

Khudoykulov, Khurshid

Article

Asset-pricing models: A case of Indian capital market

Cogent Economics & Finance

Provided in Cooperation with:

Taylor & Francis Group

Suggested Citation: Khudoykulov, Khurshid (2020) : Asset-pricing models: A case of Indian capital market, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 8, Iss. 1, pp. 1-15,
<https://doi.org/10.1080/23322039.2020.1832732>

This Version is available at:

<https://hdl.handle.net/10419/269991>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

Asset-pricing models: A case of Indian capital market

Khurshid Khudoykulov |

To cite this article: Khurshid Khudoykulov | (2020) Asset-pricing models: A case of Indian capital market, Cogent Economics & Finance, 8:1, 1832732, DOI: [10.1080/23322039.2020.1832732](https://doi.org/10.1080/23322039.2020.1832732)

To link to this article: <https://doi.org/10.1080/23322039.2020.1832732>



© 2020 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.



Published online: 19 Oct 2020.



Submit your article to this journal [↗](#)



Article views: 2513



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 2 View citing articles [↗](#)



Received: 18 May 2020
Accepted: 01 October 2020

*Corresponding author: Khurshid Khudoykulov, Department of Finance, Faculty of Finance and Accounting, Tashkent State University of Economics, Tashkent 100003, Uzbekistan
E-mail: gelios_1985@yahoo.com

Reviewing editor:
David McMillan, University of Stirling, UK

Additional information is available at the end of the article

FINANCIAL ECONOMICS | RESEARCH ARTICLE

Asset-pricing models: A case of Indian capital market

Khurshid Khudoykulov^{1*}

Abstract: The asset-pricing models have been a fundamental area of research in finance due to its applicability in corporate finance and stock analysis. The present research attempted to evaluate the three popular asset-pricing models namely the capital asset-pricing model, the Fama-French three-factor model, and the Fama-French five-factor model in the Indian equity market for the period of January 2009 to November 2018. The study also tested the role of the size, profitability, value, investment, and market factors in explaining the average equity returns at the Indian bourses. The empirical results indicate the inferior performance of single market factor in describing the variations in average stock returns in comparison of the FF3FM and FF5FM. Furthermore, the size and value factors added to CAPM yields a vital improvement in explaining the variation in average returns of sample stocks.

Subjects: Econometrics; Corporate Finance; Investment & Securities

Keywords: Capital asset-pricing model; Fama-French three-factor model; Fama-French five-factor model; Size effect; Value effect



Khurshid Khudoykulov

ABOUT THE AUTHOR

Khudoykulov Khurshid is an Associate Professor in finance from the Tashkent State University of Economics (TSUE), Tashkent. He earned his PhD in asset pricing methods from the University of Economics and his master degree in State Budget Management from the Tashkent Financial Institute in Tashkent. Before working TSUE, he conducted as research in asset pricing and financial markets at the university Alexander Technological Educational Institute of Thessaloniki, Greece and National Institute of Bank Management, India. Before becoming an academician, he worked as a banker in a leading public sector bank. He has published research articles in the fields of asset pricing, capital markets, and corporate finance for instance *American Journal of Finance*, *International Journal of Modelling and Simulation* and *International Journal of Economics and Accounting*. His research interests focus on asset pricing, behavioural finance, financial modelling, corporate finance, capital markets and investment.

PUBLIC INTEREST STATEMENT

The asset-pricing model has been a core area of research in finance due to its applicability in corporate finance and security analysis. Over the last five decades, researchers have been endeavouring to decode the issue to put forward a better asset-pricing model for their respective financial markets. Regarding the suitability of one universal asset pricing model to all markets, one should note that the literature suggests that different markets across the globe have their distinctive anomalies. The empirical results point toward the five-factor model as a better model of asset-pricing in the Indian equity market context as compared to the capital asset pricing model and three-factor model. Still, the five-factor model has to capture entire variations in average stock returns. Further research in this area may be carried out by considering country-specific or local factors concerning the Indian equity market to yield better results.

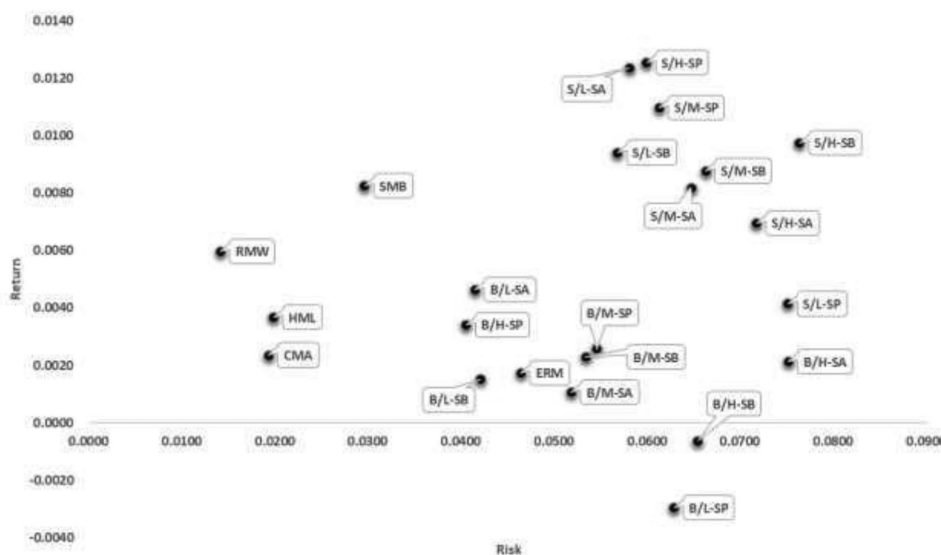
1. Introduction

Asset pricing is a nucleus point of capital market theory and is widely explored phenomena in finance literature. Asset-pricing theories portray how market participants price securities. The capital asset-pricing model (henceforth CAPM) is a combined scholarly work of Sharpe (1964), Lintner (1965), and Mossin (1966) which cemented the primordial asset-pricing theory. The primary outcome of the CAPM is a positive relationship between the expected risk premiums the systematic risk of individual security. Attributed to its appealing and straightforward result, the CAPM has been incorporated by academicians and investment managers in corporate finance and performance evaluation of securities and portfolios for an extended period. Like most of the theories, the CAPM has also been subject to many disapprovals by various researchers who document that the cross-sectional variation in average security returns cannot be explained by the market beta alone. First among above scholars were Banz (1981), Basu (1983), and Lakonishok et al. (1994) who exhibited the relationship between average stock returns and market capitalization, book-to-market ratio, price-earning ratio, and cash flow to price ratio, respectively. These findings paved the way for the birth of another asset-pricing model of Fama and French (1993, 1996) with an expansion of the CAPM by adding two factors, namely size and the book-to-market ratio. In popular literature, it is mentioned as the Fama-French three-factor model (henceforth FF3FM) Figure 1.

Since research is a never-ending task, considerable empirical research documented evidence of the superiority of FF3FM over the CAPM in explaining the cross-section of asset returns (Griffin & Lemmon, 2002; Liew & Vassalou, 2000). On the contrary, some empirical research shed light on anomalies – factors that seem to explain average returns-unapprehended by the FF3FM better. For instance, Novi-Marx (2013) assert the superior returns generated by profitable firms than low profitable firms. Similarly, Aharoni et al. (2013) depict a robust association between the average returns and investment factor. Taking a cue from these findings, Fama and French (2015) revived the three-factor model by adding two more factors, i.e., profitability and investment; hence, it becomes the five-factor model (henceforth FF5FM). As evidenced by Fama and French (2015, 2017)), the FF5FM perform better than the CAPM and the FF3FM, in explaining the cross-section of stock returns in the U.S and other developed markets.

It is worthwhile to mention that the majority of studies have empirically tested the multifactor models in the developed markets while the number of these endeavours are less in Asian emerging markets such as the Indian capital market. For instance, Connon and Sehgal (2001) documented empirical evidence in support of the Fama-French three-factor model in the Indian context. Similarly,

Figure 1. Risk-return relationship for portfolios and factors.



Dash and Mahakud (2013) asserted that the choice of a five-factor model (FFM) in its unconditional and conditional specifications could capture the book-to-market equity, liquidity, and medium-term momentum effect. Harshita and Yadav (2015) also found that the better explanatory power of the three-factor model over the Capital Asset Pricing Model and suggested that the four-factor model (without an investment factor) is parsimonious. Sehgal and Balakrishnan (2013) examined the robustness of FF3FM model. They found that the model performs better than CAPM in explaining the returns on most of the portfolios constructed based on company characteristics. Sreenu (2018) revealed that the FF3FM model could provide a better explanation of the variation in the expected rate of return in the Indian equity market. Arora and Gakhar (2019) found the superior performance of the FF3FM over the CAPM and FF5FM model in elucidating average stock returns in the Indian equity market. However, certain studies such as Balakrishnan and Maiti (2017) confirmed the inability of both CAPM and Fama-French three-factor model to capture the risk-return relationship. Anwar and Kumar (2018) examined the explanatory power of Fama and French three-factor model. Their results failed to support the FF3FM in explaining the individual asset returns in the Indian stock market.

Although some empirical evidence bolsters the view that factor models are superior predictors of stock returns, yet the final verdict is inconclusive regarding the factor models' sole contribution in explaining stock returns. Still, it is an unsolved puzzle in the Indian context as well as in other emerging markets and developed markets. The ever-rising query in finance literature is that whether the risk factors proposed by multifactor asset-pricing models. These factors are adequate to account for both cross-sectional, and time-series variations in stock return or any firm characteristics or commonly known market anomalies left unapprehended. In this regard, the present study primarily aims to evaluate the performance of the FF5FM in the Indian stock market since the majority of the studies have only emphasized the testing of this model in the developed and European emerging markets. For instance, Nichol and Dowling (2014) in the UK, Kubota and Takehara (2017) in Japan, Zaremba and Czapkiewicz (2017) in the European emerging and Fama and French (2017) in 23 developed countries. All these studies indicate that every region has its anomalies, and thus each market should be explicitly investigated.

However, some studies are also conducted in the Asian context. For instance, Guo et al. (2017) and Lin (2017), that support the superior performance of the FF5FM over the FF3FM in the Chinese stock market while Belimam et al. (2018) exhibit evidence in favour of FF3FM. On the other hand, majority of the Indian studies only tested the CAPM and FF3FM, and FF5FM has been a less explored area in the Indian equity market. Therefore, the present study contributes to broadening asset-pricing literature in the Indian equity market. Furthermore, the study also aims to compare CAPM, FF3FM, and FF5FM in explaining average returns for a better asset-pricing model in the Indian context. The asset-pricing literature, particularly in the Indian context, lacks the studies which attempt to address the issue of empirical testing of FF5FM as well as its comparison with earlier asset-pricing models the Indian stock market. Moreover, the results of the present study may have significant concerns for investors and regulators as it portrays the coherent picture of the size, value, and investment effect in the market.

2. Research method

2.1. Data collection

A data collection of 396 listed companies is used in the present study. First, we compile all the constituent companies of leading indices of National Stock Exchange of India namely Nifty 50, Nifty Next 50, Nifty 100, Nifty 200, Nifty 500, Nifty Midcap 150, Nifty Small Cap 250, Nifty Large mid-cap 250, Nifty Mid small-cap 400. The total number of companies from these 12 indices were 2200. After removing the duplicate entries, we were left with a different list of 396 companies. During the whole study period, this sample constitutes 88 per cent of the total market capitalization of listed equity shares on NSE and 26 per cent of total listed equity shares, as shown in Table 1. Overall, the present study used a sample which genuinely resembles the whole market.

Table 1. Information chosen companies

Year	Sample Companies	Listed Companies	Percent	Market cap (Rs. Cr.)	Total Market cap (Rs. Cr.)	Percent
2009	336	1291	26	2,483,532	2,896,194	86
2010	362	1359	27	5,078,905	6,009,173	85
2011	381	1484	26	5,807,022	6,702,616	87
2012	394	1563	25	5,330,774	6,096,518	87
2013	402	1582	25	5,541,639	6,239,035	89
2014	394	1586	25	6,333,249	7,277,720	87
2015	421	1544	27	8,983,461	9,930,122	90
2016	429	1613	27	8,566,367	9,310,471	92
2017	429	1696	25	10,707,973	11,978,421	89
2018	416	1817	23	11,751,662	14,044,152	84
Average	396	1554	26	7,058,458	8,048,442	88

Notes: This table reports information chosen companies of the study.

Bartholdy and Peare (2005) documented the evidence regarding the sensitivity of the CAPM betas to data frequency and period. They reported a bias estimation of beta based on the weekly or daily return as well as for an extended study period. Taking a cue from this, some studies such as Belimam et al. (2018) followed Bartholdy and Peare (2005). Therefore, the monthly adjusted closing prices of sample companies are used for a reasonable study period from July 2009 to March 2018. The monthly returns of the Nifty 50 Index are used as a proxy for the market portfolio. The monthly adjusted closing stock prices, closing values of the Nifty 50 Index and accounting information have been obtained for the sample companies from Capitaline database. Furthermore, the yield on 91-days treasury bills of the government of India is incorporated as a risk-free return, and this data is compiled from the official website (www.rbi.org.in) of the Reserve Bank of India.

2.2. Empirical models

Initially, the CAPM is verified by the following time series regression model:

$$R_{pt} - R_{mt} = \alpha + (R_{mt} - R_{ft}) + \varepsilon_t \tag{1}$$

Then, the Fama-French three-factor (FF3FM) model is tested by the following regression model:

$$R_{pt} - R_{mt} = \alpha_i + (R_{mt} - R_{ft}) + (SMB) + (HML) + \varepsilon_t \tag{2}$$

Finally, the Fama-French five-factor (FF5FM) model is examined by the following regression model.

$$R_{pt} - R_{mt} = \alpha_i + \beta(R_{mt} - R_{ft}) + S_i(SMB) + H_i(HML) + P_i(RMW) + I_i(CMA) + \varepsilon_t \tag{3}$$

where

R_{pt} is the monthly return of a specific portfolio (S/L, S/M, S/H, B/L, B/M, B/H) and R_{mt} is the monthly return on the market. R_{ft} is the monthly risk-free return. SMB indicates the difference between the average returns (for each month) of the three small market capitalization portfolios and the three big market capitalization portfolios. Similarly, HML represents the difference between the average returns (for each month) of the two high book-to-market portfolios and the returns of

the two low book-to-market portfolios. Further, the RMW and CMA factors are computed in a similar manner as HML sorted by profitability and investment, respectively. The coefficients for each variable are β_i , S_i , H_i , P_i , and I_i . The $\epsilon_t(t)$ represents the error term.

Using the methodology of Fama and French (2008, 2015), the size (SMB) factor is measured by the book capitalization of sample securities, while value (HML) is measured by the book to market ratio. The profitability (RMW) is the difference between the returns of firms with robust (high) and weak (low) operating profitability and the investment factor (CMA) is the difference between the returns of firms that invest conservatively and firms that invest aggressively. Both profitability (RMW) and investment (CMA) factors have been measured by return on equity and asset growth (percentage increase (decrease) in total assets). The size portfolios are constructed at the beginning of July of each year t from 2009 to 2018, by sorting all the sample stocks in descending order based on market capitalization. The sample is then divided into two groups based on the median market capitalization for the bottom 50% (small), and the top 50% (big). It leads to the creation of two size portfolios of stocks falling under each group, namely small, and big named as s and b , respectively.

Similarly, the value portfolios are constructed at the beginning of July of each year t from 2009 to 2018, by sorting all the sample stocks in descending order based on BE/ME. Then, three value portfolios based on the breakpoints for the bottom 30% (low), middle 40% (medium) and top 30% (high) of the ranked values of BE/ME of sample companies, are created. Thus, three value portfolios of stocks falling under each group viz. low, medium, and high named as L , M , and H , respectively, are obtained. Six portfolios are constructed from the intersection of two sizes and three BE/ME groups are named as S/L , S/M , S/H , B/L , B/M , and B/H . S/L portfolio contains stocks of small market capitalization and low BE/ME companies, while B/H portfolio represents big market capitalization companies with high BE/ME ratio. Monthly value, as well as weighted returns on the six portfolios, are calculated for each month starting from July of year t till June of year $t + 1$. The portfolios are reformed in July of year $t + 1$ by using the same sorting method mentioned earlier. Further, the RMW and CMA factors are computed in a similar fashion, i.e. constituting two size groups and three groups of profitability and investment factors, respectively.

For each month SMB is the difference between the average of the returns on the three small-stock portfolios (S/L , S/M and S/H) and the average of the returns on the three big stock portfolios (B/L , B/M and B/H).

$$SMB = \frac{1}{3} \left(\frac{S}{L} + \frac{S}{M} + \frac{S}{H} \right) + \frac{1}{3} \left(\frac{B}{L} + \frac{B}{M} + \frac{B}{H} \right)$$

HML is the difference between the average of the returns on the two high-BE/ME portfolios (S/H and B/H) and the average of the returns on the two low-BE/ME portfolios (S/L and B/L).

$$HML = \frac{1}{2} \left(\frac{S}{H} + \frac{B}{H} \right) - \frac{1}{2} \left(\frac{S}{L} + \frac{B}{L} \right)$$

RMW (Robust Minus Weak) is the average return on the two robust operating profitability portfolios minus the average return on the two weak operating profitability portfolios.

$$RMW = \frac{1}{2} (SR - BR) - \frac{1}{2} (SW - BW)$$

CMA (Conservative Minus Aggressive) is the average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios

$$CMA = \frac{1}{2}(SC - BR) - \frac{1}{2}(SA - BA)$$

We followed the Fama and French (2008, 2015), who employed the asset growth as a surrogate for investment, which is indeed a percentage change in Total Assets over the previous year. The profitability has been measured by return on equity that, in turn, computed by the net profit before tax divided by the total shareholder's equity. Further, to examine and compare the three asset pricing models; initially, the regression coefficients of all the models are computed. Then we analyzed the explanatory power of the factors, namely the size, value, profitability, investment and market. In addition to this, the Gibbons et al. (1989), or GRS, the statistic has been employed to test the null $H_0: \alpha_i = 0$ for all of i , or simply to test the intercepts jointly. The GRS test is conducted by deriving the intercepts (alphas) from the OLS regressions using and examining whether the intercepts are jointly zero. The GRS test assumes that all of the intercepts or α 's jointly equal zero, consequently the statistic should equal zero. If the α 's rise in absolute value, then the GRS test statistic will also increase. The GRS statistic is modelled with the intercepts and error terms computed from equations (1), (2) and (3). For the CAPM we let $\alpha = (\alpha_1, \dots, \alpha_n)'$ and $\epsilon, = (\epsilon_1, \dots, \epsilon_n)'$ be n vectors that include the intercepts and error terms from equation (2). We must assume that $E(\epsilon) = 0$, $E(\epsilon \epsilon') = \Sigma$, $cov(rmt, \epsilon) = 0$, and ϵ, α are jointly normally distributed.

The equation for the single factor CAPM which tests the null $H_0: \alpha_i = 0$ for all of i is shown in (4) below.

$$J = \frac{(T - N - 1)}{N} \left(1 + \frac{\hat{\varphi}_m^2}{\hat{\sigma}_m^2} \right)^{-1} \hat{\alpha}' \hat{\Sigma}^{-1} \hat{\alpha} \tag{4}$$

where $\hat{\varphi}_m$ and $\hat{\sigma}_m$ indicate the average excess return and standard deviation of the market portfolio. N shows the number of assets or portfolios and T equals to the number of time-series observations. The J statistic follows a F distribution with N degrees of freedom in the numerator and $T-N-1$ degrees of freedom in the denominator.

Equation 5 is an extension of equation 4 that is used to produce the GRS test statistic in case of the FF3FM and FF5FM models.

$$J = \frac{(T - N - 1)}{N} \left(1 + \varphi_k' \Phi^{-1} \varphi_k \right)^{-1} \hat{\alpha}' \hat{\Sigma}^{-1} \hat{\alpha} \tag{5}$$

where φ_k is a k -vector of factor means, Φ is the $k \times k$ covariance matrix of the factor returns and the alphas are derived from the multiple regression equations (2X3). An unproductive asset-pricing model yields a greater value of the GRS statistic. A higher value of GRS statistics (and a small p -value) points the rejection of the hypothesis that the value of the alphas jointly are different from zero, subsequently, the factor models are ineffective in describing the variation of the average stock returns. Therefore, a larger GRS statistic indicates the poor performance of the asset-pricing model.

2.3. The empirical test and results

Table 2 exhibits the average monthly excess returns and standard deviations for the six portfolios of every factor. It is evident from the results that small portfolios in each panel outperforms the big portfolios hence indicating a size effect in the Indian equity market. As expected, small stocks also exhibit more risk than big stocks as quantified by the standard deviation of monthly returns during the whole study period. Among the factors, the SMB (0.83 percent) yields a higher average monthly excess return that corroborates the size effect. The results exhibit a small value effect among the high market-cap (big) stocks since average excess returns increase from -0.06 percent for the highest book-to-market portfolios to 0.15 percent for the lowest book-to-market portfolios.

Table 2. Summary statistics for portfolios and factors

	Return			Risk		
	Low	Medium	High	Low	Medium	High
Panel A: Size/book-to market portfolios						
Small	0.0094	0.0088	0.0098	0.0567	0.0661	0.0762
Big	0.0015	0.0023	-0.0006	0.0419	0.0532	0.0653
Panel B: Size/profitability portfolios						
Small	0.0041	0.0110	0.0125	0.0750	0.0611	0.0598
Big	-0.0030	0.0026	0.0034	0.0627	0.0544	0.0404
Panel C: Size/investment portfolios						
Small	0.0123	0.0082	0.0070	0.0580	0.0646	0.0716
Big	0.0046	0.0011	0.0021	0.0414	0.0517	0.0750
Panel D: Factors						
	ERM	SMB	HML	RMW	CMA	
Return	0.0017	0.0083	0.0037	0.0060	0.0024	
Risk	0.0463	0.0295	0.0197	0.0140	0.0192	

Notes: This table reports the Summary statistics for Portfolios and Factors on basis of return and risk.

Furthermore, the profitability effect is more pronounced in small stock than big stocks, and the RMW (0.60 percent) factor secure the second rank among. Panel C of Table 2 exhibits the association of excess returns and the investment measured in terms of assets growth. Again, the small portfolios in all growth categories outperform the big portfolios. On the whole, the empirical results regarding risk-return summary statistics of sample stocks exhibit the superior performance of small-cap stocks in the Indian equity market, which is a manifestation of size effect reported frequently in emerging markets.

2.4. Size and book-to-market portfolios

Table 3 presents the empirical results of regression equations of three asset-pricing models for the six size and book-to-market portfolios. Panel A, B, and C document the intercept terms its the loadings for factors, and the adjusted R^2 for CAPM, FF3FM, and FF5FM, respectively. It is evident from the results presented in Panel A of the table that the market factor loadings for all the six sizes/book-to-market portfolios are statistically insignificant hence posing the question mark on the explanatory power of beta of CAPM. In addition to this, except one portfolio, i.e., small/low the intercepts for all the portfolios are indistinguishable from zero. Further, the adjusted R^2 are negative except one portfolio.

On the other hand, the empirical results of FF3FM presented in Panel B support that all the intercepts on the model are statistically insignificant. It is interesting to note that the majority of SMB factor loadings are statistically significant and have negative signs. These findings are inconsistent to results of previous studies such as Fama and French (1996), Beliraman, Tan and Lakhnati (2018), Sehgal and Balakrishnan (2013), Sreenu (2018) and indicate an insignificant size-effect in the Indian equity market during the study period of 2009 to 2018. The results also point towards a positive and statistically significant value-effect as all the HML factor loadings are positive and significant. These results are also not in line with earlier studies. Panel C reports the empirical findings of FF5FM. Similar to FF3FM, HML factors are positive and significant, while size factors loadings are statistically insignificant. It is curious to note that the RMW factor loadings are negative and significantly differ from zero for all the six portfolios.

On the contrary, the CMA factor loadings for all the portfolios are positive and statistically significant. Overall the average adjusted R^2 for the CAPM is 0.002, and the same is 0.4395 for FF3FM while for FF5FM it is 0.5310. On the whole, the empirical results indicate the superior

Table 3. Regression results for six size/book-to-market portfolios

Size/book to market						
	Low	Medium	High	Low	Medium	High
CAPM						
		α			$t(\alpha)$	
Small	0.0095	0.0089	0.0098	1.7779*	1.4212	1.3585
Big	0.0017	0.0024	-0.0005	0.4524	0.4855	-0.0827
		β			$t(\beta)$	
Small	-0.0782	-0.0808	-0.0434	-0.6721	-0.5945	-0.2769
Big	-0.1435	-0.0902	-0.0715	-1.6828*	-0.8253	-0.5324
Adjusted R²						
Small	-0.0049	-0.0058	-0.0083	GRS	1.8774	
Big	0.0162	-0.0028	-0.0064	P-Value	0.0914	
Fama-French three Factor Model						
		α			$t(\alpha)$	
Small	0.0010	0.0016	0.0016	0.2649	0.3726	0.3859
Big	0.0008	0.0023	0.0010	0.2235	0.5189	0.2649
		β			$t(\beta)$	
Small	-0.1317	-0.1516	-0.1317	-1.5594	-1.7001*	-1.4683
Big	-0.1590	-0.1242	-0.1317	-1.9168*	-1.3079	-1.5594
		SMB			$t(\text{SMB})$	
Small	0.3771	-0.5674	-0.9719	1.2424	-0.7708*	-3.0152***
Big	-0.3214	-1.2180	-2.6228	-1.0781	-3.5669***	-8.6400***
		HML			$t(\text{HML})$	
Small	1.4818	3.2952	4.4418	3.2609***	6.8691***	9.2051***
Big	0.9691	2.7679	5.4818	2.1714	5.4150***	12.0633***
Adjusted R²						
Small	0.4737	0.5696	0.6719	GRS	0.3943	
Big	0.0729	0.2456	0.6034	P-Value	0.8811	
Fama-French Five Factor Model						
		α			$t(\alpha)$	
Small	0.0085	0.0088	0.0087	2.1521**	2.0777**	2.0480**
Big	0.0065	0.0110	0.0085	1.6153	2.5123**	2.1521**
		β			$t(\beta)$	
Small	-0.2018	-0.2169	-0.1847	-2.5701**	-2.5692**	-2.1752**
Big	-0.1952	-0.2064	-0.2018	-2.4326**	-2.3604**	-2.5701**
		SMB			$t(\text{SMB})$	
Small	1.1766	0.3074	0.2522	2.2363**	0.5436	0.4433
Big	0.8508	-0.2911	-1.8233	1.5827	-0.4968	-3.4656***
		HML			$t(\text{HML})$	
Small	-0.4794	1.3770	2.5229	-0.8543	2.2823**	4.1568***
Big	-0.5765	0.4765	3.5205	-1.0054	0.7624	6.2727***
		RMW			$t(\text{RMW})$	
Small	-1.8375	-1.8787	-2.1850	-3.4674***	-3.2977***	-3.8127***
Big	-1.9232	-2.1406	-1.8375	-3.5516***	-3.6270	-3.4674***
		CMA			$t(\text{CMA})$	

(Continued)

Size/book to market						
	Low	Medium	High	Low	Medium	High
Small	1.8138	1.6686	1.2742	3.2949***	2.8197***	2.1404**
Big	0.8157	2.1271	1.8138	1.4502	3.4697***	3.2949***
Adjusted R ²						
Small	0.5711	0.6362	0.7226	GRS	1.2112	
Big	0.1822	0.3973	0.6767	P-Value	0.3067	

Notes: This table documents the regression results of CAPM (Equation 1), the FF3FM (Equation 2), and the FF5FM (Equation 3) for the six size/book-to-market portfolios for the period 2009 to 2018. The table contains the intercepts, the coefficients for each factor, and the adjusted R². The table also reports the value of GRS test statistics and P-value for the CAPM, the FF3FM and the FF5FM. ***, **, *Denote statistical significance at the 1, 5, and 10% levels, respect

performance of FF5FM over the FF3FM and CAPM in explaining average return in the Indian equity market during the study period of 2009 to 2018.

2.5. Size and profitability portfolios

Table 4 documents the empirical results of the regression equations of all the asset-pricing models for the six size and Profitability portfolios. Panel A, B, and C exhibit the intercepts terms, the slope coefficients of factors, and the adjusted R² for CAPM, FF3FM, and FF5FM, respectively. It is curious to note that the market factor loadings for all the six sizes/profitability portfolios show negative signs as well as being statistically insignificant. These results are consistent with the results of size and boo-to-market portfolios. Again, the empirical results indicate invalidity of the CAPM.

Further, in the case of small/high and small/medium profitability portfolios, the intercepts are statistically significant. The adjusted R² for all the portfolios yield negative values except one portfolio. Panel B presents the results of statistically insignificant intercepts values for all the six portfolios. It is worthwhile to note that the SMB factor loadings in the case of big portfolios are negative and statistically significant. Similar to the findings of size and book-to-market portfolios, the empirical results in this case also exhibit positive and statistically significant HML factor loadings for all portfolios. The adjusted R² varies from 0.3482 to 0.6174 for all portfolios showing an improvement over the CAPM. Panel C shows the empirical results of FF5FM. In this model, the SMB factor loading is statistically significant for only one portfolio, i.e., small/low.

Similarly, the results report only one significant HML factor loading. Interestingly, again, the RMW factor loadings are negative and significantly different from zero for five portfolios. On the other hand, all the CMA factor loadings are positive and statistically significant. Additionally, the average-adjusted R² for the CAPM is -0.02625 meaning that, there is a negative relationship between the beta and expected return of stocks. Based on the CAPM theory, there is a positive and linear relationship between expected return and its beta. It is 0.4816 for FF3FM while for FF5FM it is 0.4996. Overall, the empirical results indicate superior performance of FF5FM and FF3FM over CAPM in explaining average return in the Indian equity market during the study period of 2009 to 2018. However, the results indicate the equal magnitude of performance of the FF5FM and the FF3FM.

2.6. Size and investment portfolios

Table 5 presents the empirical results of regression equations of three asset-pricing models for the six size and investment portfolios. Panel A, B, and C document the adjusted R², the factor loadings, and intercept terms for CAPM, FF3FM, and FF5FM, respectively. As in the case of book-to-market and profitability portfolio, the results regarding investment portfolios indicate the statistically insignificant market factor loadings again doubting the validity of the explanatory power of beta

Table 4. Regression Results for six size/profitability portfolios

Size/profitability						
	Low	Medium	High	Low	Medium	High
CAPM						
		α			t(α)	
Small	0.0042	0.0110	0.0126	0.5947	1.9041*	2.2420**
Big	-0.0028	0.0027	0.0036	-0.4767	0.5288	0.9702
		β			t(β)	
Small	-0.0496	-0.0413	-0.0917	-0.3215	-0.3287	-0.7469
Big	-0.0662	-0.0851	-0.1452	-0.5132	-0.7612	-1.7701*
Adjusted R²						
Small	-0.0081	-0.0081	-0.0039	GRS	6.1490	
Big	-0.0066	-0.0038	0.0188	P-Value	0.0000	
Fama-French three Factor Model						
		α			t(α)	
Small	-0.0050	0.0037	0.0049	-1.0985	0.8996	1.1495
Big	-0.0026	0.0029	0.0010	-0.5128	0.6764	0.2649
		β			t(β)	
Small	-0.1330	-0.1038	-0.1494	-1.3961	-1.1897	-1.6760*
Big	-0.1119	-0.1243	-0.1317	-1.0622	-1.3565	-1.5594
		SMB			t(SMB)	
Small	-0.4871	-0.2801	0.0256	-1.4226	-0.8934	0.0799
Big	-1.7223	-1.4963	-2.6228	-4.5472***	-4.5420***	-8.6400***
		HML			t(HML)	
Small	3.6579	2.6326	2.0767	7.1365***	5.6090***	4.3303***
Big	3.8252	3.3045	5.488	6.7467***	6.7007***	12.0633***
Adjusted R²						
Small	0.6174	0.5176	0.4731	GRS	4.3992	
Big	0.3496	0.3286	0.6034	P-Value	0.0005	
Fama-French Five Factor Model						
		α			t(α)	
Small	0.0057	0.0095	0.0100	1.4391	2.2334**	2.2542**
Big	0.0073	0.0122	0.0067	1.5369	3.0071***	1.7321*
		β			t(β)	
Small	-0.2060	-0.1680	-0.2097	-6085**	-1.9727*	-2.3728**
Big	-0.1831	-0.1947	-0.1903	-1.9277*	-2.4042**	-2.4515**
		SMB			t(SMB)	
Small	1.6288	0.0222	0.1612	3.0777***	0.0389	0.2722
Big	0.1115	0.0719	0.0498	0.1752	0.1325	0.0958
		HML			t(HML)	
Small	0.7130	1.1371	0.7769	1.2631	1.676*	1.2298
Big	1.1163	0.7977	0.4792	1.6445	1.3782	0.8635
		RMW			t(RMW)	
Small	-3.5610	-1.1320	-0.8725	-6.6801***	-1.9689*	-1.4626
Big	-3.1771	-2.8273	-1.1125	-4.9567***	-5.1729***	-2.1232**
		CMA			t(CMA)	

(Continued)

Size/profitability						
	Low	Medium	High	Low	Medium	High
Small	1.6870	1.7307	1.6482	3.066***	2.8981***	2.6599***
Big	1.6793	1.6997	0.6129	2.5221**	2.9938***	1.1260
Adjusted R²						
Small	0.7520	0.5662	0.5115	GRS	2.8369	
Big	0.4880	0.5058	0.1746	P-Value	0.0135	

Notes: This table documents the regression results of CAPM (Equation 1), the FF3FM (Equation 2), and the FF5FM (Equation 3) for the six size/profitability portfolios for the period 2009 to 2018. The table contains the intercepts, the coefficients for each factor, and the adjusted R². The table also reports the value of GRS test statistics and P-value for the CAPM, the FF3FM and the FF5FM. ***, **, *Denote statistical significance at the 1, 5, and 10% levels, respectively

Table 5. Regression results for six size/investment portfolios

Size/investment						
	Low	Medium	High	Low	Medium	High
CAPM						
		α			$t(\alpha)$	
Small	0.0125	0.0082	0.0069	2.2948**	1.3495	1.0238
Big	0.0048	0.0013	0.0022	1.2321	0.2873	0.3167
		β			$t(\beta)$	
Small	-0.1292	-0.0509	-0.0003	-1.0875	-0.3835	-0.0021
Big	-0.0964	-0.1859	-0.0732	-1.1390	-1.7712*	-0.4745
Adjusted R²						
Small	0.0016	-0.0077	0.0719	GRS	3.2816	
Big	0.0026	0.0188	-0.0070	P-Value	0.0053	
Fama-French three Factor Model						
		α			$t(\alpha)$	
Small	0.0051	-0.0001	-0.0013	1.2765	-0.0413	-0.2979
Big	0.0048	0.0015	0.0000	1.2512	0.3619	0.0070
		β			$t(\beta)$	
Small	-0.1868	-0.1186	-0.0783	-2.2288**	-1.3340	-0.8303
Big	-0.1153	-0.2191	-0.1334	-1.4476	-2.4277**	-1.0703
		SMB			$t(\text{SMB})$	
Small	-0.0670	-0.1446	-0.5556	-0.2225	-0.4525	-1.6393
Big	-0.6852	-1.2551	-1.5799	-2.3932**	-3.8690***	-3.5269***
		HML			$t(\text{HML})$	
Small	2.1916	2.6550	3.5464	4.8586***	5.5480***	6.9893***
Big	1.5464	2.7819	4.1757	3.6082***	5.7287***	6.2273***
Adjusted R²						
Small	0.5049	0.5508	0.5891	GRS	2.3066	
Big	0.1211	0.2799	0.3459	P-Value	0.0394	
Fama-French Five Factor Model						
		α			$t(\alpha)$	
Small	0.0092	0.0078	0.0088	2.1967**	1.9121*	2.1538**

(Continued)

Table 5. (Continued)

Size/investment						
	Low	Medium	High	Low	Medium	High
Big	0.0079	0.0087	0.0132	1.9627*	2.1241**	2.4270**
		β			t(β)	
Small	-0.2059	-0.1937	-0.1840	-2.4633**	-2.3627**	-2.2530**
Big	-0.1304	-0.2474	-0.2495	-1.6180	-3.0105***	-2.2929**
		SMB			t(SMB)	
Small	1.0210	0.7601	0.2319	1.8232*	1.3832	0.4239
Big	0.1435	0.8485	0.1462	0.2658	1.5412	0.2006
		HML			t(HML)	
Small	1.0469	0.5196	0.8821	1.7525*	0.8865	1.5110
Big	0.6625	0.7392	0.6453	1.1501	1.2587	0.8299
		RMW			t(RMW)	
Small	-1.6168	-2.0307	-2.2348	-2.8662***	-3.6689***	-4.0539***
Big	-1.2385	-3.0271	-3.5591	-2.2766**	-5.4583***	-4.8471***
		CMA			t(CMA)	
Small	0.3550	1.9358	2.8015	0.6058	3.3669***	4.8922***
Big	0.2871	0.4502	2.9398	0.5081	0.7815	3.8543***
Adjusted R²						
Small	0.5360	0.6399	0.7093	GRS	1.2773	
Big	0.1515	0.4356	0.5299	P-Value	0.2744	

Notes: This table documents the regression results of CAPM (Equation 1), the FF3FM (Equation 2), and the FF5FM (Equation 3) for the six size/investment portfolios for the period 2009 to 2018. The table contains the intercepts, the coefficients for each factor, and the adjusted R². The table also reports the value of GRS test statistics and P-value for the CAPM, the FF3FM and the FF5FM. ***, **, *Denote statistical significance at the 1, 5, and 10% levels, respectively

of CAPM. Nevertheless, except one portfolio, i.e., small/low the intercepts for all the portfolios are indistinguishable from zero.

Contrary to the results of book-to-market and profitability portfolios, the adjusted R² for the majority of the portfolios are positive. The results of FF3FM are presented in Panel B. The empirical results indicate statistically insignificant intercepts values for all the six portfolios. Again, the SMB factor loadings for Big portfolios are negative and statistically significant. On the other hand, the empirical results in this case also reveal positive and statistically significant HML factor loadings for all portfolios. The adjusted R² varies from 0.1211 to 0.5891 for all portfolios. Panel C reports the empirical results of FF5FM. The results exhibit a statistically insignificant size and HML factor loadings. It is worthwhile to mention that the RMW factor loadings are negative and significantly differ from zero for all the six portfolios.

On the other hand, the CMA factor loadings for all the portfolios are positive and statistically significant in case of three portfolios out of six. The adjusted R² varies from 0.1515 to 0.7093 for all portfolios-exhibiting the superiority of FF5FM over CAPM and FF3FM. Overall, The average-adjusted R² for the CAPM is 0.0136, and the same is 0.3917 for FF3FM while for FF5FM it is 0.5003. On the whole, the empirical results indicate superior performance of FF5FM over the FF3FM and CAPM in explaining average return in the Indian equity market during the study period of 2009 to 2018.

2.7. Comparison of the asset-pricing models

The empirical results also include the GRS test statistic and its p-value to compare the three asset-pricing models. Panel A of Table 3 reports the GRS test statistics for the CAPM. The empirical results here yield credence to the null hypothesis that all of the intercepts or α 's jointly equal zero in case of CAPM. The GRS test values are between 1.87 to 6.14 for all the portfolios, and this indicates that the CAPM is ineffective in explaining the cross-section variation of sample stocks in the Indian equity market during the whole study period.

On the contrary, in the case of FF3FM, the GRS statistics are between 0.3943 and 4.39, indicating no better description of the average return of sample stocks despite adding the size and value factors in CAPM equation. Overall, the results also show the impotence of FF3FM in describing the returns of size, investment, profitability and value portfolios in the Indian equity market. It is curious to note that GRS test values in case of the FF5FM are between 1.21 and 2.83—lowest among all models. These results exhibit the FF5FM as an improved descriptor of stock return. The finding of results is the similarity to Guo et al. (2017), Lin (2017), and Fama and French (2015) who document the superiority of the FF5FM over the FF3FM. However, the empirical results of the present study contradict the findings of Belimam et al. (2018) who exhibit evidence in favour of FF3FM in the Chinese equity market.

3. Conclusion

The asset-pricing model has been a core area of research in finance due to its applicability in corporate finance and security analysis. Over the last five decades, researchers have been endeavouring to decode the issue to put forward a better asset-pricing model for their respective financial markets. The present study attempted to achieve this goal by evaluating and comparing three popular asset-pricing models that are the capital asset-pricing model, the Fama-French three-factor model, and the Fama-French five-factor model in the Indian equity market for the period of January 2009 to November 2018. The study examined the role of the size, profitability, value, investment, and market factors in explaining the average equity returns at the Indian bourses. The empirical results reveal the inferior performance of single market factor in describing the variations in average stock returns in comparison of the FF3FM and FF5FM.

Further, the size and value factors when adding to CAPM yields a vital melioration in explaining the variation in average returns of sample stocks. Based on the CAPM theory, there is a positive and linear relationship between expected return and its beta Sehgal and Balakrishnan (2013) and Sreenu (2018) in the Indian market. Unfortunately, the finding of result shows that there is no relationship between expected return and its beta thus, CAPM is invalid for the Indian market. Additionally, the five-factor model (FF5FM) generates better results than the CAPM and the FF3FM, as reported by earlier studies. It is worthwhile to note that the investment and value factors are significant for the majority of the portfolios. In contrast, the size and profitability factors could not play a role in explaining the average stock returns.

Our findings are contrary to the results of some recent studies such as Lin (2017), Guo et al. (2017), and Belimam et al. (2018) in the and Sreenu (2018), Arora and Gakhar (2019) in the Indian market. As far as the superiority of pricing model is concerned the results are similar to the findings of Guo et al. (2017), Lin (2017), Fama and French (2015, 2017)), and, who reveal the superior performance of the FF5FM. Regarding the suitability of one universal asset-pricing model to all markets, one should note that the literature suggests that different markets across the globe have their distinctive anomalies. Therefore, these markets should be distinctly examined. On the whole, the empirical results point toward the five-factor model as a better model of asset-pricing in the Indian equity market context as compared to the capital asset-pricing model and three-factor model. Still, the five-factor model has to capture entire variations in average stock returns. Further research in this area may be carried out by considering country-specific or local factors concerning the Indian equity market to yield better results.

Funding

This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

Author details

Khurshid Khudoykulov¹

E-mail: gelios_1985@yahoo.com

¹ Department of Finance, Faculty of Finance and Accounting, Tashkent State University of Economics, Tashkent, Uzbekistan.

Citation information

Cite this article as: Asset-pricing models: A case of Indian capital market, Khurshid Khudoykulov, *Cogent Economics & Finance* (2020), 8: 1832732.

References

- Aharoni, G., Grundy, B., & Zeng, Q. (2013). Stock returns and the Miller Modigliani valuation formula: Revisiting the Fama French analysis. *Journal of Financial Economics*, 110(2), 347–357. <https://doi.org/10.1016/j.jfineco.2013.08.003>
- Anwar, M., & Kumar, S. (2018). Three-factor model of asset pricing: Empirical evidence from the Indian stock market. *The IUP Journal of Applied Finance*, 24(3), 16–34. SSRN <https://ssrn.com/abstract=3275917>
- Arora, D., & Gakhar, D. V. (2019). Asset pricing models: A study of CNX nifty 500 index companies. *Indian Journal of Finance*, 13(4), 20–35. <https://doi.org/10.17010/ijf/2019/v13i4/143125>
- Balakrishnan, A., & Maiti, M. (2017). Dynamics of size and value factors in stock returns: Evidence from India. *Indian Journal of Finance*, 11(6), 21–35. <https://doi.org/10.17010/ijf/2017/v11i6/115593>
- Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of Financial Economics*, 9(1), 3–18. [https://doi.org/10.1016/0304-405X\(81\)90018-0](https://doi.org/10.1016/0304-405X(81)90018-0)
- Bartholdy, J., & Peare, P. (2005). Estimation of expected return: CAPM vs. Fama and French. *International Review of Financial Analysis*, 14(4), 407–427. <https://doi.org/10.1016/j.irfa.2004.10.009>
- Basu, S. (1983). The relationship between earnings' yield, market value and return for NYSE common stocks: Further evidence. *Journal of Financial Economics*, 12(1), 129–156. [https://doi.org/10.1016/0304-405X\(83\)90031-4](https://doi.org/10.1016/0304-405X(83)90031-4)
- Belimam, D., Tan, Y., & Lakhnati, G. (2018). An empirical comparison of asset-pricing models in the Shanghai A-share exchange market. *Asia-Pacific Financial Markets*, 25(3), 249–265. <https://doi.org/10.1007/s10690-018-9247-4>
- Connon, G., & Sehgal, S. (2001). Tests of the Fama-French model in India. *Discussion paper* (379). Financial Markets Group, London School of Economics and Political Science. <http://eprints.lse.ac.uk/25057/>
- Dash, S. R., & Mahakud, J. (2013). Conditional multifactor asset pricing model and market anomalies. *Journal of Indian Business Research*, 5(4), 271–294. <https://doi.org/10.1108/JIBR-12-2012-0126>
- Eugene, F., & Kenneth, R. F. (1996). Multifactor explanations of asset pricing anomalies. *The Journal of Finance*, 51(1), 55–84. <https://doi.org/10.2307/2329302>
- Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1), 3–56. [https://doi.org/10.1016/0304-405X\(93\)90023-5](https://doi.org/10.1016/0304-405X(93)90023-5)
- Fama, E. F., & French, K. R. (2008). Dissecting anomalies. *The Journal of Finance*, 63(4), 1653–1678. <https://doi.org/10.1111/j.1540-6261.2008.01371.x>
- Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 116(1), 1–22. <https://doi.org/10.1016/j.jfineco.2014.10.010>
- Fama, E. F., & French, K. R. (2017). International tests of a five-factor asset pricing model. *Journal of Financial Economics*, 123(3), 441–463. <https://doi.org/10.1016/j.jfineco.2016.11.004>
- Gibbons, M. R., Ross, S. A., & Shanken, J. (1989). A test of the efficiency of a given portfolio. *Econometrica: Journal of the Econometric Society*, 57(5), 1121–1152. <https://doi.org/10.2307/1913625>
- Griffin, J. M., & Lemmon, M. L. (2002). Book-to-market equity, distress risk, and the returns. *The Journals of Finance*, 57(5), 2317–2336. <https://doi.org/10.1111/1540-6261.00497>
- Guo, B., Zhang, W., Zhang, Y., & Zhang, H. (2017). The five-factor asset pricing model tests for the Chinese stock market. *Pacific-Basin Finance Journal*, 43(C), 84–106. <https://doi.org/10.1016/j.pacfin.2017.02.001>
- Harshita, S., & Yadav, S. S. (2015). Indian stock market and the asset pricing models. *Procedia Economics and Finance*, 30(12), 294–304. [https://doi.org/10.1016/S2212-5671\(15\)01297-6](https://doi.org/10.1016/S2212-5671(15)01297-6)
- Kubota, K., & Takehara, H. (2017). Does the Fama and French five-factor model work well in Japan? *International Review of Finance*, 18(1), 137–146. <https://doi.org/10.1111/irfi.12126>
- Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarian investment, extrapolation, and risk. *The Journal of Finance*, 49(5), 1541–1578. <https://doi.org/10.1111/j.1540-6261.1994.tb04772.x>
- Liew, J., & Vassalou, M. (2000). 'Can book-to-market, size and momentum be risk factors that predict economic growth? *Journal of Financial Economics*, 57(2), 221–245. [https://doi.org/10.1016/S0304-405X\(00\)00056-8](https://doi.org/10.1016/S0304-405X(00)00056-8)
- Lin, Q. (2017). Noisy prices and the fama-French five-factor asset pricing model in China. *Emerging Markets Review*, 31(C), 141–163. <https://doi.org/10.1016/j.ememar.2017.04.002>
- Lintner, J. (1965). Security prices, risk, and maximum gains from diversification. *The Journal of Finance*, 20(4), 587–615. <https://doi.org/10.1111/j.1540-6261.1965.tb02930.x>
- Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica: Journal of the Econometric Society*, 34(4), 768–783. <https://doi.org/10.2307/1910098>
- Nichol, E., & Dowling, M. (2014). Profitability and investment factors for U.K. asset pricing models. *Economics Letters*, 125(3), 364–366. <https://doi.org/10.1016/j.econlet.2014.10.013>
- Novi-Marx, R. (2013). The other side of value: The gross profitability premium. *Journal of Financial Economics*, 108(1), 1–28. <https://doi.org/10.1016/j.jfineco.2013.01.003>
- Sehgal, S., & Balakrishnan, A. (2013). Robustness of Fama-French three factor model: Further evidence for Indian stock market. *Vision*, 17(2), 119–127. <https://doi.org/10.1177/0972262912483526>
- Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, 19(3), 425–442. <https://doi.org/10.1111/j.1540-6261.1964.tb02865.x>
- Sreenu, N. (2018). An empirical test of capital asset-pricing model and three-factor model of Fama in Indian stock exchange. *Management and Labour Studies*, 43(4), 1–14. <https://doi.org/10.1177/0258042X18797770>
- Zaremba, A., & Czapkiewicz, A. (2017). Digesting anomalies in emerging European markets: A comparison of factor pricing models. *Emerging Markets Review*, 31(1), 1–15. <https://doi.org/10.1016/j.ememar.2016.12.002>



© 2020 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.

You are free to:

Share — copy and redistribute the material in any medium or format.

Adapt — remix, transform, and build upon the material for any purpose, even commercially.

The licensor cannot revoke these freedoms as long as you follow the license terms.

Under the following terms:

Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made.

You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

No additional restrictions

You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits.



***Cogent Economics & Finance* (ISSN: 2332-2039) is published by Cogent OA, part of Taylor & Francis Group.**

Publishing with Cogent OA ensures:

- Immediate, universal access to your article on publication
- High visibility and discoverability via the Cogent OA website as well as Taylor & Francis Online
- Download and citation statistics for your article
- Rapid online publication
- Input from, and dialog with, expert editors and editorial boards
- Retention of full copyright of your article
- Guaranteed legacy preservation of your article
- Discounts and waivers for authors in developing regions

Submit your manuscript to a Cogent OA journal at www.CogentOA.com

