Mexico	0.492*** [0.043]	-0.10 [0.072]	0.332*** [0.066]	0.439*** [0.043]	-0.12** [0.049]	0.318*** [0.045]
		R^2=0.341			*R^2=0.344*	
Pakistan	0.237*** [0.053]	0.088 [0.075]	-0.27*** [0.056]	0.243*** [0.086]	0.068 [0.085]	-0.32*** [0.105]
		R^2=0.037			*R^2=0.037*	
Peru	0.597*** [0.071]	0.332*** [0.085]	0.053 [0.097]	0.638*** [0.079]	0.397*** [0.120]	-0.02 [0.096]
		R^2=0.162			*R^2=0.168*	
Poland	0.475*** [0.036]	0.151*** [0.040]	0.158*** [0.054]	0.557*** [0.052]	0.190*** [0.040]	0.054 [0.042]
		R^2=0.291			*R^2=0.288*	
Philippines	0.542*** [0.065]	-0.00 [0.051]	-0.06 [0.080]	0.577*** [0.080]	-0.02 [0.093]	-0.13 [0.104]
		R^2=0.179			*R^2=0.161*	
Qatar	0.516*** [0.077]	0.314** [0.130]	-0.66*** [0.079]	0.561*** [0.104]	0.296** [0.141]	-0.73*** [0.121]
		R^2=0.089			*R^2=0.108*	
Russia	0.668*** [0.058]	-0.02 [0.100]	0.401*** [0.092]	0.693*** [0.102]	-0.17 [0.165]	0.370** [0.153]
		R^2=0.274			*R^2=0.264*	
Saudiarabia	0.445*** [0.081]	0.442*** [0.110]	-0.72*** [0.101]	0.576*** [0.075]	0.356*** [0.126]	-0.83*** [0.087]
		R^2=0.093			*R^2=0.118*	
Southafrica	0.505*** [0.032]	-0.02 [0.042]	0.096** [0.037]	0.450*** [0.056]	0.034 [0.079]	0.130* [0.071]
		R^2=0.318			*R^2=0.311*	
Taiwan	0.592*** [0.049]	-0.01 [0.052]	-0.10 [0.068]	0.627*** [0.058]	0.022 [0.071]	-0.15 [0.094]
		R^2=0.323			*R^2=0.301*	
Turkey	0.489*** [0.034]	0.018 [0.100]	0.369*** [0.061]	0.447*** [0.080]	0.027 [0.103]	0.372*** [0.128]
		R^2=0.238			*R^2=0.242*	
Thailand	0.470*** [0.063]	0.070 [0.080]	-0.02 [0.081]	0.478*** [0.051]	0.051 [0.115]	-0.04 [0.068]
		R^2=0.185			*R^2=0.190*	
Unitedae	0.419*** [0.048]	0.143* [0.075]	-0.62*** [0.060]	0.519*** [0.097]	0.142 [0.103]	-0.77*** [0.108]
		R^2=0.081			*R^2=0.099*	

Note: This table reports the five-quantile regression results including τ = 0.1, 0.25, 0.5, 0.75 and 0.9 for the research model on equally-weighted portfolios. The above table is conducted for 65,700 observations (compatible with weekly collected data) of 25 emerging markets during 657 weeks. Portfolios is maintained in the research process to measure effects of co-skewness on stock returns. The risk factors are estimated by quantile regression on excess portfolio returns and risk free rate on the corresponding market, co-skewness as well as co-kurtosis risk factors. (*), (**), (***) reflected statistically significant of the corresponding coefficients at 10%, 5% and 1% level. Standard errors of the corresponding coefficients are reflected in square brackets. The last row reports R^2 of the model including these variables.
Source: The authors.

TABLE 3. POOL-OLS, FIXED-EFFECT MODEL AND RANDOM-EFFECT MODEL FOR ROBUSTNESS

VARIABLE	POOLED-OLS	FEM	REM
RMRF	0.6027503*** [0.0093551]	0.6027503*** [0.009353]	0.6027503*** [0.009353]
CSKP	0.1255972*** [0.0110196]	0.1255972*** [0.0110171]	0.1255972*** [0.0110171]
CKTP	-0.0987943*** [0.0122943]	-0.0987943*** [0.0122915	-0.0987943*** [0.0122915]
_cons	0.0004734*** [0.0002092]	0.0004734*** [0.0002091]	0.0004734*** [0.0002396]
Adjusted R^2	0.3162	0.3164	0.3164
Observation	16,425	16,425	16,425

Note: (*), (**), (***) reflected statistically significant of the corresponding coefficients at 10%, 5% and 1% level. Standard errors of the corresponding coefficients are reflected in square brackets. The two last rows report Adjusted R^2 and observations of the model including these variables, respectively.
Source: The authors.

TABLE 4. HAUSMAN TEST TO CHOOSE FIXED-EFFECT MODEL AND RANDOM-EFFECT MODEL

Variables	(b) Fixed	(B)	(b – B)	SQRT(diag (V_b-V_B))
RMRF	0.6027503	0.6027503	2.00e-15	2.33e-10
CSKP	0.1255972	0.1255972	-9.16e-16	
CKTP	-0.0987943	-0.0987943	-1.62e-15	
Results: Chosen Random-effect model				

Note: Denoted: b = consistent under H0 and Ha; obtained from regression whereas B = inconsistent under Ha, efficient under Ho; obtained from regression. Test: H0: difference in coefficients not systematic. chi2(3) = $(b-B)'[(V\_b-V\_B)^{(-1)}](b-B)$. P-value = 1.000. (V_b-V_B is not positive definite)
Source: The authors.

TABLE 5. TEST OF ERROR THE MODELS ABOVE

TESTS	POOLED-OLS	FEM	REM
Multicollinearity	Yes	Yes	Yes
Heteroscedasticity	Yes	Yes	Yes
Serial correlation	Yes	Yes	Yes
Endogeneity with lags(1) of dependent variables	No	No	No

Note: Denoted: We used Variance Inflation Factor (VIF), test for Heteroscedasticity and serial correlation regression to define the error of models.
Source: The authors.