International Journal of Management Science
2014; 1(3): 52-57
Published online August 30, 2014 (http://www.aascit.org/journal/ijms)

AASCIT American Association for Science and Technology

Keywords
French Model,
Expected Return,
SMB,
HML,
KSE

Received: August 18, 2014
Revised: August 25, 2014
Accepted: August 26, 2014

Validity of FAMA and French Model: Evidence from KSE-100 index

Babar Rafi[1], Syed Sheheryar Ali Kazmi[2], Muhammad Hashim[3]

[1]MBA Scholar at Institute of Management Sciences Peshawar KPK, Pakistan
[2]MS (management sciences) Scholar at Abasyn University Peshawar KPK, Pakistan
[3]PhD Research Scholar Preston University Islamabad, Pakistan, Lecturer Government College of Management Sciences Peshawar, KPK, Pakistan

Email address

Babar.rafi@rmi.edu.pk (B. Rafi), sheheryarali7@gmail.com (S. S. A. Kazmi), mhashimpk@yahoo.com (M. Hashim)

Citation

Babar Rafi, Syed Sheheryar Ali Kazmi, Muhammad Hashim. Validity of FAMA and French Model: Evidence from KSE-100 Index. *International Journal of Management Science.* Vol. 1, No. 3, 2014, pp. 52-57.

Abstract

This study is carried out with an aim to test the explanatory power of three factorial Fama and French model in explaining the expected returns for the companies listed under the umbrella of KSE-100 index for the time frame of three years i.e. from 2011 to 2013. Six portfolios were constituted by intersecting size with B/M ratio of firm. The multivariate regression model was used to find the impact of three independent variables (MRP, SMB &HML) on the dependent variable (Excess Return). The intercept of four portfolios showed insignificant results which is evidence for the validity of Fama and French model for KSE-100 index for the selected time frame. Out of six portfolios three showed significant results for market risk premium, four showed for size premium and three showed for value premium confirms the existence of effect of all three independent employed factors. Contrary to the findings of (1) for FF model this study favors FF model in explaining the returns behavior of companies trading on KSE-100 index. So the findings go in partial support for FF model for companies listed on KSE-100 index.

1. Introduction

(2) Introduce the capital asset pricing model independently. Capital asset pricing model is used for the pricing of individual security or portfolio. It works on single factor that is exposure to non-diversifiable risk. Capital asset pricing model captures the sensitivity of asset to market risk.

In the Study of (3) it is found that there is strong relationship between cross-sectional average returns of stocks with that of market Beta's through CAPM.

Was the first who reported the "size effect" and argued that smaller firms have higher betas and therefore offer high returns as comparison to large firms**.** January effect" which is related to size factor is also found in empirical studies by (4) proposed their three factors model after having heavy criticism on one factor model, CAPM. Many empirical evidences show that CAPM didn't performed well while explaining the cross-sectional returns. They took the developed markets of thirteen major countries and about sixteen emerging markets of Brazil, India and Greece etc. They studied multi-variables and check their impact on average stock returns of many stock exchanges like NASDAQ, Amex and New York Stock exchange.

Fama and French predicted that the CAPM model is not valid for the stock market of U.S. Because while predicting the U.S common stock market it is found that there

is very little relation between the cross-sectional average returns of U.S common stocks and market Beta's. In their study they include variables like leverage of firm, size of the firm, market beta, BM ratio and P/E ratio. Some of the variables which have no significant role in the asset-pricing theory but show more explanatory power in cross-sectional average returns are Size (SMB) and Book-to-market equity (HML) of the firm.

They argued that those firms who have higher book-to-market value they will also offer higher returns on their stocks because they are more likely to be in financial distress.

They further added that firms having higher B/M ratio will also pay higher returns and vice versa, because stocks of such firms are considered to be under-priced. Later on, there is a hope for the increase in the price of such stocks so buying such stocks and keeping it is good for investors. This study is carried out by inspiration from Fama and French (1992) three factors model. This research will study the KSE-100 index from the time period of three years. The Methodology adopted for this paper is the same as the Published paper of (5). This study considers both financial and non-financial firms for checking the validity of Fama and French model.

To compare the results of this study we already had a benchmark in the form of FF model. The results will be compared to (5) findings which states two kinds of results. First, beta is not only responsible for the cross-sectional variations in stocks. Second, when size factor and B/M equity are taken jointly their explanatory power will be more than other variables and their results will be more significant. Also FF model shows that Capital asset pricing is no more valid for explaining the cross-sectional behavior of securities.

1.1. Problem Statement of the Study

Researchers face the problem of "asset pricing" over the period of time. Many models are developed in order to predict the true value of an asset. Among different models FF model also showed promising results in different markets around the world especially in U.S equity market. As we know that investors are very sensitive towards the movement of market. They want to know the true value of security so that they can easily make their investment decisions. So from investors' point of view pricing the security is an important step to be done. In order to come across the problem faced by investors Fama and French model is selected to help investors in their investment decision consent.

1.2. Research Questions

- What is the impact of market premium on excess returns?
- What is the impact of SMB (Small Minus Big) factor on excess returns?
- What is the impact of HML (High minus Low) factor on excess returns?

1.3. Objectives of the Study

Objectives of this study are listed below:

- To examine the impact of market premium on excess return.
- To examine the impact of SMB factor on excess return.
- To examine the impact of HML factor on excess return.

1.4. Purpose of the Study

The study is conducted with the aim that Fama and French model is able to explain the returns of companies listed on KSE-100 index.

2. Methodology

For this study data of stock prices is gathered from Business recorder and some other websites on monthly basis. The selected firms in our study belong to the different sectors of Karachi stock exchange. The time period of 2011 to 2013 is selected for this specific study. Our study contains only those firms whose data is readily available on the concerned websites for the above mentioned time period. This study constructs six portfolios for this analysis by intersecting size and B/M factor on each other. Those firms are out from analysis which has negative equity. For risk free rate figure Pakistani t-bill rates are considered.

2.1. Formation of Portfolio

The Portfolio formation is the same as used by Fama and French in their paper of 1992 i.e. formation of six portfolios by intersecting the B/M ratio with size of the firm.

Firstly firms were into two major categories named as "Big" and "Small" i.e. "Big" are those firms having highest market capitalization and second group named as "Small" is formed on the basis that those firms having smallest market capitalization in our sample of selected firms from Karachi stock exchange.

The selected firms are again divided into three categories on the basis of their B/M ratio. Group of firms having high B/M ratio is named as "Value" firms and the second is named as "Medium" contains those firms which has medium B/M ratio. The third group is made on the basis of firms having low B/M ratio among our selected sample of companies and we name it as "Growth" firms.

In order to have variations in our data, six portfolios had been constructed as already mentioned above. Study labeled the portfolios as those firms having big size and low book-to-market ratio by "B/L", those having big size and Medium book-to-market ratio by "B/M", firms with big size and also having high book-to-market ratio by

"B/H". The discussed three portfolios are made by the intersection of firms having large size and with the combination of firms having high, medium and small B/M ratios.

Further three more portfolios are made by taking the smallest firms and intersecting it with firms having high, medium and small B/M ratios. The three newly made portfolios are named as S/L, S/M & S/H. Portfolio S/L include firms with small size & low book-to-market ratio. The "S/M" portfolio is created on the basis of firms having small size with medium B/M ratio similarly "S/H" contains those firms which are small in size and has high B/M ratio.

Estimation of Variables (Market premium, SMB & HML):

The calculation of market premium has been done by subtracting the risk free rate from the return on KSE-100 index. The estimation of market premium has been done by the following formula.

$$EPt = Rmt - Rf$$

We add two more variables to namely SMB and HML.

The returns associated with the size of firm is the concerned with SMB factor. SMB can be calculated by subtracting the portfolio based on weighted average returns on three small size market capitalization from the portfolio based on three big market capitalization size.

Mathematically the representation of the SMB factor is:

$$SMB = [S/L + S/M + S/H]/3 - [B/L + B/M + B/L]/3$$

Similarly HML factor is concerned with the returns associated with the value of firm. HML can be calculated by subtracting the returns of portfolios of low book-to-market ratio from the returns of portfolios of high book-to-market ratio.

Mathematical representation of HML factor is given below:

$$HML = [S/H + B/H]/2 - [S/L + B/L]/2$$

2.1.1. Model for Analysis

This study runs two kinds of models in order to check validity of FF model on available data.

The first one is cross-sectional regression and the other one is time series regression. The cross-sectional regression equation is given below:

$$E(Ri) = Rf + \beta I\,[E(Rm) - Rf] + Si\,E(SMB) + hi\,E(HML)$$

In the above given equation [*E*(*Rm*) *Rf*] account for the market premium. E (SMB) factor and E (HML) factor accounts for size and value premium respectively. *i* ,*Si* & *hi*is the representation of betas for above mentioned variables. The below given equation is used for time-series analysis.

$$Ri - Rf = \alpha i + \beta I\,(Rm - Rf) + SiSMB + hiHML + \varepsilon i$$

This (*Ri–Rf)* factor shows excess returns, market premium is represented by (*Rm –Rf*), αirepresents the extra risk premium given on the stock returns and $\varepsilon i$is the error term.

By rearranging the above given two equations of cross-sectional regression and time series regression. The desired final model for the analysis of our data is obtained. The equation of the model is given below.

$$ER\,(q) = \alpha i + \beta\,(Rq) + Sq\,(SMB) + hq\,(HML) + \varepsilon q$$

In this equation *ER* (*q*) is equal to the *Rq-Rf* and *Rq* is equal to the average return of portfolio.

Sample Selection:

The current study considers companies listed on KSE-100 index for checking the accuracy of FF model for the time period of 2011 to 2013. The sample for this study contains 80 selected companies. 20 firms are excluded as some of their data was unavailable for the selected time period of this study.KSE-100 index includes top 100 companies of Karachi stock exchange based on their market capitalization. So the sample is concern with only those sectors of Karachi stock exchange from where these top 100 companies belong to.

Theoretical Frame Work:

Dependent variable:

The excess return of formed portfolio will be considered as our dependent variable as suggested by Fama and French model. Dependent variable is represented by E(R). The word "excess return" means that any leftover return after subtracting from risk free rate. In other words that extra return for which an investor is willing to take risk.

Independent Variables

Three factors are independent variables namely market risk premium factor, the size premium factor and the value premium factor.

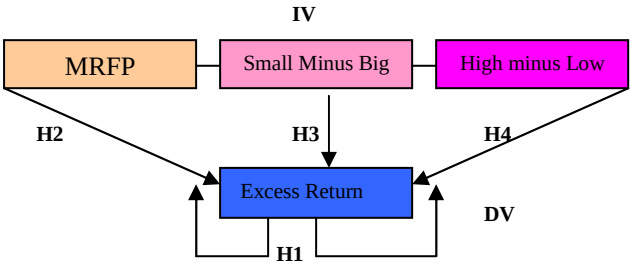
The first independent factor can be calculated by subtracting the risk free rate from the return on market portfolio. In other words one can say that the extra return that an investor will get if he take risk by investing in market portfolio instead of risk free rate security/asset. This independent variable is the same as used by capital asset pricing model. But here addition of two more independent variables has taken place.

The second independent variable is known as SMB (Small minus big) or size premium. It is calculated by subtracting the monthly average returns of big firms from the monthly average returns of small firms. Similarly HML (High minus low) is calculated by subtracting monthly average returns of firms having low B/M ratio from the firms having high B/M ratio.

The criteria for SMB and HML are set because it is believed that small size firms shows sensitivity towards various kinds of risks as compared to big size firms. The natures of small firms are less diversified as compare to big firms. Therefore it is argued that they will offer higher returns on stocks as compare to big firms

Firms having high B/M ratio are also known as value firms and there is risk associated with these firms as comparison to firms having small B/M ratio. Firms having

low B/M ratio are also known as Growth stocks. High B/M is the indication that there is deviation from the book value of firm to that of market value which further means that market is not adding value to the stocks of such firm. This may be due to the any financial crisis associated with that firm or expectation of investors about the future of that firm. Such firms are exposed to business as well as financial risk which lead to demand for extra premium on stock from the investors' side.



Model of the study

MRFP (Market Risk Premium Factor)
IV(independent variables)
DV(Dependent variable)

2.1.2. Hypotheses of the Study

Study will run the regression model in order to check the accuracy of FF model for KSE-100 index. The dependent variable is excess return and it will be regressed by the three independent variables which are market risk premium, SMB and HML.

Since Fama and French is a three factor model, so multivariate regression model has to be applied on selected data. Following hypothesis was assumed:

H1: $i \neq 0$
H2: $\beta 2t \neq 0$
H3: $\beta 3t \neq 0$
H4: $\beta 4t \neq 0$

iis the intercept of regression. β2t, β3t& β4t are the slopes/betas of three independent variables.

The results will depend on the values of intercept and slope coefficients. If the value of intercept become insignificant or in other words if it is statistically zero then it will argue that the model is accurate in predicting the return behavior. Similarly if the values of slope coefficient become significant or statistically not equal to zero then it will be stated that this model is valid.

3. Results & Discussion

After running the regression model on the gathered data from KSE, results will be interpreted in two ways. One interpreting results by descriptive statistics and other by regression results.

3.1. Descriptive Statistics

Given below is the table representing descriptive statistics of all our considered six portfolios for our study.

Table 1. *Descriptive statistics.*

	B/H	B/M	B/L	S/L	S/M	S/H
Mean	2%	4%	5%	6%	3%	3%
Median	2%	3%	4%	-2%	1%	2%
Maximum	15%	28%	27%	36%	20%	12%
Minimum	-11%	-24%	-14%	-26%	-16%	-15%
Standard Deviation	5%	13%	12%	13%	8%	9%

The Mean row of Table 1 shows the range from 2% (Portfolio B/H) to 6% (Portfolio S/L). Which means that portfolio S/L gives 6% average monthly returns which is the highest of all followed by others. The least average monthly returns are given by Portfolio B/H which is just 2%. In the Maximum row the monthly returns are ranging from 12% (Portfolio S/H) to 36% (Portfolio S/L) so one can say that the portfolio S/L gives the maximum monthly return of 36% among all others. Portfolio S/L contains firms having small size and low B/M ratio.

The third row of the descriptive statistic shows the range of minimum returns of -11% (Portfolio B/H) to -26% (Portfolio S/L) of different portfolios. The minimum monthly return was given by Portfolio S/L of -26%. The final row shows the standard deviations or risk associated with these portfolios. Portfolio B/M and Portfolio S/L reported the maximum standard deviation of 13% each. Which means that both the portfolio (B/M and S/L) contain maximum risk among other portfolios over the considered period of time.

Table 2 shows the results generated by running the statistical tool correlation on six different kinds of portfolios. Correlation tool is used in order to find the relationship between any two variables or their intra-dependency. Table shows that the maximum correlation is between the portfolio S/M and Portfolio S/H. The maximum of 58% correlation were recorded between these two portfolios. The minimum correlation had been found between the portfolio S/M and Portfolio B/H. Their correlation was -11%.

Table 2. *Correlation between variables (Maximum correlation b/w S/M and S/H*

	B/H	B/M	B/L	S/L	S/M	S/H
B/H	100%					
B/M	24%	100%				
B/L	35%	29%	100%			
S/L	20%	32%	15%	100%		
S/M	-11%	41%	33%	-22%	100%	
S/H	19%	-13%	21%	35%	58%	100%

Table 3*. Correlation between MRP, SMB, and HML (Independent Variables).*

	MRP	HML
HML	0.96%	
SMB	4.40%	-12.05%

These are the values of correlation found among the independent variables. The correlation between HML and SMB were -12.05%, HML and MRP 0.96%, and between

SMB and MRP 4.40%. It has been noted that there is no highly correlation between any two of independent variables. So it is concluded that there is absence of multicollinearity.

3.2. Regression Results

Study runs the multivariate regression for the data analysis. Multivariate regression is used for model which has two or more than two independent variables. In FF model there are three independent variables, the market premium, risk factor and book-to-market factor.

There is only one dependent variable in this study i.e. excess return of our already made six portfolios. As per (5) model three independent variables are considered. In addition to market risk premium, the value premium which is denoted by HML & Size premium which is denoted by SMB are considered.

Table 4. *T statistical result of the portfolios*

	α	β1	β2	β3	t(α)	t(β1)	t(β2)	T(β3)	R-square
B/H	0.0001	-0.214	0.012	0.918	-1.371	-0.512	0.223	11.634*	0.412
B/M	0.0003	0.006	1.061	0.332	-0.119	-0.168	-0.515	0.430	0.589
B/L	0.0002	-0.015	1.072	-0.699	-0.812	-2.110*	-14.429*	-21.451*	0.741
S/L	0.0001	-0.873	0.436	0.434	1.621	10.152*	15.230*	1.235	0.612
S/M	0.0008	0.031	0.124	0.439	2.385*	3.417*	4.239*	15.461*	0.542
S/H	0.0010	0.624	0.771	0.843	2.869*	0.919	3.862*	1.034	0.637

*Significant at 95%

The benchmark to argue that specific model is a good predictor of returns we have to look at the values of intercepts in the above table obtained from regression model. If the t-statistic values for intercepts are insignificant then it shows that the model is valid. Except for the intercepts values of S/H and S/M portfolio, the intercept of other portfolios were found to be insignificant. So it is that the model holds for KSE-100 index for the selected time frame. The three portfolios show the market risk premium which is portfolio B/L, S/L and S/M because their t-statistic values are significant at 95% confidence level. Hence it is conclude that the return behavior of B/L, S/L and S/M portfolios were explained by market risk premium. These results are similar to the findings of (1). Four portfolios including S/L, S/M, S/H and B/L showed the size premium because the t-statistic results of the slopes of these portfolios were significant. From this it is concluded that the size premium has also significant impact on return behavior. Similar results can also be seen in the study of (6).Three portfolios namely B/H, B/L and S/M values were found to be significant so it means that these portfolios show the value premium. The portfolio B/L and S/M are the only portfolios which show the presence of market risk premium plus existence of both size and value premium. And both results are supported by values of R-square of 0.741 and 0.612 respectively.

4. Conclusion

Over the Period of time many financial economists are trying to find such model which is accurate in predicting the stock return behavior. Initially they developed capital asset pricing model for the purpose of finding the true value of a security. CAPM was successful initially in predicting the return behavior of stocks but with the passage of time round the globe it fails to do so. Some researchers favors the capital asset pricing model some have strong reservations about its validity. Current study aims to predict the return behavior of KSE-100 index with advance model known as FF three factorial model. The sample for this study is companies listed on KSE-100 index for the time of three years i.e. from 2011 to 2013. Study considers Pakistani T-bill rates as proxy for risk free rate. To check the validity of FF model this study deployed the multivariate framework. Four portfolios out of six shown insignificant results to their intercept values which is evidence that FF model is able to show the return behavior ok KSE-100 index. Portfolio B/M, S/L and S/M show the significant t-statistic values toward the market risk premium. This means that market risk premium has also an effect in explaining the return behavior. Similarly three portfolios show support for value premium and four portfolios show support for size premium. The portfolio B/L and S/M are the only portfolios which show the presence of market risk premium plus existence of both size and value premium. And both results are supported by values of R-square of 0.741 and 0.612 respectively. So the study partially goes in the favor of FF model and it is concluded that investor or fund managers should consider FF model for their investment decisions. Contrary to the findings of Shah et. al. (2011) this finding goes in the favor of Fama and French three factor model. The finding of size premium is very much similar to the findings of Gaunt (2004) and Mirza (2009). Those investors who want to get higher returns should look for small size firms and also for firms having high book-to-market ratio.

List of Acronyms and Abbreviations

KSE Karachi Stock Exchange
FF model Fama and French Model
HML High Minus Low
SMB Small Minus Big
MRP Market Risk Premium
NASDAQ National Association of Securities Dealers Automated Quotations
B/M Book to Market
SEM Stock Exchange of Mauritius
BSE Bombay Stock Exchange
S/L Small Size Firm to Low book-to-market ratio Firm

S/M Small Size Firm to Medium book-to-market ratio Firm

S/H Small Size Firm to High book-to-market ratio Firm

B/L Big Size Firm to Low book-to-market ratio Firm

B/M Big Size Firm to Medium book-to-market Firm

B/H Big Size firm to High book-to-market Firm

References

[1] Shah, A., Abdullah, F., Khan, T., & Khan, S. U. (2011). Simplicity Vs Accuracy: The Case of Capm And Fama And French Model. Peshawar: Australian Journal of Basic and Applied Sciences.

[2] Jack_Treynor in 1961 and 1962, Sharpe in1964, Lintner in 1965, and Jan Mossin in 1966.

[3] Sharpe (1964)-Lintner (1965), Breeden (1979). multivariate proxies and asset pricing relations. Journal of Financial Economics 18 (1987) 91-110. North-Holland

[4] Kim, Dongcheol (1997). "A Re-examination of Firm Size, Book-to-Market and Earnings Price in the Cross- Section of Expected Stock Return." The Journal of Financial and Quantitative Analysis, Vol. 32 (4), pp. 463-489.

[5] Fama, F. Eugene and French R. Kenneth (1992). "The Cross-Section of Expected Stock Returns", Journal of Finance, Vol. 47, pp. 427-465.

[6] Fama, F. Eugene and French R. Kenneth, (1993). "Common Risk Factors in the Returns on Stocks and Bonds", Journal of Financial Economics, Vol. 33, pp. 3-65.

[7] Fama, F. Eugene and French R. Kenneth, (1995). "Size and Book-to-Market Factors in Earnings and Returns", Journal of Finance, Vol. 50, pp. 131-155.

[8] Guan, L., Hansen, D. R., Leikam, S. L., & Shaw, J. (2007).Stable betas, size, earnings-to-price, book-to-market and the validity of the capital asset pricing model. Managerial Finance, 33(8), 595–614. doi: 10.1108/03074350710760313.

[9] Gaunt, Clive (2004). "Size and Book to Market Effects and the Fama French Three Factor Asset Pricing Model: Evidence from the Australian Stock market", Accounting and Finance, Vol. 44, pp. 27-44.

[10] Basu, Sanjoy. "The Relationship between Earnings Yield, Market Value and Return for NYSE Common Stocks: Further Evidence." Journal of Financial Economics 12 (1983): 129-156.

[11] Berk, J. (1995). "A Critique of Size Related Anomalies", Review of Financial Studies, Vol. 8, pp. 275-286.

[12] Beaulieu, M.-C., Gagnon, M.-H., &Khalaf, L. (2009).A cross-section analysis of financial market integration in North America using a four factor model. International Journal of Managerial Finance, 5(3), 248–267. Doi: 10.1108/17439130910969710.

[13] Bundoo, S. K. (n.d.). An Augmented Fama and French Three-Factor Model :

[14] New Evidence from, An Emerging Stock Market, (1993), 1–25.

[15] Connor, G. (2001). Tests of the Fama and French Model in India *

[16] Daniel, K. and S. Titman (1997). "Evidence on the Characteristics of Cross-Sectional Variation in Stock Returns",Journal of Finance, Vol. 52, pp. 1-33.

[17] Drew E. Michall, Naughton, Tony and Veeraraghavan, Madhu (2003). "Firm Size, Book-to-market equity and security returns: Evidence from the Shanghai Stock Exchange." Australian Journal of Management, Vol. 28 (2), pp. 119-140.

[18] Faff, R. (2004). A simple test of the Fama and French model using daily data: Australian evidence. Applied Financial Economics, 14(2), 83–92.doi:10.1080/0960310042000176353

[19] Kim, Dongcheol (1997). "A Re-examination of Firm Size, Book-to-Market and Earnings Price in the Cross- Section of Expected Stock Return." The Journal of Financial and Quantitative Analysis, Vol. 32 (4), pp. 463-489.

[20] Mirza, N. Size and Value Premium in Karachi Stock Exchange, 1–40.

[21] Nartea, G. V., Ward, B. D., &Djajadikerta, H. G. (2009). Size, BM, and momentum effects and the robustness of the Fama-French three-factor model: Evidence from New Zealand. International Journal of Managerial Finance, 5(2), 79–200. doi: 10.1108/17439130910947895.

[22] Pandey, I. M. Mohan (2001). "The Expected Stock Returns of Malaysian Firms: A Panel Data Analysis",IIMA Working Paper No. 2001-09-01, September, Available at SSRN: http://ssrn.com/abstract=299913 or DOI: 10.2139/ssrn.299913.

[23] Sehgal S and Tripathi V (2005). "Size Effect in Indian Stock Market: Some Empirical Evidence", Vision-The Journal of Business Perspective, Vol. 9 (4), pp. 27-42.

[24] Theriou, N. G., Maditinos, D. I., &Chadzoglou, P. (2005). Managerial Finance Emerald Article : The Cross-Section of Expected Stock Returns : An Empirical Study in the Athens Stock Exchange The Cross-Section of Expected Stock Re turns : An Empirical Study in the Athens Stock Exchange.

[25] Vassalou, M., and Y. Xing, (2004). "Default Risk in Equity Returns." Journal of Finance, Vol. 59, pp. 831-868.