Article

Do Asset Pricing Models Explain Size, Value, Momentum and Liquidity Effects? The Case of an Emerging Stock Market

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Abstract

This article examines whether the alternative asset pricing models and more specifically the liquidity-augmented multifactor models can explain the effect of size, value, momentum and liquidity on cross section of stock returns in India during September 1995 to March 2011. We employ time series and panel data methodology to carry out the analysis. Our findings suggest that the value and liquidity effects are often explained, but the explanatory power of size and short-run past return or momentum effect remain consistent irrespective of alternative asset pricing models risk adjustment process. The liquidity-augmented multifactor models are found to have better explanatory power than to the other alternative multifactor models. The relative performance of liquidity-augmented multifactor modes for capturing the role of

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firm characteristics on stock returns varies across the individual firms' liquidity sensitivity and the aggregate market liquidity conditions.

JEL Classification: G11, G12, G14, G15

Keywords

Emerging market, liquidity effect, momentum effect, multifactor model, stock returns

Introduction

The relationship between expected stock returns and risk in Capital Asset Pricing Model (CAPM) (Lintner 1965; Sharpe 1964) is hypothesised upon the systematic market risk as the sole determinant factor. However, since the appearance of size effect (Banz 1981), an extant body of literature discusses the cross-sectional return predictability with respect to the value or book-to-market effect (Basu 1977), momentum effect (Jegadeesh and Titman 1993) and liquidity effect (Amihud 2002) which is inconsistent with the maintained theoretical argument of the CAPM. Motivated by the pervasiveness of size and book-to-market equity characteristics (Fama and French 1992, 1998, 2012), the recent literature suggests the applicability of three-factor model (Fama and French 1993), which incorporates systematic risk factors for size and value characteristics along with the market risk factor. The basic tenet of argument that supports the construction of risk factors on the basis of firm risk characteristics closely resembles with Merton's (1973) argument for systematic state variables or common risk factors that can account for the firm risk characteristics that are of concern to investors (Fama and French 1993). Following the theoretical argument of characteristic-based risk pricing in the form of market-wide risk factors (Fama and French 1993) and assuming momentum effect on the determination of expected stock returns, Carhart (1997) advocates towards a four-factor model or an augmented three-factor model with a momentum factor. Similarly, given the importance of liquidity in the cross-sectional return variation, several researchers also tried to augment the four-factor model with a liquidity factor in essence of a five-factor model

(Keene and Peterson 2007; Pastor and Stambaugh 2003). Moreover, the available literature recognises the empirical validation of systematic risk factors with respect to market, size, book-to-market equity, momentum and liquidity in both developed and emerging stock markets for the determination of cross section of expected stock returns (Dash and Mahakud 2012; Fama and French 1996, 2012; Griffin 2002; Her et al. 2004; Keene and Peterson 2007; Lam and Tam 2011; Lischewski and Voronkova 2012; Sehgal and Jain 2011).

However, in the recent finance literature, the empirical question is no more to search the alternative sources of risk factors, but to seek the answer for a more fundamental question, whether the factor models are sufficient enough to answer the return predictability of firm characteristics. In this regard, it has been argued that, if the empirically motivated risk factors represent the source of market-wide systematic risk, then after making the stocks raw return risk adjusted with respect to the risk factors, the incremental explanatory power of the firm characteristics for the risk adjusted return should be statistically insignificant (Avramov and Chordia 2006). Put it differently, if the risk factors, those have been motivated from the risk-based explanation of firm characteristics represent the systematic market risk component, then the factors themselves should completely explain the effect of respective firm characteristics. In such kind of environment, the multifactor specification considering all the major risk factors taken together must not leave any scope for firm characteristics to retain their importance for the explanation of returns that have been already risk adjusted with respect to the systematic risk factors. From the investment practitioners prospective, if particular multifactor model holds perfectly in a market, then the profit opportunity on the characteristic-based investment strategy can be ruled out completely.

A set of recent literature investigates this complete explanation hypothesis in several developed markets. Brennan et al. (1998), Avramov and Chordia (2006) and Chou et al. (2010) lead the way for the US stock market and find evidence that size and value effects are captured with the Fama and French (1993) three-factor model (FFTFM, hereafter), whereas momentum and liquidity effects are still persistent. Authors also suggest the inability of the CAPM to capture anomalous return behaviour associated with any of the firm characteristics. In the European market Bauer et al. (2010) find that FFTFM fails to eliminate the size, value, liquidity and momentum effect completely. Narayan and Zheng (2010) find that the Carhart (1997) four-factor model (CFM, hereafter) augmented with the liquidity factor is able to explain the liquidity, size and value effect but not the momentum effect in the Chinese stock market. To briefly sum up, the available empirical literature suggests that the effects of different firm-specific characteristics are not consistently captured through alternative asset pricing models across the different markets. Moreover, there is a conspicuous gap in the available literature to find a conclusive answer for such an imperative empirical question in the case of both developed and emerging stock markets. Complementary to our ascertainment, a similar line of concern also raised by Chou et al. (2010) while raising the question '*does there exist a risk-based factor model that can explain the role of firm characteristics that are otherwise commonly known as asset-pricing anomalies*'.

Motivated with the equivocal empirical findings for the complete explanation of firm characteristics by alternative asset pricing models, and lack of substantial empirical support with respect to the emerging stock market, this article aims to revisit the explanation evidence in an emerging stock market like India. In particular, we search answers for two specific questions: First, do firm-specific risk characteristics continue to affect stock returns regardless of the inclusion of market-wide risk factors in alternative multifactor specifications in the Indian stock market? Second, do the specific liquidity-augmented FFTFM and CFM models give better explanation for capturing the risk effects of firm's characteristics? Although our motivation for the first question is derived from the ongoing complete explanation debate, our motivation for the second question is derived from the available literature that argue for the implication of liquidity to increase the information content of market prices (Fang et al. 2009). Therefore, we hypothesise that the inclusion of the liquidity factor in multifactor models can have better predictability of firm characteristics as it is has been validated as one of the major factor responsible for stock price informativeness. The empirical finding for the second question is also important given the order-driven market structure of the Indian stock market as compared to the quote-driven developed stock markets. The special nature of order-driven market support several unique characteristics as it generates liquidity demand, supply schedules and price discovery that are consistent with equilibrium under perfect condition (Brockman and Chung 2002).

Moreover, choice of the emerging stock market like Indian stock market as an ideal candidate to test the complete explanation hypothesis is important for three reasons. First, the market microstructure literature suggests that the emerging stock markets are characterised by high stock price synchronicity, and thus, low price informativeness (Chana and Hameed 2006; Morck et al. 2000). Low price informativeness left less firm-specific information to diffuse in to the stock prices (Xing and Anderson 2011), and thus lower chance to find a profit opportunity with respect to the firm characteristic based trading strategies. Second, the literature that continues to find best suitable asset pricing models for the determination of stock returns in the context of emerging markets often suggests that, '*Emerging markets have long posed a challenge for finance. Standard models are often ill suited to deal with the specific circumstances arising in these markets*' (Bekaert and Harvey 2003). Third, despite the existence of empirical findings that either support or refute the explanatory power of alternative multifactor models in developed markets, those findings are less likely to be generalised given the data-snooping biases (Lo and MacKinlay 1990) documented in such markets.

This study contributes to the available literature by giving an out of sample evidence from an emerging stock market with different market settings on such an imperative long standing debate for fresh insights. Present study also adds a value to the existing literature from an order-driven market by considering the liquidity-augmented multifactor models for revisiting the complete explanation hypotheses of firm characteristics. To our knowledge, none of the available literature investigates the aforementioned anomaly effects with special reference to the liquidity-augmented models. More close to our work is the observation made by Narayan and Zheng (2010) in the context of the Chinese stock market. However, our work considers several alternative momentum proxies (short term, medium and long term) for a robust validation of momentum effect which has been explored in a very limited sense by Narayan and Zheng (2010). With special reference to the Indian stock market, our study perhaps makes the first attempt to provide an empirical answer for the firm characteristics complete explanation evidence considering alternative multifactor asset pricing models. In the robustness test of our findings, this study also explores complete explanation evidence by segregating entire sample into two different states: first it explores the possible evidence for complete explanation debate in high and low liquid stocks, second it explores the possible implications under high and low liquid market conditions.

In order to find answers for our proposed set of questions, we follow the first pass time series approach suggested by Brennan et al. (1998), and Avramov and Chordia (2006) for finding the risk-adjusted return of individual companies. Unlike to the popular portfolio-based approach in the asset pricing literature, we consider individual stocks in our analysis as it avoids the under rejection bias (Roll 1977) and data-snooping bias (Lo and MacKinlay 1990) observed with the portfolio-based approach. As an alternative to the commonly used Fama and MacBeth's (1973) two-pass cross-sectional regression approach to analyse the impact of firm-specific risk characteristics on stock return, we use the panel data estimation approach. This approach helps us to avoid the errors-in-variables problem (Shanken 1992) associated with the Fama and MacBeth approach.

Our empirical findings can be briefly summarised as follows. Consistent with the related literature, the decile shorted portfolios on firm characteristics like size, book-to-market equity, liquidity and momentum reveal that hedge portfolios constructed on the long-short strategy generated significant return variations for the four firm characteristics. Considering the explanatory power of aforementioned firm characteristics for explaining the risk-adjusted returns of individual securities, our results suggest that the value and liquidity effects are often explained, but the explanatory power of size and short-run past return or momentum effect remain consistent irrespective of the risk adjustment process of alternative asset pricing models. The liquidity-augmented multifactor models are found to have better explanatory power than to the other alternative multifactor models. However, the relative performance of liquidity-augmented multifactor modes for capturing the role of firm characteristics on stock returns varies across the individual firms' liquidity sensitivity and the aggregate market liquidity conditions.

The rest of this article is organised as follows. The second ection presents model specifications and the econometric method. The third section describes data. The fourth section discusses the variables of interest. Empirical results are presented in the fifth section. The sixth section concludes the article.

Model Specifications and Econometric Methods

Assuming that returns are generated by a conditional version of L-factor asset pricing model, return on security j at time t (R_{jt}) can be specified as:

$$R_{jt} = E_{t-1}(R_{jt}) + \sum_{l=1}^{L} \beta_{jlt-1} f_{lt} + \varepsilon_{jt} \tag{1}$$

where E_{t-1} is the conditional expectations operator, β_{jlt-1} is the conditional beta corresponding to the lth factor, f_{lt} is the unanticipated return on the lth factor with respect to the information available at $t-1$. Under exact pricing specification:

$$E_{t-1}(R_{jt}) - R_{Ft} = \sum_{l=1}^{L} \lambda_{lt-1} \beta_{jlt-1} \tag{2}$$

where R_{Ft} is the risk-free interest rate, λ_{lt-1} is the risk premium for factor l at time $t-1$. Following the approach of Brennan et al. (1998) and Avramov and Chordia (2006), the estimated risk adjusted return from the first pass time series regression on each security j for the month t can be specified as

$$R_{jt}^{*} \equiv R_{jt} - R_{Ft} - \sum_{l=1}^{L} \hat{\beta}_{jl} F_{lt} \tag{3}$$

where $F_{lt} \equiv f_{lt} + \lambda_{lt}$ is the sum of the factor realisation and its corresponding risk premium. $\hat{\beta}_{jl}$ is the beta estimated by a first pass time series regression over the entire sample period, R_{jt}^{*} is the estimated risk-adjusted return on stock j at time t from the first pass time series regression. The suggested risk-adjustment procedure imposes the assumption that the zero beta equals the risk-free rate, and that the L-factor premium is equal to the excess return on the factor. The derived risk-adjusted return in equation (3) becomes the ideal candidate for testing the impact of market anomalies on stock returns left unexplained by the risk adjustment process of alternative pricing models. For deriving the risk adjusted return, we consider three non liquidity-augmented models (CAPM, FFTFM and CFM) and two liquidity-augmented models. The two liquidity-augmented models are FFTFM augmented with the liquidity factor (hereafter, LAFFTFM) and CFM augmented with liquidity factor (hereafter, LACFM). In a more generic form, the risk adjustment process of equation (3) can be summarised as:

$$R^*_{jt} \equiv R_{jt} - [R_{Ft} + \beta f_t] = \theta + \mu_{jt}\varphi_{jt-1} + \varepsilon_{jt} \tag{4}$$

where R^*_{jt} is the estimated risk-adjusted return on stock j at time t, β denotes the parameters that capture the loadings of the risk factor. The vector of beta is estimated by the first pass time series regression over the entire sample period with the asset pricing models containing the risk factors (f_t). φ_{it-1} is the vector of firm characteristics and μ_{jt} is a vector of characteristics rewards with respect to the firm characteristics of interest. Given that the asset pricing models are sufficient enough to describe the pervasive firm characteristics $\hat{\mu}_{jt}$, i.e., $(\varphi'_{jt-1}\varphi_{jt-1})^{-1}\varphi'_{jt-1}R^*_{jt}$ will be equal to zero. The argument for testing the importance of firm characteristics (i.e., m = 1, …, M) for explaining the risk-adjusted return as in specification (4) can be specified as:

$$R^*_{jt} = \alpha + \sum_{m=1}^{M} \mu_m \varphi_{mjt-1} + \varepsilon_{jt} \tag{5}$$

where φ_{mjt-1} is the firm characteristic for security j at time t – 1, M is the total number of market anomalies and μ_m the estimated coefficient with respect to the firm characteristics m. Under the null of exact pricing or expected excess return on security j is determined solely by the loadings of security's return on the L-factors, the coefficients of firm characteristics will be equal to zero. We extend equation (5) to a panel data model specification as follows:

$$R^*_{jt} = \alpha_j + (\mu_m \varphi_{mt-1} + \dots\dots\dots\dots\dots + \mu_M \varphi_{Mt-1}) + \varepsilon_{it} \tag{6}$$

Considering the four firm characteristics like firm size (SZ), book-to-market equity (BM), liquidity (LQ) and momentum (MM) as explanatory variables equation (6) can be specified as

$$\begin{aligned} R^*_{jt} = \alpha_j + (\mu_{\text{sz}}\text{SZ}_{jt-1} + \mu_{\text{BM}}\text{BM}_{jt-1} \\ + \mu_{\text{LQ}}\text{LQ}_{jt-1} + \mu_{\text{MM}}\text{MM}_{jt-1}) + \varepsilon_{jt} \end{aligned} \tag{7}$$

where R^*_{it} is the risk-adjusted return of stock j at time t, the explanatory variables, namely, SZ, BM, LQ, MM are the firm characteristics. α_j is the individual effect, which is assumed as constant over time and varies across the individual cross-sectional unit (firm). ε_{jt} is a stochastic error term assumed to have mean zero and constant variance. The panel estimation approach helps to control for the unobserved individual heterogeneity, increasing the degrees of freedom and reducing collinearity among the explanatory variables. This approach is also robust to the errors-in-variables problem (Shanken 1992) associated with the Fama and MacBeth second-step cross-sectional regression approach. For the estimation of equation (7), we use the panel data estimation technique. The Likelihood Ratio (LR) test (Gourieroux et al. 1982) has been carried out to identify the existence of individual firm-specific effects in the dataset. Lagrange Multiplier (LM) test (Breusch and Pagan 1980) has been used to test the acceptability of panel data models over the classical regression models. The Hausman (1978) test has been used to determine the preferred model (i.e., fixed effect model or random effect model).

Data

The basic data consists of monthly returns and other firm-specific risk characteristics of National Stock Exchange (NSE) of India-listed non-financial companies for the period September 1995 to March 2011(187 months). Controlling for various stock selection criteria as discussed in Fama and French (1992) and omitting the firms with negative book-to-market value of equity, we have considered 582 continuously traded firms in the NSE. In order to avoid data-snooping bias and survivorship bias for our analysis, we consider only those stocks which are continuously traded in NSE since December 1994. The S&P CNX Nifty has been taken as the market proxy. The 91-days Treasury bill rate is considered as the proxy for the risk-free rate. While considering the S&P CNX Nifty as the market proxy, we assume implicitly that the Indian stock market is segmented, and the market risk premium is priced because of local macroeconomic and firm-specific factors (Bekaert and Harvey 2003; Misra and Mahakud 2009). The required data on stocks return and other firm-specific information have been collected from Centre for Monitoring Indian Economy PROWESS database, risk-free rate data have been collected from Reserve Bank of India (RBI) website.

Variables

This section has been categorised into two parts. In the first part, we discuss our approach for testing the cross-sectional regularity of firm characteristics and measures of firm characteristics. In the second part, we explain the construction of five market-wide risk factors.

Identification and Measures of Firm Characteristics

Among the several firm-specific risk characteristics, we have considered four firm-specific characteristics such as, SZ, BM, LQ and MM which are well documented in the asset pricing literature for their pervasive presence in both developed and emerging stock markets (see, for example, Asness 1997; Classens et al. 1998; Fama and French 2012; Groot and Verschoor 2002; Hart et al. 2003; Moor and Sercu 2013; Rouwenhorst 1999). In order to specifically validate the aforementioned firm characteristics in the Indian stock market for their cross-sectional variation in average stock returns, we follow the approach of Chen et al. (2010) and Artmann et al. (2012) for using equally weighted one-dimensional shorts. In other words, we form equally weighted decile portfolios for all the four firm characteristics to find their cross-sectional regularities in the Indian stock market.

Following Fama and French (1992, 1993), Lam and Tam (2011) and Jegadeesh and Titman (1993) for constructing the decile portfolios firm characteristics are measured as follows: SZ is the natural logarithm of market capitalisation (stock prices times outstanding shares) at the end of August of year y. BM in year y is the ratio between book equity for the fiscal year ending in calendar year y by the market value of equity at the end of August in calendar year y. MM is the cumulative return of a stock in month $t-12$ through month $t-2$ preceding August of year y. We skip one month between portfolio formation and holding period to avoid the effects of bid-ask spread, price pressure, and any lagged reaction. LQ is measured at the end of August of calendar year y as the annual average of monthly turnover ratio, that is, number of shares traded to the number of shares outstanding. For each firm characteristic at the beginning of September of year y, we form ten portfolios based on the decile break-points. The portfolios are held constant during the following 12 months, and portfolios are reformed every year at the beginning of September of year *y*. Portfolios formed for the momentum strategy has been rearranged every month. We consider September (t_9) as the base month in each year to rebalance our portfolios by allowing a five-month lag to match the accounting data available for the month of financial year end (t_3) of the calendar year *y* with the return data available for the portfolio formation month (t_9). This approach helps us to avoid the look-ahead bias. To calculate monthly portfolio returns, we apply an equal weighting. Consistent with the prior literature, we apply an equal weighting since our objective is to capture the cross-sectional pattern in average returns with respect to each specific characteristics and not to highlight the role of investability (Artmann et al. 2012; Chen et al. 2010).

Table 1 reports the average returns for decile portfolios sorted on firm characteristics and the findings suggest that, in the one-dimensional sorts SZ, BM, MM and LQ lead to significant average hedge portfolio returns. Among the decile shorted portfolios, D-0 represents the highest decile of the stock return predictor, and D-1 is the lowest. Long-short-strategies of buying stocks with the high BM, MM and selling stocks with low BM, MM generate significant monthly average returns of 2.66, 3.06 percentages, respectively. Furthermore, the average return spread between the small SZ and low LQ stocks and large SZ and high LQ stocks are 2.31 and 1.28 percentage, respectively. This gives a first-hand impression that these four characteristics are indeed associated with cross-sectional return variation in the Indian stock market. It is also important to mention that, one may argue the return variability across different decile shorted portfolios are not uniformly showing an increasing or decreasing trend. For instance, in the SZ shorted decile portfolios although D-10 and D-1 show a theoretically consistent return variation (D-1 > D-10, i.e., small stocks pay higher returns than large stocks), the return variation do not follow similar pattern among all portfolios. In other words, among SZ deciles D-7 portfolio returns are higher than D-5, which apparently at the fundamental level must be in a reverse order. One possible explanation for such inconsistency may be attributable to the impact of other idiosyncratic firm characteristics that could be influencing the return variations. Since in a portfolio-based shorting approach, the focus point is one-firm characteristics, the possible impact of other firm characteristics are assumed be subsumed within the selected firm characteristic, as in this case firm SZ. But this assumption may not

Table 1. Average Returns for Decile Portfolios Sorted on Firm Characteristics

Firm	Mean Returns on Decile Portfolios										Hedge Portfolio Returns	
Characteristics	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	D-9	D-10	D10-D5	D10-D1
Firm size (SZ)	3.34	1.98	1.96	1.78	1.85	1.66	1.91	1.60	1.47	1.03	–0.85	–2.31
											(–1.68)	(–1.78)
Book-to-Market Equity (BM)	0.81	1.21	1.80	1.92	2.28	1.99	1.69	2.09	2.59	3.46	1.18	2.66
											(1.97)	(2.36)
Liquidity (LQ)	2.33	1.78	1.73	1.49	1.51	1.45	1.33	1.29	1.11	1.05	–0.46	–1.28
											(–1.41)	(–3.19)
Momentum (MM)	1.25	1.70	1.33	2.15	1.33	1.52	1.17	1.73	2.17	4.31	2.98	3.06
											(2.74)	(2.35)

Notes: Sample period consists of 187 monthly observations from September 1995 to March 2011. D-10 represents the highest decile of the stock return predictor, and D-1 is the lowest. The average monthly hedge portfolio return obtained from a long-short position in deciles D-10 and D-5, D-10 and D-1, respectively. For the decile shorted portfolios, firm size (SZ) is natural logarithm of market capitalisation at the end of August of year *y*, book-to-market equity (BM) in year *y* is the ratio between book equity for the fiscal year ending in calendar year *y* by the market value of equity at the end of August in calendar year *y*, liquidity (LQ) is measured at the end of August of calendar year *y* as the annual average of monthly turnover ratio, momentum (MM) is the cumulative return of a stock in month $t-12$ through month $t-2$ preceding August of year *y*. Corresponding *t*-statistics are in parenthesis.

hold across all the portfolios given the impact of any other idiosyncratic return component in a particular decile. However, in our analysis, the hedge portfolio like D10–D5 which focuses on the median values of the decile series generates theoretically consistent return variations for all the three firm characteristics except for the LQ.

In order to examine return predictability of the above mentioned four risk characteristics for individual stock returns, we follow the approach of Brennan et al. (1998) and Avramov and Chordia (2006) and use the following measures: SZ is measured as the natural logarithm of the market value of the equity of the firm as of the end of the second to last month. BM is the ratio of the book value of equity at the end of financial year end in the calendar year y to the market value of the equity at the end of the month $t - 1$ in the calendar year y. LQ is measured as the annual average of monthly turnover ratio, that is, number of shares traded to the number of shares outstanding. To account for the momentum effect, we consider three sets of lagged return variables (RET2-3, RET4-6 and RET7-12). Motivation for the inclusion of two sets of lagged return variables, namely, RET2-3, RET4-6 is consistent with the importance of short-run momentum strategy documented in the context of the Indian stock market (Ansari and Khan 2012; Sehgal and Jain 2011). RET2-3 is the cumulative return over the two months ending at the beginning of the previous month. RET4-6 is the cumulative return over the three months ending three months previously. RET7-12 is the cumulative return over the six months ending six months previously. Consistent with Brennan et al. (1998), the lagged return variables were constructed to exclude the return during the immediate prior month in order to avoid any spurious association between the prior month return and the current month return caused by thin trading or bid–ask spread effects. All the firm characteristics are lagged by one month with respect to the stock return for each firm j. The measures of firm characteristics for the decile portfolios construction are slightly different from that of the individual companies because of their distinctive objectives. While in the case of decile portfolios, we access the return variation associated with each form characteristics, in the firm-specific test we test their return predictability as a priced source of risk.

Table 2 reports summary statistics and correlation matrix of firm risk characteristics of our interest. The reported descriptive statistics in Table 2 are the time series averages of the cross-sectional means and

Table 2. Descriptive Statistics and Correlation Matrix of Firm Characteristics

Firm	Descriptive Statistics		Correlation Matrix of Firm Characteristics					
Characteristics	Mean	St. Dev.	SZ	BM	LQ	RET2-3	RET4-6	RET7-12
SZ	20.62	1.97	1.00					
BM	4.86	12.25	–0.28	1.00				
LQ	2.22	13.41	0.12	–0.03	1.00			
RET2-3	4.94	23.36	0.03	–0.01	0.07	1.00		
RET4-6	7.43	28.65	0.03	–0.02	0.04	0.02	1.00	
RET7-12	14.30	41.18	0.04	–0.02	0.05	0.04	0.03	1.00

Notes: For firm characteristics, the descriptive statistics is computed as the time series average of cross-sectional mean and standard deviation (St. Dev.) value. For firm characteristics, the correlation matrix is computed from the time series of monthly cross-sectional correlations. SZ is measured as the natural logarithm of the market value of the equity of the firm as of the end of the second to last month. BM is the ratio of the book value of equity at the end of financial year end in the calendar year y to the market value of the equity at the end of the month $t - 1$ in the calendar year y. LQ is measured as the annual average of monthly turnover ratio, that is, number of shares traded to the number of shares outstanding. RET2-3, RET4-6 and RET7-12 are the cumulative return over the two months ending at the beginning of the previous month, three months ending three months previously and six months ending six months previously, respectively. Sample period consists of 187 monthly observations from September 1995 to March 2011.

standard deviations of security characteristics. The mean values of all the return variables representing the short- and long-term executable momentum strategies show a positive value. This indicates that the momentum strategy both short and long and more specifically the long strategies can have a chance to generate positive momentum profits. The high value of standard deviation in the case of all momentum or return characteristics may be resultant of high volatile nature of emerging stock markets. The correlation matrix shows a very low level of correlation structure among the selected firm characteristics. In Table 2, the negative correlation between BM and all the momentum variables, and in Table 1 the reported positive relationship of these variables with cross-sectional return variation are consistent with the findings of Asness (1997) in the international stock market. Asness (1997) observes that measures of momentum and value are negatively correlated across stocks, yet each is positively related to the cross-section of average stock returns.

Construction of Market Risk Factors

The systematic market factor (MRKT) is measured as market excess return in excess of risk-free rate of interest. The measures of SZ, BM, MM and LQ for the construction of size factor (SMB, i.e., small minus big), book-to-market equity factor (HML, i.e., high minus low), momentum factor (WML, i.e., winners minus losers) and liquidity factor (LMHL i.e., low liquid minus high liquid) is similar to the measures mentioned in the preceding sub-section 'Identification and Measures of Firm Characteristics' for the construction of decile portfolios. Following Fama and French (1993), the six value-weighted portfolios used for SMB and HML construction are, S/L (small–low), S/M (small–medium), S/H (small–high), B/L (big–low), B/M (big–medium) and B/H (big–high) from the intersection of two SZ and three BM groups. SMB is measured each month as the equal-weight average of the returns on the three small stock portfolios minus the returns on the three big stock portfolios, that is, (S/L + S/M + S/H) − (B/L + B/M + B/H)/3. Similarly, HML measured each month as the equal-weight average of the returns on two high BM portfolios minus returns on the two low BM portfolios, that is, (S/H + B/H) − (S/L + B/L)/2. Following Keene and Peterson (2007) for the LMHL construction, four value weighted portfolios formed with the intersection of two SZ-based and two LQ-based portfolios, that is, S/HL (small–high liquid), S/LL (small–low liquid), B/HL (big–high liquid), B/LL (big–low liquid). LMHL is the difference between the simple average of returns from the two low liquid portfolios and the simple average of returns from the two high liquid portfolios, that is, (S/LL + B/LL) – (S/HL + B/HL)/2. In order to measure WML, we follow Carhart (1997) and Her et al. (2004) for constructing six value-weight portfolios with the intersection of two size and three return momentum groups are S/W (small–winner), S/N (small–neutral), S/L (small–loser), B/W (big–winner), B/N (big–neutral) and B/L (big–loser). WML is the equal-weight average of the returns on the two winner stock portfolios minus the returns on the two loser stock portfolios, that is, (S/W + B/W) – (S/L+ B/L)/2. For obtaining the monthly value of SMB, HML, WML and LMHL factors, we hold the respective portfolio positions from September of year y to August y + 1, and portfolios were updated at the beginning of September every year. Similar to the deciles shorted portfolio approach, the five months gap has been provided to minimise the look-ahead bias.

Table 3 reports the descriptive statistics for all the five major risk factors and shows the mean positive return for all the risk factors except the market factor. However, the high level of standard deviation observed for the HML and WML warrants the caution for following such investible strategies. Except for the market excess return, monthly mean returns reported in Table 3 with respect to SMB, HML and WML are found to be higher than the mean returns observed by Fama and French (2012) for the Global, North America, Europe, Japan and Asia Pacific markets. Consistent with our findings in Table 1, the statistics presented in Table 3 confirm the presence of the size (SMB), value (HML), liquidity (LMHL) and Momentum (WML) premiums on the Indian stock market. The positive but small correlation between LMHL and other factors (SMB, HML and WML) indicate that the liquidity factor in addition to the well-documented four factors captures another dimension of systematic risk. Consistent with the finding of Liu (2006), our liquidity factor is negatively correlated with market excess return. This may be because of the fact that, when aggregate market performs badly, causing

Table 3. Descriptive Statistics and Correlation Matrix of Market Risk Factors

Risk Factors	Descriptive Statistics		Correlation Matrix of Risk Factors				
	Mean (*t*-mean)	St. Dev.	MRKT	SMB	HML	LMHL	WML
MRKT	–5.81 (–10.64)	7.48	1.00				
SMB	0.30 (0.41)	9.97	0.26**	1.00			
HML	1.55 (1.90)	11.12	−0.25**	−0.29**	1.00		
LMHL	0.48 (1.45)	3.50	−0.13#	0.06	0.05	1.00	
WML	1.09 (1.87)	10.35	−0.02	0.02	−0.10	0.04	1.00

Notes: Sample period consists of 187 monthly observations from September 1995 to March 2011. MRKT, SMB, HML, LMHL and WML are the systematic risk factors with respect to size, book-to-market equity, liquidity and momentum, respectively. *t*-Mean is the ratio of mean to its standard error. ** and # represent statistical significance at 5% and 10% levels, respectively.

liquidity to be low, investor requires a high liquidity premium as a compensation for the systematic liquidity risk. The positive correlation observed within SMB and LMHL may be because of the apparent relationship between market equity and liquidity. Amihud (2002) and Keene and Peterson (2007) suggest that the negative (positive) relationship of large size (small size) stocks with return can be considered as an alternative proxy for liquidity (illiquidity) measure of stocks. Overall, consistent with the findings of Rouwenhorst (1999) for a large number of emerging markets our results suggest that return factors in emerging markets are qualitatively similar to those documented for many developed markets.

Discussion of Results

This section has been divided into three parts. In the first part, we present estimation results of equation (7) for alternative asset pricing models. The second part focuses on the robustness test which explores the microscopic aspect of liquidity with respect to individual firm's sensitiveness towards the systematic liquidity risk factor (LMHL) and the macroscopic aspect of aggregate market-wide liquidity. The third part presents a brief outline of the key findings.

Alternative Asset Pricing Models Risk Adjusted Returns and Firm Characteristics

Table 4 reports the cross-sectional average slope coefficients of systematic risk factors for the first step time series regression specification in equation (3). For the purpose of brevity we only report the cross-sectional average slope coefficients of risk factors (MRKT, SMB, HML, LMHL and WML) used in the alternative asset pricing models. The insignificant intercepts across all the alternative asset pricing models suggest that the systematic risk factors are able to explain the return behaviour of individual firms. Reported results in Table 4 confirm the significant risk factor pricing to explain the time series return variation of individual firms.

Table 5 shows the estimation results of the equation (7) for four different alternative asset pricing models. The three different columns under each asset pricing models indicate the estimation results with respect to the three different momentum characteristics. For all the three alternative models, LR test results show that the firm-specific effects are present in the dataset. The reported LM test statistics indicate that either the fixed effect or random effect panel data models are to be preferred to

Table 4. Cross-sectional Average of Slope Coefficients of Risk Factors

Factor Models	θ_i	β_{MRKT}	β_{SMB}	β_{HML}	β_{WML}	β_{LMHL}	Adj. R^2
CAPM	0.96	0.50	–	–	–	–	0.16
	(1.18)	(4.89)					
FFTFM	0.14	0.54	1.43	0.71	–	–	0.19
	(1.62)	(2.41)	(2.36)	(2.69)			
CFM	–0.02	0.53	0.48	0.47	–0.50	–	0.21
	(–1.51)	(3.21)	(1.87)	(2.90)	(–1.38)		
LAFFTFM	0.30	1.20	0.89	0.46	–	0.65	0.34
	(0.17)	(2.02)	(3.74)	(2.11)		(2.16)	
LACFM	0.02	0.68	0.80	0.56	–0.12	0.79	0.26
	(1.56)	(4.28)	(2.75)	(2.38)	(–0.92)	(2.19)	

Notes: This table reports the cross-sectional average slope coefficients of risk factors for the first step time series regression specification in equation (3) to calculate the risk adjusted return of the individual firms. Corresponding cross-sectional average t-statistics are in parenthesis. Sample period consists of 187 monthly observations of 582 firms from September 1995 to March 2011.

ordinary pooled data model. Hausman test results for all the alternative specifications in Table 5 reject the use of random effect model. Reported results under columns 1, 2 and 3 in Table 5 suggest that CAPM fails to capture the SZ and the MM effects. MM characteristics of three different forms (RET2-3, RET4-6 and RET7-12) are significant in explaining the risk-adjusted returns of individual firms in the case of CAPM risk-adjusted returns. Similar to the results of the CAPM, among all the four risk characteristics, the FFTFM (columns 4, 5, 6) also fails to capture the effects of SZ effect. However, the FFTFM risk-adjustment process captures the long-run momentum effect (RET7-12), which was statistically significant in the case of CAPM. As the FFTFM augments the CAPM with the size factor (SMB), it is expected to have incremental explanatory power to capture the size effect. Given the significant coefficient of SZ characteristic for explaining the risk-adjusted returns of FFTFM, our result is not consistent with the Fama and French (1993) pervasive size factor argument in their proposed three factor model. Even though the firm-specific value effect (BM) is well captured for the Indian stock market, the model fails to account for the size effect completely.

Reported results in Table 5 with respect to the SZ, BM, LQ and MM effects are inconsistent with the findings of the related literature in the context of developed markets like the US and European stock markets. For instance, inconsistent with Brennan et al. (1998), Avramov and Chordia (2006) and Chou et al. (2010) in the context of US market, we find that the FFTFM is able to capture the BM and LQ effects, but not the SZ and MM effects in the context of the Indian stock market. In European market, Bauer et al. (2010) observe that the FFTFM fails to eliminate the SZ, BM, LQ and MM effects completely. Our results are found to be inconsistent with Bauer et al. (2010) as the FFTFM only fails to explain the SZ and MM effect; however, the model performs well to capture the BM and LQ effects. The significant SZ and MM effects are also evident for the CFM (columns 7, 8 and 9), which gives an indication that the CFM fails to capture the size and momentum effects (RET2-3 and RET 4-6). These results are intuitively more appealing with respect to the behaviour of two momentum characteristics. As the CFM augments the FFTFM with momentum factor, from the theoretical strand of multifactor models (Carhart 1997; Fama and French 1993), the MM characteristics are expected to be insignificant in the second step.

Table 5. Fixed Effect Model Regression Estimates of Alternative Asset Pricing Models

Coefficients and Test Statistics	CAPM			FFTFM			CFM		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
μ_{1SZ}	–0.96*	–0.98*	–1.01*	–0.85*	–0.82*	–0.84*	–0.84*	–0.84*	–0.82*
	(–20.15)	(–20.21)	(–21.1)	(–18.83)	(–18.32)	(–18.62)	(–18.91)	(–18.66)	(–18.40)
μ_{2BM}	0.13	0.18	0.43	0.21	0.11	0.48	0.09	0.10	0.18
	(0.24)	(0.21)	(0.69)	(0.86)	(0.23)	(0.09)	(0.17)	(0.18)	(0.35)
μ_{3LQ}	–0.25	–0.05	–0.02	–0.11	–0.16	–0.11	–0.27	–0.06	–0.19
	(–0.68)	(–0.21)	(–0.16)	(–0.69)	(0.67)	(–0.68)	(–0.65)	(–0.84)	(–0.73)
$\mu_{4RET2-3}$	0.01*	–	–	0.01*	–	–	0.11*	–	–
	(5.30)			(5.13)			(5.94)		
$\mu_{4RET4-6}$	–	0.01*	–	–	0.05*	–	–	0.02*	–
		(5.3)			(3.35)			(5.96)	
$\mu_{4RET7-12}$	–	–	0.14*	–	–	0.16	–	–	0.15
			(11.7)			(1.48)			(1.43)
LR Test [$x^2(581)$]	794.01	770.32	795.27	712.91	725.31	725.27	701.95	720.08	725.89
	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}

LM Test	417.11	412.74	367.64	493.29	533.35	490.50	513.25	550.62	516.63
$[x^2(1)]$	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}
Hausman	832.54	1301.99	651.65	1102	1206	1705.94	42581.51	2860.53	1381.16
Test $[x^2(4)]$	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}
R^2	0.0051	0.0051	0.0061	0.0042	0.0041	0.0040	0.0043	0.0043	0.0040
D-W Stat.	2.32	2.31	2.32	2.38	2.37	2.38	2.39	2.39	2.40
F-Test	107.25	106.64	129.03	88.35	85.32	83.32	90.09	90.09	84.57
	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}	{0.00}

Notes: This table reports the estimation results of the equation (6) for different alternative asset pricing models. The three columns under each asset pricing models indicate the estimation results with respect to the three momentum characteristics such as RET2-3, RET4-6 and RET7-12. The number of observation in the panel dataset consists of 582 individual firms for the sample period consists of 187 monthly observations (September 1995–March 2011). SZ is measured as the natural logarithm of the market value of the equity of the firm as of the end of the second to last month. BM is the ratio of the book value of equity at the end of financial year end in the calendar year *y* to the market value of the equity at the end of the month $t - 1$ in the calendar year *y*. LQ is measured as the annual average of monthly turnover ratio, that is, number of shares traded to the number of shares outstanding. RET2-3, RET4-6 and RET7-12 are the cumulative returns over the two months ending at the beginning of the previous month, three months ending three months previously and six months ending six months previously, respectively. All firm characteristics are lagged by one month with respect to the stock return for each firm *j*. The reported *t*-statistics are in parenthesis. Figures in the curly brackets represent corresponding p-values of model specification test statistics. * indicate significance at 1% level.

However, FFTFM and CFM are only able to account for the long-term momentum characteristics (RET7-12). Moreover, the CFM retains no incremental explanatory power with respect to RET2-3 and RET4-6 characteristics as compared to FFTFM. Overall reported results in Table 5 suggest that, the three alternative models are able to account for the complete explanation of BM and LQ effects. However, the three alternative non liquidity-augmented models fail to capture the effects of SZ and MM (RET2-3 and RET4-6) characteristics.

Table 6 reports the estimation results for the impact of firm characteristics on the risk-adjusted return derived from the first step liquidity-augmented FFTFM and CFM. Similar to the Table 5 model specification test statistics like LR, LM and Hausman tests statistics suggest that firm-specific effects are present in the dataset and negate the use of random effect model. Reported results in Table 6 for the LAFFTFM indicate complete explanation evidence for the BM, LQ (columns 1, 2 and 3) and medium-term momentum (RET4-6) effect (column 2). Reported results in Table 6 reveal that the liquidity-augmented FFTFM fails to capture SZ and short-term momentum (RET2-3) effects. However, results are more intuitive in case of the LACFM i.e., liquidity-augmented CFM model (columns 4, 5 and 6) that accounts for all the five major systematic risk factors. For the LACFM risk-adjusted returns, the firm characteristic like BM, LQ, RET4-6 and RET7-12 lost their explanatory. Similar to other alternative multifactor models, although LACFM failed to capture the SZ and short-term momentum (RET2-3) effects still this model accounts for the maximum effects of the firm-specific characteristics. This may be because of the special nature of the LACFM as it includes all the systematic risk factors with respect to the market excess returns, size factor, value factor, liquidity and momentum factors. The performance of LACFM is also found to be inconsistent with that of the Narayan and Zheng (2010) in the context of Chinese stock market. Narayan and Zheng (2010) observe that among all the firm characteristics, long-run momentum effect (RET7-12) is robust to the risk adjustment process of LACFM, but the SZ, BM and LQ effects lose their importance. Our results, however, suggest that except for SZ and short-run momentum effects (RET2-3), rest of the other anomalies including long-term momentum effect (RET7-12) lost their significance for explaining the risk-adjusted return derived from LACFM specification.

Table 6. Fixed Effect Model Regression Estimates of Liquidity-augmented Asset Pricing Models

Coefficients and	LAFFTFM			LACFM		
Test Statistics	(1)	(2)	(3)	(4)	(5)	(6)
μ_{1SZ}	–0.77* (–17.27)	–0.75* (–16.84)	–0.74* (–16.64)	–0.78* (–17.67)	–0.76* (–17.24)	–0.77* (–17.06)
μ_{2BM}	0.08 (0.15)	0.02 (0.13)	0.09 (0.26)	0.01 (0.16)	0.08 (0.45)	0.28 (1.01)
μ_{3LQ}	–0.11 (–0.69)	–0.16 (–0.67)	–0.11 (–0.68)	–0.12 (–0.65)	–0.10 (–0.63)	–0.10 (–0.64)
$\mu_{4RET2-3}$	0.01* (6.30)	–	–	0.02* (6.55)	–	–
$\mu_{4RET4-6}$	–	0.21 (1.38)	–	–	0.17 (1.12)	–
$\mu_{4RET7-12}$	–	–	0.20* (1.91)	–	–	0.16 (1.59)
LR Test [$x^2(581)$]	734.11 {0.00}	729.31 {0.00}	738.26 {0.00}	722.90 {0.00}	725.39 {0.00}	721.29 {0.00}
LM Test [$x^2(1)$]	605.35 {0.00}	640.89 {0.00}	635.44 {0.00}	451.07 {0.00}	482.10 {0.00}	477.52 {0.00}
Hausman Test [$x^2(4)$]	1096.54 {0.00}	2194.77 {0.00}	1057.53 {0.00}	1417.98 {0.00}	16728.06 {0.00}	1607.66 {0.00}
R^2	0.0037	0.0033	0.0033	0.0039	0.0035	0.0035
D-W Stat.	2.34	2.35	2.34	2.36	2.37	2.37
F-Test	77.83 {0.00}	70.23 {0.00}	70.44 {0.00}	81.61 {0.00}	73.26 {0.00}	73.40 {0.00}

Notes: This table reports the estimation results of the equation (6) for different alternative liquidity-augmented asset pricing models. LAFFTFM and LACFM represent liquidity factor augmented Fama and French three-factor model (FFTFM) and Charhat (1997) four factor models (CFM), respectively. Explanatory variable descriptions are similar to Table 5. The number of observation in the panel dataset consists of 582 individual firms for the sample period of 187 monthly observations (September 1995–March 2011). The reported t-statistics are in parenthesis. Figures in the curly brackets represent corresponding p-values of model specification test statistics. * indicate significance at 1% level.

Robustness Tests

This section discusses two robustness tests for examining the persistence of LACFM in proving a complete explanation for the four firm characteristics of our interest. We consider LACFM for our subsequent analysis instead of all the alternative models that have been considered above, because of its better explanation of firm characteristics in the previous section. In the first robustness test, we explore the possible implications of firm characteristics among the high and low liquid stocks. The second test explores the possible implications under the context of high and low liquid market condition. Apparently, while the first test explores the microscopic aspect of liquidity with respect to individual firm's sensitiveness towards the systematic liquidity pricing, the second test exhibits the macroscopic aspect of aggregate market-wide liquidity. We consider liquidity aspect as the benchmark criteria for the subsequent analysis partly because of the intuitive outcomes in the case of liquidity-augmented models in the previous section, and partly because of the considerable attention devoted by the finance literature to the aggregate liquidity effect in the emerging stock markets (Bekaert et al. 2007; Jun et al. 2003). It has been also observed that, although the stock market liquidity in emerging markets is positively related to economic growth, liberalisation policies and the level of global integration, it is not unreasonable to find emerging markets are still very concentrated, with high trading costs and low trading volume (Jun et al. 2003).

The aforementioned two distinctive microscopic (individual firm's liquidity sensitivity) and macroscopic (aggregate markets liquidity aspect) approaches are motivated from the observations made by Jun et al. (2003). In their attempt to investigate time-series and cross-sectional behaviour of liquidity and stock return for 27 emerging equity markets, Jun et al. (2003: 2–3) posit that, '*the notion of liquidity for individual assets is quite different from the notion of liquidity of an overall equity market. While supply and demand conditions determine liquidity in both cases, the factors that characterize the supply and demand functions for individual assets within a market are different from the factors that characterize the liquidity of a country's equity market*'. Finding of Jun et al. (2003) suggest that in the case of individual security while the firm characteristics play a major role for determining its relative liquidity, the aggregate equity market liquidity is determined by the systematic macroeconomic factors.

In order to determine the sensitivity of individual securities towards the systematic liquidity risk, we run time series regression for each individual security return with the LMHL. The way the liquidity risk factor has been constructed, that is, the difference between the simple average of returns from the two low liquid portfolios and the simple average of returns from the two high liquid portfolios, we can expect positive factor loadings in case of the low liquid stocks and negative loadings in case of the high liquid stocks. Based on the respective stocks loadings, we then segregate the stocks into two samples as the high liquid (negative LMHL loading, i.e., $\beta_{LMHL} < 0$) low liquid (positive LMHL loading, i.e., $\beta_{LMHL} > 0$). Consistent with Pastor and Stambaugh (2003) and Martinez et al. (2005), our approach also conjectures that if liquidity varies systematically, that is, liquidity risk factor explains cross-sectional return variation, then securities which are positively correlated with market liquidity should have high expected returns or high illiquidity risk. For the macroscopic aspect of aggregate market liquidity, we compute the market-wide turnover ratio (ratio of total trading value over market capitalisation of S&P CNX Nifty) for the whole sample period and then, we segregate high and low liquid market conditions depending upon the median value of the market turnover ratio. Months in which the market turnover ratio value is lower (higher) than the median value is considered as the low (high) liquidity period. In our unreported analysis, consistent with the findings of Jun et al. (2003), we find a positive correlation between the aggregate market return and aggregate market liquidity. For example, the average return difference between the high market liquidity and low market liquidity period is 1.79 per cent and statistically significant ($t = 1.82$).

Table 7 reports the estimation results for firm characteristics impact on the risk-adjusted return derived from the first step liquidity-augmented CFM in the case of high and low liquid sensitive stocks. The LR, LM and Hausman tests statistics suggest that firm-specific effects are present in the dataset and negate the use of random effect model. Reported results in Panel (A) of Table 7 suggest that for low liquidity beta stocks LACFM is able to capture the RET2-3 effect which has been found to be persistent across all the alternative asset pricing models that has been discussed previously. This indicates that the

Table 7. Fixed Effect Model Regression Estimates for High and Low Liquidity Beta Stocks

Coefficients and Test Statistics	Panel (A) Stocks with Low LMHL Loading [$\beta_{LMHL} < 0$]			Panel (B) Stocks with High LMHL Loading [$\beta_{LMHL} > 0$]		
	LACFM			LACFM		
	(1)	(2)	(3)	(4)	(5)	(6)
μ_{1SZ}	–0.86* (–7.36)	–0.85* (–7.26)	–0.85* (–7.19)	–0.75* (–14.92)	–0.74* (–14.59)	–0.73* (–14.43)
μ_{2BM}	0.01 (0.26)	0.01 (0.24)	0.01 (0.23)	–0.01 (–1.30)	–0.06 (–1.50)	–0.03 (–1.55)
μ_{3LQ}	0.03 (0.59)	0.01 (0.58)	0.01 (0.58)	0.01 (0.36)	0.01 (0.36)	0.01 (0.34)
$\mu_{4RET2-3}$	0.05 (1.55)	–	–	0.02* (7.10)	–	–
$\mu_{4RET4-6}$	–	0.01 (0.87)	–	–	0.01 (0.39)	–
$\mu_{4RET7-12}$	–	–	0.01 (0.83)	–	–	0.01 (1.44)
LR Test	$x^2(475)$ = 682.00 {0.00}	$x^2(475)$ = 632.07 {0.00}	$x^2(475)$ = 623.44 {0.00}	$x^2(123)$ = 322.75 {0.00}	$x^2(123)$ = 338.30 {0.00}	$x^2(123)$ = 341.64 {0.00}
LM Test [$x^2(1)$]	18.24 {0.00}	19.58 {0.00}	19.25 {0.00}	312.73 {0.00}	337.61 {0.00}	337.63 {0.00}
Hausman Test [$x^2(4)$]	378.65 {0.00}	156.66 {0.00}	108.45 {0.00}	1588.63 {0.00}	2639.03 {0.00}	991.50 {0.00}
R^2	0.0035	0.0035	0.0035	0.0039	0.0032	0.0033
D-W Stat.	2.51	2.50	2.51	2.35	2.37	2.37
F-Test	13.31 {0.00}	13.19 {0.00}	19.25 {0.00}	58.91 {0.00}	48.82 {0.00}	49.27 {0.00}

Notes: LACFM represents the systematic liquidity factor augmented Carhart (1997) four factor models (CFM). Explanatory variables and model specification tests description are similar to the Table 5. The reported *t*-statistics are in parenthesis. Figures in the curly brackets represent corresponding p-values of model specification test statistics. * indicate significance at 1% level.

liquidity-augmented CFM is well suitable for capturing the effect of short-run momentum effect (RET2-3), however, only in case of low liquidity beta or high liquid stocks. In Panel (A) of Table 7, except for the SZ effects, all other market anomalies associated with low LQ beta stocks are found to be subsumed to the risk-adjustment process of LACFM. Results presented in Panel (B) of Table 7 seem to be similar to the results observed when we consider all the stocks taken together (columns 4, 5 and 6 of Table 6). It is quite evident in Panel (B) of Table 7, low liquid stocks show significant short-run momentum effects (RET2-3) as compared to high liquid stocks. . Similar to the estimation results for alternative asset pricing models, the SZ effect is still persistent in case of low liquid stocks.

Panel (A) and Panel (B) of Table 8 report the estimation results for firm characteristics impact on the risk-adjusted return derived from the LACFM in the case of high and low liquid market conditions, respectively. Results reported in columns 1, 2 and 3 of Table 8 suggest that SZ, LQ and MM effects are persistent under the high liquid market conditions. The pricing of LQ under the high liquid market condition is more intuitive as it has been found to be captured in case of all the alternative factor models discussed and analysed previously. The momentum effects (RET2-3, RET 4-6, RET7-12) are also found to be strong during the high liquid market condition. Considering the reported results for low liquid market condition (columns 4, 5 and 6) of Table 8 suggest that except for SZ and RET2-3 no other characteristics are able to explain the risk-adjusted return derived by considering LACFM. As compared to the high liquidity period, the LQ effect and the two momentum effects (RET2-3 and RET4-6) lost their importance under the low liquidity market conditions. The BM effect, however, is well captured by the LACFM during both the high and low liquid market conditions. Comparing the reported results in Panels (A) and (B) it can be conclude that during the high liquidity market conditions firm characteristics are more persistent as compared to the low liquid market conditions.

A Brief Outline of Major Findings

This section attempts to present a brief description of key empirical findings. Table 9 shows a brief outline of the alternative asset pricing models

Table 8. Fixed Effect Model Regression Estimates for Different Liquid Market Conditions

Coefficients and Test Statistics	Panel (A) High Liquid Market Condition			Panel (B) Low Liquid Market Condition		
	LACFM			LACFM		
	(1)	(2)	(3)	(4)	(5)	(6)
μ_{1SZ}	–1.14*(13.65)	–1.11* (–13.30)	–1.12* (–13.41)	–0.72* (15.09)	–0.79* (–15.21)	–0.79* (–15.42)
μ_{2BM}	0.01 (0.92)	0.01 (1.20)	0.01 (–1.26)	0.01 (0.24)	0.01 (0.23)	0.02 (0.60)
μ_{3LQ}	–0.03* (–3.89)	–0.03* (–3.63)	–0.04* (–3.62)	–0.01 (–0.79)	–0.01 (–0.72)	–0.01 (–0.66)
$\mu_{4RET2-3}$	0.01* (2.57)	–	–	0.03* (10.78)	–	–
$\mu_{4RET4-6}$	–	0.01* (6.41)	–	–	0.02 (1.35)	–
$\mu_{4RET7-12}$	–	–	0.01* (5.33)	–	–	0.01 (1.08)
LR Test [$x^2(581)$]	622.7 {0.00}	638.30 {0.00}	641.64 {0.00}	684.75 {0.00}	690.96 {0.00}	652.80 {0.00}
LM Test [$x^2(1)$]	53.28 {0.00}	65.56 {0.00}	63.72 {0.00}	136.05 {0.00}	132.38 {0.00}	138.19 {0.00}
Hausman Test [$x^2(4)$]	1160.39 {0.00}	552.70 {0.00}	290.91 {0.00}	792.51 {0.00}	527.02 {0.00}	482.56 {0.00}
R^2	0.0050	0.0057	0.0054	0.0073	0.0064	
D-W Stat.	2.52	2.50	2.51	2.33	2.35	2.39
F-Test	60.03 {0.00}	68.69 {0.00}	65.49 {0.00}	88.55 {0.00}	76.86 {0.00}	138.19 {0.00}

Notes: LACFM represents systematic liquidity factor augmented CFMs. Explanatory variable descriptions are similar to Table 5. The reported t-statistics are in parenthesis. Figures in the curly brackets represent corresponding p-values of model specification test statistics. * indicate significance at 1% level.

Table 9. Performance of Asset Pricing Models to Capture the Effect of Firm Characteristics

		Asset Pricing Models Used for Deriving the Individual Securities Risk Adjusted Returns								
							LACFM			
							Firm Liquidity		Aggregate Market Liquidity Condition	
		CAPM	FFTFM	CFM	LAFFTFM	LACFM	High $\beta_{LMHL} < 0$	Low $\beta_{LMHL} > 0$	High	Low
Firm Characteristics		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
SZ		No	No	No	No	No	No	No	No	No
BM		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LQ		Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
MM	RET2-3	No	No	No	No	No	Yes	No	No	No
	RET4-6	No	No	No	Yes	Yes	Yes	Yes	No	Yes
	RET7-12	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Total Firm Characteristics Explained		Two	Three	Three	Three	Four	Five	Four	One	Four

Notes: This table reports a brief summary of the explanatory power of alternative asset pricing models that have been considered for our aforementioned analysis to capture the impact of firm characteristics. We mention 'Yes' when an asset pricing model is able to explain a particular firm characteristic or 'No' otherwise, that is, asset pricing model fails to capture the firm characteristic. Columns (A), (B) and (C) summarise the estimation results of Table 5. Columns (D) and (E) summarise the estimation results of Table 6. Columns (F) and (G) summarise the estimation results of Table 7 for different liquidity risk sensitive stocks. Columns (H) and (I) summarise the estimation results of Table 8 for high and low aggregate market liquidity conditions. MM indicates the three momentum characteristics (RET2-3, RET4-6, RET7-12).

performance to capture the impact of firm characteristics. We mention 'Yes' when an asset pricing model is able to explain a particular firm characteristic or 'No' otherwise. The basic proposition is that, if the risk factors included in the alternative asset pricing models are the sufficient descriptor of market-wide systematic risks, then the individual stocks raw return once risk adjusted with respect to a particular asset pricing model should not leave any scope for the firm characteristics to explain the risk adjusted return. If this proposition fails to be stand valid, then it gives an indication that firm characteristics still retain their importance for explaining stock return irrespective of the applicability of alternative asset pricing models. In such a scenario, the asset pricing model which explains or captures more firm characteristics can be considered as best performing model, at least for ruling out the role of firm characteristics.

Columns (A), (B) and (C) of Table 9 summarise the estimation results of Table 5. In case of the CAPM test, the firm characteristics like SZ, RET2-3, RET4-6 and RET 7-12 retain their importance for explaining the risk-adjusted return of individual firms and the model is able to explain only two firm characteristics like BM and LQ. The FFTFM in its multifactor specification captures the impact of BM, LQ and RET7-12, but fails to capture the impact of SZ and two momentum characteristics (RET2-3 and RET4-6). As compared to CAPM the FFTFM performs better by capturing the impact of three firm characteristics. The CFM which augments the FFTFM with the momentum factor performs equally same as the FFTFM by capturing the impact of three firm characteristics like BM, LQ and RET7-12. Columns (D) and (E) of Table 9 summarises the estimation results of Table 6. Among the two liquidity-augmented asset pricing models in columns (D) and (E), it is evident that the performance of LACFM, that is, liquidity-augmented CFM performs better by capturing the effects of four firm characteristics (BM, LQ, RET4-6, RET7-12) as compared to all the other asset pricing models. The LAFFTFM, i.e., liquidity-augmented FFTFM performs similar to the FFTFM by capturing the impact of three firm characteristics. This gives an indication that the five-factor model or LACFM performs better among all the asset pricing models to capture the effects of maximum firm characteristics. Columns (F) and (G) summarise estimation results of Table 8. Considering LACFM as the best performing asset pricing model among the alternative asset pricing models, columns (F) and (G) suggest that LACFM even performs better to capture five firm characteristics among the high liquid stocks as compared to the low liquid stocks. Furthermore, columns (H) and (I) summarise the estimation results of Table 8. Analysing the comparative performance of our benchmark five-factor model, that is, LACFM in two different aggregate market liquidity conditions, it is evident that the LACFM performs only better during low aggregate market liquidity condition (column I). This also gives an indication that during the high aggregate market liquidity condition most of the firm characteristics retain their importance of profitable investment trading strategy.

Summary and Conclusions

This article attempts to revisit the complete explanation of firm characteristics effect with the use of alternative asset pricing models in the context of an emerging stock market like India. For empirical assessment the explanatory power of the four risk characteristics like firm size, book-to-market equity, liquidity and momentum have been tested to explain the risk-adjusted return derived by using alternative asset pricing models.

Our results suggest that the liquidity-augmented multifactor models are found to be more applicable for controlling the effects of some of the firm characteristics. Specifically, the liquidity-augmented CFM is found to be more suitable for capturing the effect of book-to-market equity, liquidity, medium term and long term momentum effects. The size effect is not found to be captured by any of the alternative multifactor models. This gives an indication that, the profitable strategy exploration with respect to the size effect can still generate cross-sectional return variation and, thus, a source of investible trading strategy. This also suggests that in an emerging market like India it is premature to consider that size effect has disappeared as in the case of the developed markets. For instance, Dichev (1998) and Schwert (2003) suggest that the size effect disappeared around the time of its discovery in US market because practitioners began to use investment vehicles that tried to exploit size-based trading strategies. However, consistent with the findings of Mohanty (2002) our findings suggest that size effect retains its importance as a profitable investment strategy in India even though the evidence of size effect in India spans over the last 17 years of research. The significant cross-sectional regularity observed with respect to size and momentum is also consistent with the findings of Fama and French (2012), Lischewski and Voronkova (2012), Moor and Sercu (2013) in other emerging international stock markets. Unlike to the findings in the developed market (Avramov and Chordia 2006), our results suggest that, the liquidity effect can be easily captured by most of the multifactor models without even incorporating systematic liquidity factor. This may be because of the special nature of an order-driven market or may be because of the low liquidity characteristics of emerging market.

While the applicability of a multifactor model that accounts all the systematic risk factors found to be suitable for complete explanation of some of the pervasive risk characteristics, our findings in the case of high and low individual liquidity sensitive stocks and high and low aggregate market-wide liquidity states show some of the inconsistency. In particular liquidity-augmented CFM helps to explain almost all the firm characteristics except size in the case of the low liquid stocks. The high liquid market condition helps to persist all the market anomalies except book-to-market effect. This suggests that except for the book-to-market all other firm characteristics can be considered as profitable investment strategy in the context of the Indian stock market. The two distinctive findings give an indication that the liquidity-augmented CFM or in essence the five-factor model helps to give a partial explanation of firm characteristics, but the generalisation of its applicability must consider the individual stocks sensitivity towards the systematic liquidity risk and aggregate market liquidity conditions.

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