Identifying Structural Breaks in Asset Pricing Behavior in the Indian Context

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Abstract

The paper studied the asset pricing behavior in India for the time period from April 1991 till March 2015 by employing the Fama-French three factor model and discovered a structural break in November 2001. This structural break was due to the coefficient of the value factor that showed a statistically significant increase post break point. For all the six test portfolios considered, the market factor and size factor premiums had statistically significant coefficients throughout the study period. In the pre-break point period, four of the six portfolios had a statistically significant coefficient for the value factor premium, while for the post break point, all the six test portfolios had a statistically significant coefficient for the value factor premium. The evidence, therefore, pointed to an increasing importance for the value factor. The paper also provided evidence that the Fama-French three factor model is a good descriptor of returns in the Indian context. The discovery of the structural break in the asset pricing behavior was also consistent with the adaptive market hypothesis (AMH).

Key words : asset pricing, structural break, market, size, value, Fama - French three factor model, adaptive market hypothesis (AMH)

JEL Classification : G11, G12, G14

Paper Submission Date : August 10, 2016 ; Paper sent back for Revision : February 22, 2017 ; Paper Acceptance Date : April 17, 2017

The period from 1991 till the present has seen many reforms and transformations in the Indian capital market. It is possible that one, more, or all of them significantly impacted the asset pricing behavior in the Indian market. A few of the reforms and transformations and their implications are discussed below.

SEBI Replacing CCI and the Free Pricing of Issues

Prior to 1992, public issues of equity issues were to be priced strictly on the basis of the formula prescribed by the Controller of Capital Issues (CCI) in the Ministry of Finance, Government of India. The conservative pricing formula of the CCI, which often resulted in underpricing of public issues and their consequent heavy oversubscription, deterred companies from going in for public issues. The permission of the Government of India was also required with regard to the timing and the size of the public issue.

The Securities and Exchange Board of India (SEBI) Act was passed in January 1992 and in May 1992, SEBI replaced CCI as the apex regulatory body for the capital markets in India. With the coming of the SEBI, companies

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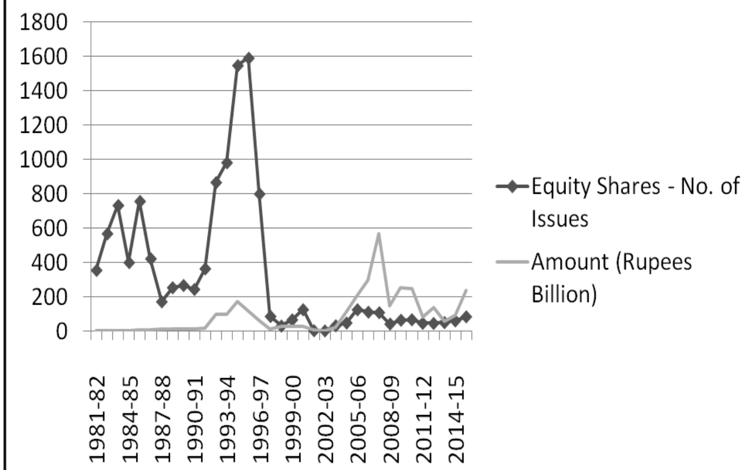
Figure 1. No. of Equity Issues and Amount Raised



Data Source: The Reserve Bank of India Website (www.rbi.org.in)

were free to determine the price, size, and the timing of their public issues. However, the pricing of the issues has to be in accordance with the relevant SEBI guidelines.

The takeover of SEBI and the free pricing of issues had a significant impact on the market as can be seen in the Figure 1. While the number of public issues dramatically increased in 1994-95 and 1995-96 and later declined, and the total amount of money raised through public issues kept fluctuating over the years, it can be seen that the amount of money raised through public issues significantly increased over the years.

Shift from Open Outcry Floor Trading to Nationwide Screen Based Trading

Prior to the establishment of the National Stock Exchange (NSE), the Indian equity market consisted of three components: the Bombay Stock Exchange (BSE), 20 smaller regional stock exchanges, and the Over-the-Counter Exchange of India (OTCEI). The BSE was the most important exchange in the country, accounting for more than 75% of the total trading volume. The trading and settlement infrastructure of the Indian capital market was poor. Trading on all stock exchanges was through open outcry; settlement systems were paper-based, and market intermediaries were largely unregulated. Stock exchanges were run as “brokers clubs” in that their management was largely composed of brokers. There was no prohibition either on insider trading or on fraudulent and unfair trade practices (Cho, 1999).

The National Stock Exchange of India (NSE) was established in 1994 as a competitor to the Bombay Stock Exchange, with major financial institutions led by the Industrial Development Bank of India, backing the NSE. The NSE introduced nationwide screen-based trading (SBT) with a dish-to-satellite data transmission system that provides instant trading access to brokers anywhere in India. BSE adapted to the competition from the NSE by upgrading to computerized systems and by reforming trading rules and procedures, which included increased surveillance over the capital adequacy of brokers. BSE shifted from an “open outcry” trading system to a screen-based system, making major investments in equipment, and revised its own procedures to provide transparency for investors. The National Securities Clearing Corporation Limited (NSCCL), a wholly owned subsidiary of the NSE, commenced operations in April 1996. NSCCL served as the legal counter party to the net settlement obligations of each brokerage firm and fulfilled these obligations to the counter parties when a brokerage firm defaulted. By instituting a mark-to-market margin system, NSCCL substantially reduced settlement risk, thereby promoting market liquidity. During 2011-12, the share of National Stock Exchange (NSE) accounted for 80.7% of the trading volume; Mumbai Stock Exchange (BSE) controlled 19.2%, with a fraction going to the Calcutta Stock Exchange. As a result of the reforms associated with NSE, total transactions costs on India's equity markets dropped from 5% in mid-1993 to roughly 2.5% in 1997.

Impact of Screen Based Trading on Markets and Cost of Equity

Some studies on emerging markets reported that automated trading has been shown to significantly improve market efficiency (Jiang, Tang, & Law, 2002 ; Naidu & Rozeff, 1994 ; Shah & Thomas, 1996). Grunbichler, Longstaff, and Schwartz (1994) stated that automated screen based trading results in the following which enable better price discovery - cost effectiveness (lower transaction costs), speedier processing and execution of orders, rapid information dissemination, and greater trade volume and transparency. Jain (2005), in a study of monthly stock returns time series on stock exchanges of 56 countries and annual returns time series of stock exchanges of another 15 countries, demonstrated that 62% to 83% of the regime shifts from floor based open outcry trading system to screen based electronic trading system were associated with reduced cost of equity for the listed companies. Domowitz and Steil (2002) documented reduction of cost of equity for S&P 500 companies due to introduction of screen based automated trading. The study also predicted further reduction in cost of equity for U.S. and European companies in the time to come as a result of screen based automated trading. Reduction in the cost of equity can, to a large extent, imply changes in the asset pricing.

Introduction of Dematerialized Trading

Trading in dematerialized stocks has many merits like reduced transaction costs, avoidance of the risks associated with physical shares (like physical damage, loss in transit, counterfeit shares, odd lots), quicker delivery, etc. Dematerialized trading was implemented in a phased manner starting from its introduction in January 1998. The introduction of dematerialized trading added to the speed and efficiency of the nationwide screen based trading system. Today, as per the information on the official website of SEBI, 99.9% of the transactions on the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE) take place in the dematerialized form.

Electronic Funds Transfer (EFT)

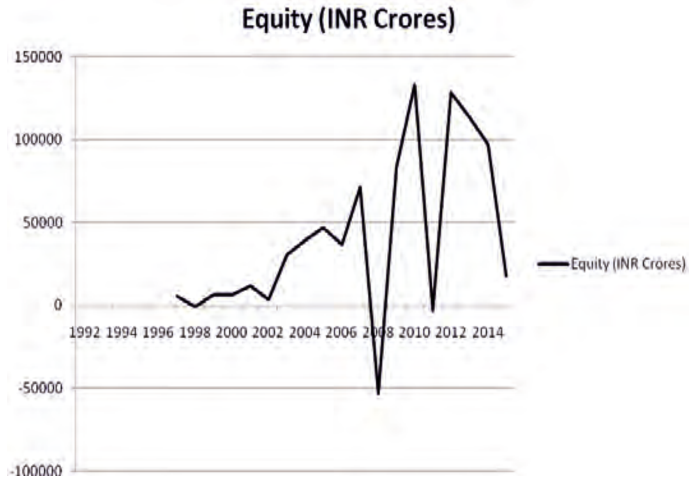
The Electronic Funds Transfer (EFT) was launched in the late 1990s. Through the EFT, an account holder of a bank could electronically transfer funds to another account holder of any other participating bank. The EFT system was available across 15 major centers in India. The EFT system was replaced by a more efficient and feature rich National Electronic Funds Transfer (NEFT) system.

The NEFT system enabled one-to-one transfer of funds across bank accounts of individuals or corporates. This system achieves the funds transfer through batch settlements at hourly intervals, which for most purposes is almost real time funds transfer.

Entry of Foreign Institutional Investors

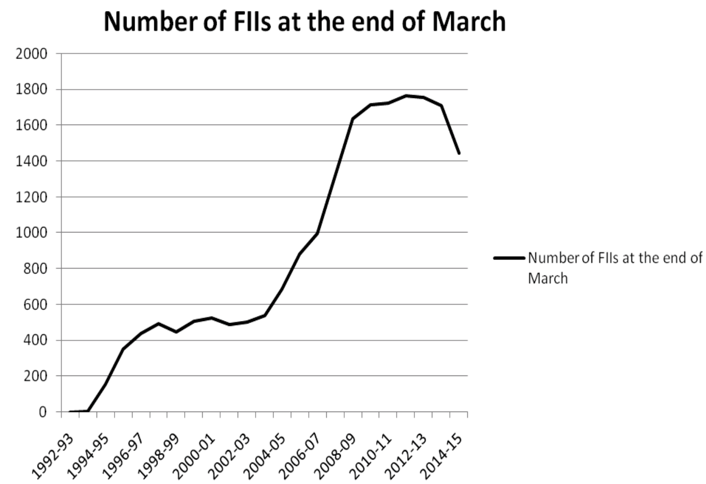
From September 14, 1992, FIIs and overseas corporate bodies (OCBs) could invest in securities traded on the primary and secondary markets and these included shares, debentures, and warrants issued by listed companies or companies that were to be listed on the stock exchanges in India and in the schemes of domestic mutual funds. The entry and investments of FIIs grew tremendously over the years. The Figure 2 shows the growth of net FII

Figure 2. Net FII Investments in Equity Over the Years



Data Source: www.sebi.gov.in and www.fpi.nsdl.co.in.

Figure 3.Number of FIIs Registered with SEBI



Data Source: Indian Securities Market, A Review (ISMR) available on www.nseindia.com.

investments (FII purchases less sales) in equity over the years. The years in the graph are calendar years from January till December. The Figure 3 shows the increase in the number of FIIs registered with SEBI in the Indian market over the years. The years shown in the graph are financial years from April 1st till March 31st.

It can be seen from both Figure 2 and Figure 3 that the number of FIIs and the net investments by FIIs increased tremendously over the years. It is possible that the investments by the FIIs influenced the pricing of stocks and stock returns in the Indian market. Babu and Prabheesh (2008) used daily data from the Indian stock market for the period from January 2003 till February 2007 and employed the VAR framework and Granger causality test to give evidence of bidirectional causality between FII flows and stock returns. Inoue (2009) explored the causalities in mean and variance between stock returns and foreign institutional investment (FII) in the Indian context. Daily data was used and the study period from January 1999 to March 2008 was divided into two periods before and after May 2003. The study found that for the first period, stock returns influenced FII flows ; whereas, in the second period, FII flows influenced stock returns. Guru and Parikh (2009), in a study on the FII flows and stock returns on the National Stock Exchange (NSE) in India for the time period from 2003-2008, reported a significant bi-directional causal relationship between the two. They stated that increased FII participation, *ceteris paribus*, would lead to a permanent decrease in the risk premium and ,therefore, a permanent increase in prices.

Literature Review

➭ **Anomalies of the CAPM and the Development of the Fama-French Three Factor Model :** The Sharpe (1964) - Lintner (1965) capital asset pricing model (CAPM) asserted a linear relationship between expected returns and beta. While the model gained considerable currency among financial economists due to its elegance, a lot of evidence mounted, starting in the late 1970s, that a significant portion of the variation in expected returns is unrelated to market beta. Researchers began to report patterns in stock returns that later came to be referred to as the anomalies of the CAPM - anomalies because these patterns could not be explained by the CAPM. Basu (1977) showed that stocks with high earnings/price ratios (or low P/E ratios) earned significantly higher returns than stocks with low earnings/price ratios and that the differences in beta could not explain these return differences. Banz (1981) and Reinganum (1981) described the size effect, that is, the inverse relation between size (measured by market capitalization) and average stock returns. They discovered that small-capitalization firms earned higher average returns than is predicted by the Sharpe-Lintner capital asset-pricing model (CAPM) and ,therefore, concluded that this was an anomaly. Stattman (1980) and Rosenberg, Reid, and Lanstein (1985) found that average returns on U.S. stocks were positively related to the ratio of a firm's book equity, BE, to its market equity, ME. Bhandari (1988) demonstrated that leverage had an extra explanatory value for the cross section of average stock returns when size (market equity) and the beta were already included in the model. Bondt and Thaler (1985) found a reversal in long-term returns ; stocks with low long term past returns tended to have higher future returns. Jegadeesh (1990) found that stock returns tend to exhibit short-term momentum, that is, stocks that have done well over the previous few months continued to have high returns over the next month. Chan, Hamao, and Lakonishok (1991) showed that high ratio of cash flow to price predicted higher returns. Fama and French (1993) developed a three-factor asset pricing model to correct for the anomalies of the CAPM. The Fama-French three-factor model is given by:

$$R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t$$

where, R_i is the rate of returns expected by the equity shareholders of a firm i, R_f is the risk-free rate of returns, R_m is the rate of returns on the market portfolio, *SMB* is the size factor risk factor [1], and *HML* is the book-to-market-value risk factor [2] α_i, β_i, s_i, and h_i are parameters to be estimated. The subscript t indicates time period.

The Fama-French three-factor model (Fama & French, 1992, 1993) corrects for almost all the reported anomalies in the CAPM and has found empirical support across the globe and in India. Fama and French (1996) showed that the three-factor model captures the return to portfolios formed on earnings to price (E/P) ratio, cash flow to price (C/P) ratio, and past sales growth. Fama and French (2006) provided an indirect support for the Fama-French three factor model. They, among other things, examined if the CAPM explained value premium and more generally, if the beta was adequate to explain the cross-section of returns. They concluded that the CAPM was unable to explain the portion of the variation in the cross-section of returns that was explained by size and value, implying that the CAPM does not adequately explain the cross-section of returns and that the Fama-French

[1] *SMB* is the expected returns of a portfolio of small cap stocks minus the expected returns on portfolio of large cap stocks.
[2] *HML* is the expected returns of a portfolio of high book-to-market stocks minus the expected returns of a portfolio of low book-to-market stocks.

model corrects for this inadequacy.

There have been many studies supporting the view that the Fama-French model is a good descriptor of stock returns in the Indian market and other emerging economies. Connor and Sehgal (2001) and Mohanty (2001) stated that the Fama-French three factor model well describes the stock returns in the Indian context. Drew and Veeraraghavan (2003) gave evidence supporting the applicability of the Fama-French model in Hong Kong, Korea, Malaysia, and the Philippines. Bundoo (2008) stated that the Fama-French three factor model is a good descriptor of returns for stocks listed on the Stock Exchange of Mauritius. Tripathi (2008), Bahl (2006), Taneja (2010), and Balakrishnan (2016) are among the other authors who have given evidence in support of the Fama-French three factor model in the Indian context.

Considering the research support for the Fama-French model in India and abroad, the Fama-French three factor model was chosen to test for structural breaks in the asset pricing behavior in the Indian stock market.

Data and Methodology

The Fama-French three-factor model is given by:

$$R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t \qquad (1)$$

where, R_i is the rate of returns expected by the equity shareholders of the firm i, R_f is the risk-free rate of returns, R_m is the rate of returns on the market portfolio, *SMB* is the size factor risk factor, and *HML* is the book-to-market-value risk factor. α_i, β_i, s_i, and h_i are the parameters to be estimated. The subscript t indicates time period.

To identify the breakpoint, the Quandt likelihood ratio (QLR) test (Quandt, 1960) as described in Hansen (2001) is used. The critical values for the QLR test are from p. 559 of Stock and Watson (2011), which are, in turn, based on values given in Andrews (2003). The QLR test was performed with 15% trimming at the ends of the time series. The QLR test was performed on the monthly returns time series of each of the six test portfolios whose construction is detailed in the next section.

Once the break point was identified for each of the six test portfolios, Chow test (dummy variable version) was done for each of the test portfolios to identify the cause of the structural break (the source of the structural break could be one or more of the following : change in the intercept, change in coefficients of one or more of the factors.).

$$R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + d_{\alpha i} D + d_{\beta i} D (R_{mt} - R_{ft}) + d_{si} D(SMB_t) + d_{hi} D(HML_t) \qquad (2)$$

where, D is an indicator taking the value 0 prior to the break point and 1 after, $d_{\alpha i}$ is the intercept shifter for the post break point period; $d_{\beta i}$, d_{si}, and d_{hi} are slope shifters.

Koller, Goedhart, and Wessels (2010) recommended computing stock returns on a monthly frequency rather than daily or even weekly frequency, especially when the frequency of trades is low. So, this paper uses monthly frequency price data to compute monthly percentage returns.

Monthly closing prices time series of all the Bombay Stock Exchange (BSE) listed stocks were extracted from Prowess, a CMIE database (CMIE – Centre for Monitoring Indian Economy), for the time period from April 1991 till March 2015. Market capitalization and book value to market value ratio data as at the end of February were extracted from the same database for the time period from 1991 till 2015. Stocks for which the price, book value to market value, and market capitalization were not available on the respective required dates have not been included in the study.

Six equally weighted test portfolios are constructed on the basis of the methodology followed in Davis, Fama, and French (2000). The portfolios are constructed for every Indian financial year from April to March on the basis of the market capitalization and book-to-market-value data as at February end of the previous financial year. For example, for the six portfolios constructed using market capitalization data and book value to market value ratio data at the end of February 1992, equally weighted monthly percentage returns are computed for the 12 months from April 1992 till March 1993. Thus, the six portfolios are newly constructed for every financial year.

The portfolios are constructed on the basis of February end data to avoid any look ahead bias [3]. Big stocks *(B)* are above the median market equity of BSE firms, and small stocks *(S)* are below. Similarly, low book-to-market-value stocks *(L)* are below the 33rd percentile of the ratio for BSE firms, medium book-to-market-value stocks *(M)* are in the middle (33rd percentile till 67th percentile), and high book-to-market-value stocks *(H)* are above the 67th percentile. Six equally weighted portfolios - *S_L, S_M, S_H, B_L, B_M, and B_H* - are formed as the intersections of the two size and three book-to-market-value groups [4].

From the above, we can construct the *SMB* and *HML* measures. *SMB* is the difference between the equal-weight averages of the returns on the three small stock portfolios and the three big stock portfolios (the procedure for *SMB* computation is the same as given in Davis et al. (2000)).

$$SMB = \frac{R(S\_L) + R(S\_M) + R(S\_H)}{3} - \frac{R(B\_L) + R(B\_M) + R(B\_H)}{3}$$

HML is the difference between the returns on a portfolio of high book-to-market-value stocks and the returns on a portfolio of low book-to-market-value stocks, constructed to be neutral with respect to size. In line with this definition, Davis et al. (2000) used the below formula to estimate *HML* and the same formula has been used in the present study too :

$$HML = \frac{R(S\_H) + R(B\_H)}{2} - \frac{R(S\_L) + R(B\_L)}{2}$$

The construction of the six portfolios, *S_L, S_M, S_H, B_L, B_M,* and *B_H* as well as the computation of the size and value premiums are as per the procedure followed in Davis et al. (2000).

The size premium, *SMB* is computed as follows :

$$SMB = \frac{R(S\_L) + R(S\_M) + R(S\_H)}{3} - \frac{R(B\_L) + R(B\_M) + R(B\_H)}{3}$$

The value premium, *HML* is computed as follows :

[3] Look ahead bias refers to using data for decisions on a date when the data would not have been available on the date. Suppose, while back testing, one uses financial year end data to form portfolios exactly at the end of the financial year, it would result in look ahead bias as the financial year end data would definitely not be available on the last day of the financial year. The financial year for most corporates in India is from April 1st till March 31st, while a few may have the financial year end in June or in September. While most large corporates would have declared their annual financial statements within three months of the financial year end, smaller firms might take a longer time to declare the financial results. Hence, February end data has been used for forming the portfolios.

[4] For example, portfolio *S_L* refers to the portfolio of stocks that are below the BSE /NSE median in size and in the bottom 30% of book-to-market-value ratio.

$$HML = \frac{R(S\_H)+R(B\_H)}{2} - \frac{R(S\_L)+R(B\_L)}{2}$$

In the above equations, *R(S_L), R(S_M), R(S_H), R(B_L), R(B_M),* and *R(B_H)* refer to the equally weighted monthly returns of the portfolios *S_L, S_M, S_H, B_L, B_M,* and *B_H,* respectively. So, a time series of monthly size *(SMB)* and value *(HML)* premiums are generated for the time period from April 1991 till March 2015.

Davis et al. (2000) followed the above procedure for computing the size premium and value premium so that the size premium is computed neutral to value and the value premium is computed neutral to size.

The market proxy is the BSE Sensex, the monthly percentage returns time series of which are generated from the monthly closing prices of the same obtained from the BSE website, www.bseindia.com. Obviously, the time period considered for the market proxy time series is the same as mentioned earlier, that is, March 1991 till March 2015.

➢ **Choice of Risk - Free Rate :** Stowe, Robinson, Pinto, and McLeavey (2007) advised the use of yield on a liquid long term government bond (with 10 or 20 years to maturity) as the proxy for the risk free rate in the context of research in long term assets like equities. This view is in line with that of Armitage (2005) and Damodaran (2008). The yield on Government of India bonds with time to maturity of 10 years are taken to be risk free rate. The yield data of these securities for the time period from April 1996 till March 2015 is taken from the Reserve Bank of India (RBI) website (www.rbi.org.in).

For the time period from April 1991 till March 1996, interest rates on Central government dated securities given on the Reserve Bank of India (RBI) website were taken as the risk free rate proxy because of non-availability of data on Government of India bond yields. All the regression and analysis was done using EasyReg econometric software (Bierens, 2015).

Analysis and Results

The results of the QLR test for all the test portfolios are given in the Table 1. It can be seen from the Table 1 that for each of the six test portfolios, the Chow test statistic is the maximum for the break point at November 2001. This maximum value of the Chow test statistic is the Quandt's statistic described in Hansen (2001). The Quandt's statistic for all the six test portfolios exceeds the critical value at 5% level of significance and 15% trimming (Stock & Watson, 2011, p. 559). Thus, the QLR test results indicate a structural break at November 30, 2001 for all the six test portfolios, *S_L, S_M, S_H, B_L, B_M* and *B_H*. So, for all the six test portfolios, the Chow test regression (dummy variable version) (2) is run for all the test portfolios, the results of which are given in the Table 2.

The coefficients of the size and market premiums are statistically significant [5] for the periods before and after the break point for all the six test portfolios. But there has been no statistically significant change to the coefficients of the size and market premiums post break point for any of the test portfolios.

In the pre-break point period, the coefficient of the value premium is statistically significant for four of the six test portfolios. In the post break point period, there has been a statistically significant increase in the coefficient of the value premium for these four portfolios. For the rest of the two portfolios whose value premium coefficient is insignificant in the pre-break point period, the value premium coefficient is positive and significant in the post-break point period.

From the discussion of the results, the following conclusions can be drawn. While the market, size, and value

[5] 5% level of significance has been considered throughout the discussion of the results.

Table 1. Results of the QLR Test for all the Test Portfolios

	Chow Test Statistic for the Test Portfolios						Critical Values for the QLR Statistic
Chow Test Break Points	***S_L***	***S_M***	***S_H***	***B_L***	***B_M***	***B_H***	
Oct 1991 - May 1995, June 1995 - March 2015	3.5072	0.8776	2.8427	1.9784	3.0328	2.8082	4.7100
Oct 1991 - Aug 1998, Sept 1998 - March 2015	4.5553	0.8352	1.4621	0.9805	1.8794	3.8835	4.7100
Oct 1991 - Nov 2001, Dec 2001 - March 2015	33.4725	11.2322	7.6835	7.5619	18.9704	40.9892	4.7100
Oct 1991 - Feb 2005, March 2005 - March 2015	13.8873	5.7542	5.5790	4.7363	12.4442	15.2971	4.7100
Oct 1991 - May 2008, June 2008 - March 2015	10.1061	5.7636	2.5001	2.4166	10.9893	11.6023	4.7100
Oct 1991 - Sept 2011, Oct 2011 - March 2015	4.5833	1.8047	1.3187	1.6208	3.4238	5.2397	4.7100

Notes on the table:

1) The QLR statistic critical values in the table are for 15% trimming and 5% level of significance and taken from p. 559 of Stock and Watson (2011). The critical values in Stock and Watson (2011) are *F*-statistic critical values based on chi-square critical values given in Andrews (2003).

2) The six equally weighted portfolios, *S_L, S_M, S_H, B_L, B_M,* and *B_H*, are formed as the intersections of the two size and three book-to-market-value groups. Big stocks *(B)* are above the median market equity of BSE firms and small stocks *(S)* are below. Similarly, low book-to-market-value stocks *(L)* are below the 33rd percentile of the ratio for BSE firms, medium book-to-market-value stocks *(M)* are in the middle (33rd percentile till 67th percentile), and high book-to-market-value stocks *(H)* are above the 67th percentile.

Table 2. Results of the Chow Test Regression (Dummy Variable Version) for all the Test Portfolios

	α_i	s_i	h_i	β_i	$d_{\alpha i}$	d_{si}	d_{hi}	$d_{\beta i}$
S_L	0.875474	1.347096	-0.72657	1.073856	-0.54343	0.146242	1.00473	0.009339
	(0.31)	(0.00)	(0.00)	(0.00)	(0.47)	(0.34)	(0.00)	(0.95)
S_M	1.173916	1.28983	0.136205	0.944591	-0.28189	-0.02078	0.532795	0.138848
	(0.17)	(0.00)	(0.35)	(0.00)	(0.71)	(0.91)	(0.02)	(0.22)
S_H	0.048141	1.268978	0.976419	1.12026	0.266466	0.136698	0.30443	-0.0877
	(0.94)	(0.00)	(0.00)	(0.00)	(0.59)	(0.24)	(0.002)	(0.44)
B_L	0.312457	0.282648	-0.03479	1.088483	0.124028	0.080161	0.298329	-0.05437
	(0.60)	(0.00)	(0.63)	(0.00)	(0.79)	(0.37)	(0.04)	(0.60)
B_M	0.645284	0.262492	0.158615	1.008144	0.002982	0.092297	0.544997	0.072182
	(0.33)	(0.00)	(0.0049)	(0.00)	(0.99)	(0.44)	(0.00)	(0.50)
B_H	1.139791	0.360765	0.26222	1.042079	-0.68587	0.089705	0.998629	0.042672
	(0.16)	(0.00)	(0.02)	(0.00)	(0.32)	(0.48)	(0.00)	(0.77)

factors remain relevant both in the pre-break point and post-break point periods, the value factor importance has increased in the post-break point period. It could be noted that the change in the asset pricing behavior is solely due to an increase in the value premium coefficients of the six test portfolios in the post break point period.

The intercept is statistically insignificant for all the test portfolios. There has been no statistically significant change in the intercept post the break point for all the six test portfolios. These results, when seen together with the results that the market, size, and value factors remain relevant (in describing asset pricing behavior) both in the pre-break point and the post break point period are evidence that the Fama-French three factor model is a good descriptor of returns in the Indian context.

The results of the present paper are consistent with the findings of Bauer, Cosemans, and Schotman (2010), who studied the conditional Fama-French three factor model in a European context and found that risk loadings in the Fama-French (1993) three-factor model varied with time. The study sample of Bauer et al. (2010) included common stocks from 16 European nations, and the time period of the study was from February 1985 till June 2002. The results of the present paper are also consistent with the results obtained by Schrimpf, Schröder, and Stehle (2007). In a study employing monthly German stock market data for the period from December 1969 till December 2002, they reported that their tests for structural breaks on the Fama-French three factor model indicated instability in parameters.

Discussion

This paper presents evidence that asset pricing behavior could change over the long term and should not be assumed to remain constant. The paper employs the Fama-French three factor model and identifies a structural break in the asset pricing behavior in the Indian context at November 2001 when monthly returns data for the time period from April 1991 till March 2015 are studied. The structural break arises from the coefficient of the value premium showing a statistically significant increase post break point for all the six test portfolios. This structural break could probably be attributed to the wide-ranging transformations and reforms that took place in the Indian capital market during the study period.

While the market, size, and value factors remain relevant for describing asset returns both in the pre-break point and post break point period, we can infer from the results an increasing importance for the value factor in the post break point period. That is, the evidence points to an increasing importance for the value factor in the Indian context. Another inference that can be drawn is that the Fama-French three factor model is a good descriptor of returns in the Indian context. The identification of a structural break in the asset pricing behavior is also consistent with the adaptive market hypothesis (AMH), and this is discussed in the next section.

Research Implications

(1) Implications with Regard to the Adaptive Market Hypothesis : The concept of adaptive markets hypothesis (AMH) as stated in Lo (2004, 2005) postulates that efficiency evolves in the markets and markets could alternate between periods of lesser and greater efficiency. Urquhart and McGroarty (2014) provided a unique support to the AMH. They examined four calendar anomalies, namely Monday effect, January effect, turn-of-the-month (TOTM) effect, and the Halloween effect by employing the daily Dow Jones Industrial Average (DJIA) returns over the period from 1900 - 2013 and discovered that the behavior of these anomalies varied over time. They stated that this discovery of time varying behavior of these anomalies was consistent with the AMH.

Raghuram (2017) studied the calendar anomaly 'month of the year' effect in the Indian context for three sub-periods within the time period from January 01, 1990 till April 01, 2015 by employing the daily returns of four stock indices to find the existence of a different 'month of the year' effect in each of the three sub-periods. In the spirit of Urquhart and McGroarty (2014), this can be considered to be consistent with AMH. Hiremath and Kumari (2014) employed the daily time series data of two Indian stock indices for the time period from January 1991 to March 2013 to give evidence that market efficiency is evolving in India and that possibly the Indian market is moving towards efficiency. Thus, Hiremath and Kumari (2014) provided evidence in support of AMH in India.

One of the implications of the adaptive markets hypothesis (AMH) that is stated in Lo (2004, 2005) is that any relation between risk and reward in the financial markets is unlikely to be stable over time. This would, in turn, imply that asset pricing models which essentially measure rewards to identified risk factors could experience changing sensitivities to the risk factors/premiums in them over time. This paper identifies a structural break in the asset pricing behavior in the Indian market which is consistent with the AMH in the Indian context.

(2) Utility to Fund Managers : Changing asset pricing behavior is also of interest to fund managers using quantitative equity portfolio management to construct portfolios. If stock returns exhibit changing sensitivities to asset pricing factors, then these changing sensitivities could be used to bring about corresponding factor tilts to their investment portfolios so as to generate superior returns for their clients/investors.

Limitations of the Study and Scope for Further Research

The present paper does not study if the structural break it identifies coincides with a change in the market efficiency. If any evidence regarding this could be provided by future research, this would add to the evidence regarding AMH in the Indian context. Asset pricing behavior, as implied by adaptive market hypothesis, evolves over time and there might be a need to replicate the present study in the future so that new changes, if any, can be identified.

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