Fama–French Five-Factor Model: Usefulness in Emerging Markets

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Abstract

I investigate whether the Fama–French five-factor model Fama and French (2015) is useful for understanding and explaining returns in emerging markets. Using monthly data from 1990 to 2023 for six value-weighted portfolios, I estimate OLS regressions to test whether the factors explain returns. I find statistically significant coefficients for the market, size, and value factors, whereas profitability and investment show less explanatory power. The paper concludes that the five-factor model is relevant for explaining the returns of emerging-market portfolios.

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Introduction

In the financial and academic communities, models proposed to explain portfolio returns—and their applications—are generally developed for advanced markets; therefore, the study of their validity in emerging markets has been relegated.

The objective of this paper is to analyze whether the five-factor model proposed by Fama and French (2015) is applicable in emerging markets. The existing literature offers no consensus on the empirical validity of this model in such markets.

The following research hypotheses are posed:

1. The portfolio intercepts will tend toward zero, showing that the factors explain portfolio returns.
2. The factors **1) *market*, 2) *size*, 3) *value*, 4) *profitability*, and 5) *investment*** are relevant for explaining portfolio returns in emerging markets.
3. The Fama and French five-factor model is capable of explaining portfolio returns in emerging markets.

Thus, this paper seeks to validate the model by testing its ability to explain emerging-market portfolio returns using an ordinary least squares model and analyzing whether the estimated coefficients align with the model's predictions.

Theoretical Framework

Since the creation of stock markets, the question has arisen: What determines an asset's return? Numerous models have been developed to address this. Perhaps the most well-known approach is the *Sharpe–Lintner–Black* model, better known as the *Capital Asset Pricing Model (CAPM)*, proposed by Sharpe (1964), Lintner (1965), and Black (1972). CAPM reframes the question as: What is an asset's expected return, given the risk-free rate and the market return? CAPM dominated the literature and industry practice for decades; however, in application, its predictive capacity proved insufficient (Fama and French (2004)).

In one of the most important works in modern finance, *Common Risk Factors in the Returns on Stocks and Bonds*, Fama and French (1993) provided empirical evidence for factors beyond the familiar *beta* that affect asset returns:

1) **Size**: small firms tend to earn higher returns than large firms; this factor is known as *Small Minus Big (SMB)*. 2) **Value**: firms with a higher book-to-market ratio ("value") tend to outperform firms with the opposite ratio ("growth"); this factor is known as *High Minus Low (HML)*. 3) The market factor (the only factor also included in *CAPM*): the difference between the market return and the risk-free rate, commonly

denoted $\mathbf{r_m - r_f}$. This three-factor model received wide acclaim in academia and industry.

However, much like the evolution from CAPM to the three-factor model, empirical evidence showed that the latter could not fully explain stock returns, particularly for highly profitable firms and firms that invest conservatively.

Thus, *A Five-Factor Asset Pricing Model* by Fama and French (2015) expands the three-factor model by adding the two missing dimensions: 4) more profitable firms earn higher returns than less profitable firms (***RMW***) and 5) firms that invest conservatively earn higher returns than those that invest aggressively (***CMA***). Although this model has been influential, it has not been free of criticism.

Factor	Name
1. **Market**	$r_m - r_f$
2. **Size**	SMB (*Small Minus Big*)
3. **Value**	HML (*High Minus Low*)
4. **Profitability**	RMW (*Robust Minus Weak*)
5. **Investment**	CMA (*Conservative Minus Aggressive*)

Table 1: *Fama and French (2015) factors.*

This paper employs the latter model Fama and French (2015) to test its validity on emerging-market portfolios, given prior evidence of differentiated behavior for the **market** and **size** factors in economies with lower liquidity and financial structures distinct from those of developed markets (Barberis et al., 2003; Bekaert et al., 2002).

Empirical Application

The five-factor model Fama and French (2015) posits that the excess return on portfolio $R_{i,t} - R_{f,t}$ can be explained by:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,MKT}(R_{m,t} - R_{f,t}) + \gamma_i \, SMB_t + \theta_i \, HML_t + \delta_i \, RMW_t + \phi_i \, CMA_t + \varepsilon_{i,t}.$$

Where:

- α: idiosyncratic risk.
- The coefficients show the influence of each factor.
- $R_{m,t} - R_{f,t}$: the market risk premium.

- SMB: difference between small and big firms.
- HML: difference between "value" and "growth" firms.
- RMW: difference between more and less profitable firms.
- CMA: difference between firms with more conservative and more aggressive investment policies.
- ε is the error term.

The factors and portfolio returns were obtained from Ken French's website.[1] The data span January 1990 to December 2023.

Both the portfolios and the factors correspond to emerging markets (including 24 countries). The portfolios are value-weighted and arranged in a 2x3 size–book-to-market sort. For details on the construction methodology for the factors and portfolios, see French's site.

[1] Fama–French Emerging 5 Factors and 6 Emerging Market Portfolios Formed on Size and Book-to-Market (2 x 3). https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

The model is estimated via Ordinary Least Squares (OLS) with robust standard errors (HC3). The results are:

Table 2: *Effects of the factors on portfolios*

	Small – Low BM	**Small – Mid BM**	**Small – High BM**	**Big – Low BM**	**Big – Mid BM**	**Big – High BM**
Intercept	-0.0025	0.0000	0.0014	0.0019	-0.0007	-0.0019
	(0.0007)	(0.0006)	(0.0005)	(0.0006)	(0.0006)	(0.0007)
MKT-RF	1.0463***	0.9950***	0.9887***	0.9700***	1.0262***	1.0277***
	(0.0134)	(0.0135)	(0.0109)	(0.0123)	(0.0137)	(0.0145)
SMB	0.9559***	0.9803***	0.8118***	-0.1061	-0.1481	0.0378
	(0.0425)	(0.0416)	(0.0284)	(0.0268)	(0.0329)	(0.0413)
HML	-0.5980***	-0.0367	0.4068***	-0.4266***	0.1128***	0.5686***
	(0.0390)	(0.0357)	(0.0273)	(0.0284)	(0.0312)	(0.0376)
RMW	-0.1153**	-0.0307	-0.0581*	0.0294	0.0323	-0.0277
	(0.0622)	(0.0528)	(0.0473)	(0.0434)	(0.0458)	(0.0625)
CMA	0.1697***	-0.1042*	0.0535	-0.0606	0.0360	0.0554
	(0.0471)	(0.0634)	(0.0392)	(0.0439)	(0.0490)	(0.0492)
Observations	393	393	393	393	393	393
R^2	0.9646	0.9666	0.9810	0.9760	0.9762	0.9698

Notes: Huber–White robust standard errors (HC3) in parentheses.
Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.
BM = book-to-market ratio.
"Small" and "Big" are defined by firm size (market capitalization).
Source: Author's calculations based on data from K. French and Bloomberg (2025).

- All intercepts are not statistically different from zero.
- The coefficient on the market factor (**MKT–RF**) is positive and statistically significant at the 1% level in all portfolios, with values close to one, indicating that portfolio returns depend heavily on the market (almost 1:1).
- The size factor (**SMB**) has positive and statistically significant coefficients in small-firm portfolios, indicating higher returns attributable to firm size. For big-firm portfolios, the coefficients are not significant and in some cases negative.
- The value factor (**HML**) shows differentiated effects: for low-BM portfolios (growth firms) the coefficients are negative and significant; for high-BM portfolios (value firms) the coefficients are positive and significant.
- The profitability factor (**RMW**) exhibits small and mostly insignificant coefficients. Only in the Small – Low BM and Small – High BM portfolios is there a negative and significant effect, indicating that firms with low profitability earn lower returns.
- The investment factor (**CMA**) is positive and statistically significant for the Small – Low BM portfolio, and negative and significant for Small – Mid BM. In all

other portfolios its effect is not statistically significant, suggesting that investment policies generally have limited impact for the portfolios considered.

Conclusions

This paper empirically evaluated the Fama–French five-factor model on six value-weighted emerging-market portfolios using OLS with robust standard errors. The findings are:

- Based on the R^2 values, the model explains between 96.5% and 98.1% of portfolio returns, **supporting the hypothesis that the model can explain returns in emerging markets**. It is worth noting that the magnitudes of intercepts, coefficients, and R^2 are consistent with (Claesson, 2021).
- In all cases, the intercept is close to 0 and statistically insignificant, as predicted by theory. **Therefore, the hypothesis that the included factors explain portfolio returns is met.**
- For all portfolios, the **market factor** is statistically significant, positive, and approximately one in magnitude, underscoring the importance of market risk.
- The (**SMB**) coefficients are statistically significant and positive for small-firm portfolios. By contrast, the value (**HML**) coefficients change sign between low- and high-BM portfolios, reflecting heterogeneous behavior across growth and value firms. **Thus, the hypothesis that all factors explain returns is only partially met.**

I conclude that **the hypothesis that the five-factor model is useful for explaining the returns of emerging-market portfolios is supported.**

Given these results, future research should consider:

1. Given issues with residual normality, implementing conditional heteroskedasticity models (GARCH).
2. Conducting a more granular analysis during periods of high volatility (e.g., 2008 or the pandemic) to evaluate model robustness.
3. Comparing results with the original three-factor model, the six-factor model Doğan et al. (2022), and the model of Carhart (1997) with the *momentum* factor, assessing their performance in emerging economies.

Appendix

This section presents the model diagnostics along with brief interpretations:

- **Breusch–Pagan** for heteroskedasticity.
- **Link test** for omitted variables.
- **Ramsey** test for functional form.
- **Cook's distance** for influential observations.
- **Shapiro–Wilk** for residual normality.
- **Durbin–Watson (DW):** for autocorrelation in residuals.
- **Variance Inflation Factor (VIF):** for multicollinearity among regressors.

Table 3: *Econometric tests (p-values)*

Portfolio	BP	Link	Ramsey	Max Cook's D	SW	Durbin–Watson
Small – Low BM	0.2434	0.9875	0.9875	0.1119	0.0000	1.9067
Small – Mid BM	0.0700	0.1206	0.1199	0.3711	0.0000	1.9094
Small – High BM	0.0009	0.0973	0.0945	0.2131	0.0000	1.6695
Big – Low BM	0.0070	0.2206	0.2210	0.0942	0.0000	1.8422
Big – Mid BM	0.0351	0.1964	0.1964	0.1502	0.0000	2.0321
Big – High BM	0.0414	0.9079	0.9076	0.1604	0.0000	2.1022

Cook's distance and Durbin–Watson are not p-values.
Source: Author's calculations based on robust regressions.

Table 4: *Variance Inflation Factors (VIF) of the regressors*

Variable	VIF
MKT-RF	1.3513
SMB	1.1271
HML	1.5032
RMW	1.5053
CMA	1.3531

Source: Author's calculations based on robust regression estimates.

- **Heteroskedasticity (Breusch–Pagan):** For the Small – Low BM and Small – Mid BM portfolios, there is no significant heteroskedasticity. For Small – High BM, Big – Low BM, Big – Mid BM, and Big – High BM, $p < 0.05$, i.e., **residuals are not homoskedastic**, which is why Huber–White (HC3) robust standard errors are used. HC3 is employed instead of HC1 for greater theoretical stringency. In practice, coefficients and significance levels are similar under HC1 and HC3.

- **Residual normality (Shapiro–Wilk):** For all portfolios, $p < 0.05$, indicating non-normal residuals. Nonetheless, using robust standard errors allows valid inference.

- **Model specification (Link and Ramsey):** For both tests, $p > 0.05$ in all portfolios, indicating no functional-form misspecification and no omission of relevant variables.

- **Cook's distance:** Maximum Cook's D values are below 1 in all portfolios, indicating an absence of highly influential observations.

- **Multicollinearity (VIF):** In all cases, factors exhibit VIFs below 2, indicating no **concerning** multicollinearity among regressors.

- **Error autocorrelation (Durbin–Watson):** DW values are approximately 2 for all portfolios; therefore, there are no autocorrelation issues in the residuals.

We conclude that OLS with robust standard errors is appropriate for analyzing risk factors in these portfolios.

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