

## The Fama-French Five-Factor Model: Evidence of the Emerging Markets Exchange Traded Funds Performance

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DOI: 10.14595/CP/03/005

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**Abstract** The main purpose of this study is to provide an insight into the investment performance of emerging markets' exchange-traded funds. The Fama-French five-factor model was used to perform the regression of the returns of individual exchange-traded funds that have exposure to emerging markets, against the model's factors. The study uses monthly returns and covers the period from August 2017 until December 2021, due to the exchange-traded funds' inception date the track record was limited. Overall, the findings are in the line with the Fama-French five-factor model initial results. According to these results, expected positive contributors to the investment performance are, in the presented order of importance, market premium and small-capitalization, as well as funds' tilt towards stocks of the companies with strong operating profit and conservative investing policy. However, there is one exception and that is the growth style that outperformed the value style. Therefore, the value-style tilt of some of the emerging markets' exchange-traded funds led to negative performance contributions, because the style was out of favor. At the same time, during the observed period, there were no exchange-traded funds that delivered statistically significant alpha. Moreover, only one of emerging markets' exchange-traded fund produced a positive alpha, the other three underperformed in relation to the adequate benchmark as per the Fama-French five-factor model.

**Keywords:** Emerging markets, Fama-French model, Exchange-traded funds' performance

**JEL:** G110

### Introduction

This study aims to provide insight into the investment performance of exchange-traded funds (ETFs) that have exposure to emerging markets. The component of the investment performance evaluation process that needs to be applied to accommodate the stated aim is known as investment performance attribution. To conduct investment performance attribution, it is necessary to identify the components of the excess return concerning the appropriate benchmark. Various attribution models are used to fulfill this goal. However, all the models can be categorized into two groups that are used for investment performance attribution.

The first group is known as asset-based models. These types of models use, in addition to historical returns, holdings data for the portfolio and benchmark (Korenak & Stakic, 2021).

The second group is represented by factor models. The model that has been used in this research belongs to this group. The literature review section provides a chronological

overview of the mentioned models group, as well as its application in the research that followed.

## Theoretical premises

Arguably the most used factor model, partially due to its simplicity, is Capital Asset Pricing Model (CAPM), introduced many decades ago, even though it failed many empirical tests (Black et al., 1972; Fama & French, 2004). This is a single factor model that explains expected return using the market premium as a factor.

As an extension to the CAPM, Fama-French three-factor model identifies common risk factors in the returns on stocks and bonds (Fama & French, 1993). Regarding the stock-market, three factors were identified: an overall market factor, same as in CAPM, and additional factors related to firm size, small minus big (SMB), and book-to-market equity, high-minus-low book-to-market ratio (HML). According to the model extension, there are stock return premiums for the stocks that have small market capitalization and the ones that can be characterized as value-style stocks based on a high book-to-market ratio.

Another extension to the model is the Carhart (1997) four-factor model, which uses momentum as an additional factor (Carhart, 1997). For example, one of the studies applied the Fama–French and Carhart models to the South African stock market (SASM) (Boamah, 2015). The study examined the ability of the models to capture size, book-to-market, and momentum effects on the SASM. The author offered evidence that size, book-to-market, and momentum effects exist on the SASM. Also, the small- and high-book-to-market stocks portfolios, respectively, appear riskier than the big- and low- book-to-market stocks portfolios

One of the most prominent examples of the multi-factor model is the Fama-French five-factor model (Fama & French, 2015). The five-factor model extends the three-factor Fama-French model by adding two factors: robust-minus-weak profitability (RMW) and conservative-minus-aggressive investment (CMA). According to model extensions, there are additional stock return premiums for the companies that have a higher level of profitability and for the ones who invest conservatively. The authors also concluded that with the addition of profitability and investment factors, the value factor of the previously used

three-factor Fama-French model becomes redundant for describing average returns in the sample that they examined.

In the following paper, the same authors show that positive exposures to RMW and CMA (stock returns that behave like those of profitable firms that invest conservatively) capture the high average returns associated with the low market beta, share repurchases, and low stock return volatility, and vice versa (Fama & French, 2016).

The study that followed covered the international markets application of the Fama-French five-factor model, and concluded that the average stock returns for North America, Europe, and the Asia Pacific increase with the book-to-market ratio (B/M) and profitability are negatively related to investment. That is in the line with the original conclusions from the prior studies. On the other hand, what is also common with the previous research conducted by Fama-French model's main problem is the failure to fully capture the low average returns of small stocks whose returns behave like those of low profitability firms that invest aggressively (Fama & French, 2017).

The paper published by Foye J. studied whether the new Fama-French five-factor model can offer a better description of emerging market equity returns than the three-factor model. The study covered three different geographic regions, across 18 emerging markets. The findings suggest that the five-factor model consistently outperforms the three-factor model in Eastern Europe and Latin America. On the other hand, a profitability or investment premium cannot be distinguished in the Asian markets and the five-factor model fails to provide an improved description of equity returns in the region (Foye, 2018).

Horváth, D. and Wang, Y.-L. (2021) pointed out that the Fama-French five-factor model performed poorly during the Covid-19 outbreak. The comparison was made to the financial crisis of 2008, when the model also drastically lost its explanation power based on the coefficient of determination (Horváth & Wang, 2021).

In one of the most recent published studies that used the Fama-French five-factor model, Mollaahmetoğlu E. (2021) tested model validity for Istanbul and German Stock Exchanges. Findings suggest that there is not enough evidence to support the explanation power of the five-factor model. The author argues that a four-factor model would be a better fit for the stock returns listed on the Istanbul stock exchange. He also concluded

that contraction of the model's factors would be a better fit for the German stocks (Mollaahmetoğlu, 2021).

The study conducted by Dutta, A. (2019) came to a similar conclusion, i.e. that five-factor specification is more powerful than three-factor specification. However, the findings also suggest that if the book-to-market factor is excluded from the five-factor model, the resulting four-factor model documents almost similar power to the five-factor model (Dutta, 2019).

Mosoou, S. and, Kodongo O. used Fama-French five-factor model on selected developing and developed equity markets. Their findings suggest that profitability is the single most important factor explaining average equity returns in emerging markets. However, the authors also found out that the market factor does not appear to explain emerging markets' equity returns during the observed period (Mosoou & Kodongo, 2020).

## Methodology

Monthly returns of four emerging markets exchange-traded funds were used. The observed period is from August 2017 to December 2021 (the track record is limited due to the inception date). The following ETFs are included: Invesco BLDERS Emerging Markets 50 ADR (ADRE), iShares MSCI BRIC ETF (BKF), iShares MSCI Emerging Mkts ex-China ETF (EMXC), and SPDR S&P Emerging Markets Small-Cap ETF (EWX).

The first version of the Fama-French model was an extension of the industry's prevailing model at the time, mainly to its simplicity. It was a single factor model, known as the CAPM. The only factor it considers is the difference between market and risk-free return.

In addition to market premium, the researchers argued that two more factors possess explanation power. First is the size of the company, observed through market capitalization. The other is a proxy for the value investment style, namely the book-to-market ratio. The rationalization behind the inclusion of the additional factors is that small companies, on average, should outperform their large peers, at the same time companies that have higher book-to-market ratios should outperform the ones with lower ratios.

Acronym SMB stands for the small minus big (market capitalization) and HML stands for the high minus low (book-to-market ratio).

$$(1) \quad R_{it} - R_{ft} = a_i + b_i(R_{Mt} - R_{ft}) + s_iSMB_t + h_iHML_t + e_{it}$$

In the year 2015, the authors revisited their original model and proposed an extension to it. Two additional factors have been added.

$$(2) \quad R_{it} - R_{ft} = \alpha_i + b_i(R_{Mt} - R_{ft}) + s_iSMB_t + h_iHML_t + r_iRMW_t + c_iCMA_t + e_{it}$$

In practice, there are different ways in which the factors can be obtained. We present the 2x3 approach. This approach is based on six size/book-to-market, six size/operating profitability, and six size/investment portfolios. Size factor can be obtained as the average return on the nine small-size portfolios minus the average return on the nine large-size portfolios.

$$(3) \quad \begin{aligned} SMB(B/M) = & 1/3 (\text{Small Value} + \text{Small Neutral} + \text{Small Growth}) - \\ & 1/3 (\text{Big Value} + \text{Big Neutral} + \text{Big Growth}) \end{aligned}$$

$$(4) \quad \begin{aligned} SMB(OP) = & 1/3 (\text{Small Robust} + \text{Small Neutral} + \text{Small Weak}) - \\ & 1/3 (\text{Big Robust} + \text{Big Neutral} + \text{Big Weak}) \end{aligned}$$

$$(5) \quad \begin{aligned} SMB(INV) = & 1/3 (\text{Small Conservative} + \text{Small Neutral} + \text{Small Aggressive}) - \\ & 1/3 (\text{Big Conservative} + \text{Big Neutral} + \text{Big Aggressive}) \end{aligned}$$

So, the SMB factor is a simple average of the previously obtained components.

$$(6) \quad SMB = 1/3 (SMB(B/M) + SMB(OP) + SMB(INV))$$

The rest of the factors can be obtained in the following way.

$$(7) \quad HML = 1/2 (\text{Small Value} + \text{Big Value}) - 1/2 (\text{Small Growth} + \text{Big Growth})$$

$$(8) \quad RMW = 1/2 (\text{Small Robust} + \text{Big Robust}) - 1/2 (\text{Small Weak} + \text{Big Weak})$$

$$(9) \quad \begin{aligned} CMA = & 1/2 (\text{Small Conservative} + \text{Big Conservative}) - \\ & 1/2 (\text{Small Aggressive} + \text{Big Aggressive}) \end{aligned}$$

## Results

The results of the Fama-French five-factor model are presented at the individual level for all four analyzed emerging markets exchange-traded funds (Tables 1, 2, 3, and 4). The

coefficients of determination range from 91.96% to 96.80%. F-stat shows a high value and corresponding low p-value for all tested ETFs. There is no presence of significant autocorrelation and heteroscedasticity.

When the market premium is high, all observed emerging markets ETFs perform well, as expected. The coefficients are close to one (0.95 to 1.09). At the same time, t-stat is in the range of 19.453 to 30.390, which leads to the conclusion that this factor has very high explanation power concerning the performance.

The periods when small-size stocks outperform large-size stocks lead to a favorable outcome for two out of four observed ETFs. ADRE and BKF ETFs show a clear exposure tilt towards large-cap stocks. On the other hand, EWX shows relatively significant exposure to small-cap stocks. In both cases t-stat is significant. At the same time, EMXC is relatively neutral when it comes to market cap tilt.

The relative performance of value versus growth style based on market-to-book ratio does not pose significant explanation power, for all observed ETFs. This can be concluded based on relatively low coefficient values with the corresponding low t-stat.

Two more factors need to be considered. The operating profit factor shows a relatively low coefficient but with statistical significance in the case of ADRE, meaning when the returns on the high profitable stocks outperform their peers, the impact is negative for the mentioned ETF.

The investing factor indicates that ADRE and BKF have exposure to the stock of the companies that pursue more aggressive investing policies. The opposite is true when it comes to EMXC. At the same time, the t-stat value suggests statistical significance. The same factor does not show significance in the case of EWX.

**Table 1.** Invesco BLDRS Emerging Markets 50 ADR  
(ADRE) Fama-French Five-Factor Model Results  
(Aug 2017-Dec 2021)

Factors	Rm-Rf	SMB	HML	RMW	CMA	Annual Alpha	R <sup>2</sup>	F-stat
coefficient	1.04	-0.65	-0.05	-0.44	-0.49	-0.34%	91.96%	107.5
t-stat	19.182	-4.099	-0.261	-2.216	-2.239	-0.116		
p-value	0.000	0.000	0.795	0.032	0.030	0.908		

*Source: own work*

**Table 2.** iShares MSCI BRIC ETF (BKF) Fama-French Five-Factor Model Results

(Aug 2017-Dec 2021)

Factors	Rm-Rf	SMB	HML	RMW	CMA	Annual Alpha	R <sup>2</sup>	F-stat
coefficient	0.95	-0.48	0.07	-0.15	-0.67	-0.67%	92.28%	112.4
t-stat	19.453	-3.375	0.445	-0.867	-3.426	-0.258		
p-value	0.000	0.001	0.658	0.390	0.001	0.798		

Source: own work

**Table 3.** iShares MSCI Emerging Mkts ex-China ETF

(EMXC) Fama-French Five-Factor Model Results

(Aug 2017-Dec 2021)

Factors	Rm-Rf	SMB	HML	RMW	CMA	Annual Alpha	R <sup>2</sup>	F-stat
coefficient	1.09	0.09	-0.02	0.13	0.64	-1.06%	96.15%	235.0
t-stat	30.390	0.830	-0.191	1.005	4.497	-0.553		
p-value	0.000	0.411	0.850	0.320	0.000	0.583		

Source: own work

**Table 4.** SPDR S&P Emerging Markets Small-Cap ETF (EWX) Fama-French Five-Factor Model Results

(Aug 2017-Dec 2021)

Factors	Rm-Rf	SMB	HML	RMW	CMA	Annual Alpha	R <sup>2</sup>	F-stat
coefficient	0.99	0.72	0.08	-0.06	0.03	0.86%	94.80%	171.5
t-stat	24.966	6.258	0.609	-0.430	0.179	0.404		
p-value	0.000	0.000	0.545	0.669	0.859	0.688		

Source: own work

Annualized alphas are negative for three out of three ETFs. They also show no statistical significance. For the model comprising purpose, using the three-factor Fama-French model, EWX was once again the only ETF that delivered the positive alpha. Also, the five-factor model provided higher explanatory power than the three-factor model. Only when the coefficient of determination was adjusted to penalize the additional factors, it resulted in slightly less value in the case of the five-factor model for EWX (Table 5).

**Table 5.** Multifactor models comparison

Name	Fama-French Three-Factor model			Fama-French Five-Factor model		
	Monthly Alpha	R <sup>2</sup>	R <sup>2</sup> Adjusted	Monthly Alpha	R <sup>2</sup>	R <sup>2</sup> Adjusted
ADRE	-0.09%	90.4%	89.8%	-0.35%	92.0%	91.1%
BKF	-0.05%	90.3%	89.7%	-0.06%	92.3%	91.4%
EMXC	-0.10%	94.5%	94.2%	-0.09%	96.2%	95.7%
EWX	0.06%	94.8%	94.5%	0.07%	94.8%	94.3%

Source: own work

Investment performance appraisal measures for the observed ETFs confirmed that SPDR S&P Emerging Markets Small-Cap ETF (EWX) outperformed the peer group on a risk-adjusted basis. That can be seen by higher values of Sharpe, Sortino, Calmar, and Information ratios. At the same time, it exhibits the lowest expected losses according to VaR., with exception of analytical VaR for the benchmark that is slightly lower. This time a single-benchmark iShares MSCI Emerging Markets ETF (EEM) that captures 24 emerging markets countries was used (Table 6).

**Table 6.** Descriptive Statistics and Investment Performance Appraisal for Emerging Markets ETFs (Aug 2017-Dec 2021)

Measure	ADRE	BKF	EMXC	EWX	Benchmark
Arithmetic Mean (monthly)	0.51%	0.50%	0.69%	0.78%	0.52%
Arithmetic Mean (annualized)	6.25%	6.11%	8.59%	9.80%	6.45%
Geometric Mean (monthly)	0.34%	0.36%	0.54%	0.64%	0.40%
Geometric Mean (annualized)	4.19%	4.37%	6.64%	8.00%	4.86%
Standard Deviation (monthly)	5.77%	5.29%	5.48%	5.22%	5.04%
Standard Deviation (annualized)	19.99%	18.31%	18.98%	18.09%	17.45%
Downside Deviation (monthly)	3.82%	3.55%	3.75%	3.57%	3.44%
Maximum Drawdown	-27.76%	-25.91%	-34.43%	-35.85%	-29.69%
Beta	1.08	1.01	1.02	0.95	1.00
Alpha (annualized)	-0.71%	-0.37%	1.89%	3.42%	NA
R Squared	89.27%	91.95%	87.49%	84.09%	100.00%
Sharpe Ratio	0.25	0.26	0.38	0.45	0.29
Sortino Ratio	0.37	0.39	0.54	0.66	0.43
Treynor Ratio (%)	4.58	4.80	7.03	8.70	5.15
Calmar Ratio	0.42	0.38	0.40	0.58	0.42
Active Return	-0.67%	-0.49%	1.78%	3.14%	NA
Tracking Error	6.71%	5.19%	6.72%	7.26%	NA
Information Ratio	-0.10	-0.09	0.27	0.43	NA
Skewness	-0.09	-0.27	-0.80	-1.01	-0.48
Excess Kurtosis	0.57	0.84	3.75	4.23	0.93
Historical Value-at-Risk (5%)	-8.14%	-7.24%	-6.47%	-5.22%	-6.79%
Analytical Value-at-Risk (5%)	-8.99%	-8.20%	-8.32%	-7.81%	-7.76%

Source: own work

However, to get a better insight into the investment performance of the emerging markets' ETFs it is necessary to decompose the tracking record. To do that the performance attribution results are presented (Table 7).



Starting with the market premium, the outperformance of the stock market about the risk-free proxy created a quite favorable environment for all observed emerging markets ETFs. The outperformance of the small to large stocks created an additional layer of positive return to the ETFs that had a bias toward the small-cap stocks. At the same time, ADRE and BKF experienced negative return contributions due to their tilt towards large-cap stocks. The results are in the line with expectations of the Fama-French model studies and the outperformance of the small- vs large-cap stocks. The value style delivered lower returns than the growth style, judging by the book-to-market ratio. Due to exposure to stocks with a relatively high book-to-market ratio, in the case of ADRE and EMXC the value was lost. The other two ETFs had the benefit of the growth style outperformance. Exposure to stocks of the companies that have strong operating profits together with the outperformance of these stocks to their peers resulted in the added value only in the case of EMXC. The stocks of the companies with conservative investing have underperformed. However, due to the negative exposure to this factor, the value was added in the case of EMXC and EWX.

**Table 7.** Emerging Markets ETFs Performance Attribution (Aug 2017-Dec 2021)

Name	Rm-Rf	SMB	HML	RMW	CMA	Total	Annual Alpha	R <sup>2</sup>
Invesco BLDRS Emerging Markets 50 ADR (ADRE)	59.44	-3.48	-1.38	-6.30	-3.87	41.58	-0.34%	91.96%
iShares MSCI BRIC ETF (BKF)	54.07	-2.57	2.11	-2.21	-5.31	40.46	-0.67%	92.28%
iShares MSCI Emerging Mkts ex-China ETF (EMXC)	61.91	0.46	-0.66	1.88	5.11	59.85	-1.06%	96.15%
SPDR S&P Emerging Markets Small-Cap ETF (EWX)	56.40	3.88	2.35	-0.89	0.23	69.13	0.86%	94.80%
Factor Premiums (BPS)	56.91	5.38	30.08	14.36	7.94			

*Source: own work*

## Conclusion

The main purpose of this study is to provide an insight into the investment performance of emerging markets' exchange-traded funds, and it was achieved by deploying the Fama-French five-factor model for the observed emerging markets ETFs.

Fama-French five-factor model showed a higher explanation power in relation to the three-factor model and single-benchmark model. It is worth mentioning that there is a high level of consistency among models and appraisal measures regarding ETFs' excess return and risk ranking.

Classifying an ETF as an emerging market investment might not be insightful enough for an investor. Utilizing this model from the perspective of an investor provides an insight into the factor exposures of the particular ETFs that are part of the current portfolio or being considered to be included in the portfolio. Only once being able to understand the associate risk exposures of emerging markets ETFs, as a relatively new investment instrument, should be included in the portfolio. Moreover, an ETF risk/return profile needs to be always considered in the overall portfolio context.

The findings lead to a twofold set of conclusions. The first pertains to the Fama-French five-factor model application itself and corresponding factor exposures. The other set of findings pertains to the performance attribution of the analyzed emerging markets ETFs and their components.

Within the span of the observed relative short-time period, the market premium is still the main factor to explain the investment performance of the emerging markets ETFs. That means that emerging market stock premium over risk-free rate is the key determinant of the emerging markets ETFs, as expected. The size factor is in the line with initial findings from the Fama-French model, and subsequent studies. The small-cap stock outperformed on average the ones with large-cap.

However, the value style has been out of favor in comparison to the value style for the past decade and is shown in this study as well. The emerging markets stocks of the companies that have higher operating profit outperformed their peers. This is also in line with expectations from the model. Finally, the stocks of the companies that had conservative investing policies outperformed in relation to their peers. Once again this is in the line with the model expectations.

Overall, the findings are in the line with the Fama-French five-factor model initial results. According to these results expected positive contributors to the investment performance are, in the presented order of importance, market premium and small-capitalization, as well as funds' tilt towards stocks of the companies with strong operating profit, and conservative investing policy. However, there is one exception and that is the growth style that outperformed the value style. Therefore value-style tilt of some of the emerging markets ETFs led to negative performance contributions because the style was out of favor.

Understanding the source of the realized ETFs results is possible by using multifactor models for the investment performance attribution. Doing so makes it relatively straightforward to determine which factors were in favor and due to exchange-traded funds' exposures over time the given performance was delivered. Exposures to the given factors defined the direction and levels of sensitivity. Together with the market premium and other factors effects the performance of each emerging market ETFs were presented.

Lastly, during the observed period, there was no emerging markets ETF that was able to deliver statistically significant alpha. Moreover, only one emerging markets ETF produced a positive alpha, the other three underperformed in relation to the adequate benchmark as per the Fama-French Five-Factor model. The excess return results show a high level of consistency using the Fama-French three-factor model, as well as the single-benchmark model. Possible further studies that may complement this one might be in the field of asset-based attribution. The same one would include in addition to return track-record dynamic holdings data for emerging markets ETFs and benchmarks. The application of both types of mentioned investment performance attribution models provides an explanation of all aspects of return and risk sources of the observed ETFs. Additionally, it quantifies the sources of investment success and offers in-depth feedback regarding the impact of investment choices on risks and realized returns. This kind of information is highly valuable to the current and potential investors in emerging markets ETFs.

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**Proceedings of the 2022 IX International Scientific Conference Determinants  
of Regional Development, No 3, Pila 27 - 28 October 2022**

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