

# Capital Asset Pricing Model and Stock Return Variation: Evidence from Colombo Stock Exchange

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**Abstract:** *Stock return variation is one of the prominent concerns in the financial literature and many researchers continue to unfold the underlying dynamics of the returns. The current study empirically investigates the applicability of Fama and French (1993) three factor model and Capital asset pricing model in Sri Lanka. The study employs Newey and West (1987) weighted average least square regression model for five portfolios constructed on profitability for a period from June 2009 to December 2018. The three factor model seems to be explaining the stock return variation in Sri Lanka based on the F statistics. However, the size and value factor are not found significant for any of the portfolios during the study period. The presence of market risk premium is robust throughout the sample period and therefore, it could be concluded that the CPAM is still applicable in explaining the stock return variation in Sri Lanka.*

**Keywords:** assets pricing models, risk factors, stock returns

## 1. Introduction

The behaviour of stock returns lies right at the heart of any investment management problem. Understanding the underlying dynamics of these returns is essential for making good investment decisions and therefore investors and scholars have tried to develop strategies and theories to predict future returns. The foundation for the development of asset pricing models in the finance literature was laid by Markowitz (1952) with the introduction of modern portfolio theory. Subsequently, a good number of researches examining the behaviour of stock returns were carried out and resulted in asset pricing models that are still widely used in the discipline of finance.

While the CAPM is still the most widely accepted description for security pricing, empirical studies have repeatedly found evidences rejecting the common applications of the theory. It is continuously argued that the market beta alone is not sufficient to explain cross sectional variation of expected returns (Bhatnagar & Ramlogan, 2012; Paul & Asarebea, 2013; Samarakoon, 1997). Although, it is obvious that CAPM has many criticisms in explaining risk and return, yet there is no universally accepted model to substitute it (Nartea, Ward & Djajadikerta, 2009). The contradicting evidences have driven researchers to augment the original CAPM with additional explanatory factors and to seek completely different factors and explanations for behaviour of stock returns.

The search for a better asset pricing model which was amplified during 1990s resulted in multi factor models. In the early 1990s, one of the most influential investigations contesting the CAPM was published by Fama and French (1992). The study rejects the market beta associated with the CAPM and instead finds that stock size and book to market (B/M) ratio better capture the cross-sectional variation in average stock returns. Soon after, Fama and French (1993) published a study proposing that a three factor asset pricing model supplementing the CAPM with size and book to market proxies for risk might be a superior description of

average returns. They further emphasized that the explanatory power of the three factor model is much higher than the CAPM. Many empirical findings in many developed and emerging markets have supported the model.

However, the validity of model in explaining stock return variation has been rejected by scholars from both developed and emerging market. In the context of Sri Lanka, validity of the CAPM and Fama and French three factor models have been empirically tested and contradictory results have been reported (Randeniya & Wijerathna, 2012; Riyath & Nimal, 2016; Thilakarathne & Jayasinghe, 2014; Samarakoon, 1997). Therefore, the current study attempts to investigate the validity of CAPM and three factor model in explaining the cross-sectional variation in stock returns of portfolios based on profitability.

## 2. Methodology

The main objective of the study is to empirically test the validity of CAPM and Fama and French (1993) three factor models to explain the variation of stock returns in Sri Lankan stock market. In order to carry out the test, the following empirical models are used.

Capital Asset pricing model

$$R_{pt} - R_{ft} = \alpha_p + b_p MKT_t + \varepsilon_{pt}$$

Fama and French three factor model:

$$R_{pt} - R_{ft} = \alpha_p + b_p MKT_t + s_p (SMB_t) + h_p (HML_t) + \varepsilon_{pt}$$

Where;

$R_{pt}$  is the return on portfolio  $p$  for period  $t$ ;

$R_{ft}$  risk free rate in period  $t$ ;

$SMB$  (small minus big),  $HML_t$  (high minus low) are the factor mimicking portfolios for size and value of Sri Lankan equities;

$MKT_t$  is the excess returns on Sri Lankan stock market portfolio

The excess portfolio return ( $R_{pt} - R_{ft}$ ) is the dependent variable in the study. Excess portfolio return is the

difference between the return on portfolio  $p$  for period  $t$  and risk free rate. Portfolio return is the weighted average return of the companies that compose the respective portfolio. The 91 days Treasury bill rate is used as a proxy for risk free rate. This is in consistent with Shaker and Elgiziry (2014). The current study uses monthly data and therefore, monthly rate on 91 days treasury bills is taken as the risk free rate in line with the monthly accounting data.

Excess market portfolio is the difference between weighted average return on market portfolio and the risk free rate. All share price index (ASPI) of CSE is used as a proxy for the market portfolio return. The growth rate of ASPI is calculated and used as the market return. Risk free rate is the monthly rate on 91 days treasury bills. Accordingly, excess market portfolio return to excess portfolio return relationship is stated by the MKT (ASPI – monthly Treasury bill rate) factor.

Size is measured by market capitalization. Market capitalisation as a proxy for size has been used in almost all the studies that investigated the Fama and French (1993) model. Market capitalization is defined as the share price of a company at the end of each month multiplied by the number of shares outstanding at the end of the same month. Market capitalization is used to differentiate small size and big size firms whereas low capitalised firms are referred to as small sized company while highly capitalised firms are referred to as big sized firms. The size to excess portfolio return relationship is stated by the SMB (Small minus Big) factor in the model. The stocks are allocated into two size portfolios (small and big) depending on whether their market equity is above or below the median. The size factor (SMB) is the return difference between the average returns on the small firms' portfolios and the average returns on big firms' portfolios.

Book to market equity factor is measured by the book to market equity ratio and it is calculated by dividing book value of shareholder's equity by market value of shareholder's equity. Book value of total shareholders' equity is defined as the total shareholders' equity minus the value of preference shares, outside interest and future tax benefits (Chiah et al., 2016). The book to market sort uses market equity at the end of the year  $t - 1$  and book to market ratio for the fiscal year ending in calendar year  $t - 1$ . Three portfolios are formed using the breakpoints of 30<sup>th</sup> and 70<sup>th</sup> percentiles. From these independent sorting six portfolios from the intersection of two size and three book to market portfolios (SL, SN, SH, BL, BN, BH) are constructed. The value factor (HML) is the return difference between the high book to market portfolios and the low book to market portfolios. The relationship between book to market equity factor and excess portfolio return is presented by the HML (High minus Low) factor in the model. HML is the difference between average returns diversified portfolios of high and low book to market equity stocks.

The sample of the study consists of 181 companies listed on CSE. These companies represent 19 sectors namely, beverage, food and tobacco, chemical and pharmaceuticals, construction, diversified holdings, footwear and textiles, health care, hotels and travels, investment trust, IT, land and

property, manufacturing, motors, oil palms, plantations, power and energy, services, stores and supplies, telecommunication and trading. The sample excludes Banking, Finance and insurance sector companies since high leverage firm do not have the same meaning as for non-financial firms (Fama & French, 1993).

Newey and West (1987) weighted least square regression models are run and for brevity only the Newey and West (1987) adjusted statistics are presented and discussed.

### 3. Findings

Table 1 presents the mean and standard deviation of regression portfolio while Table 2 presents the mean and standard deviation of explanatory factors. The average excess returns on all the portfolios despite the level profitability remains negative with less than 1.5 standard deviation. It is also noted that the returns are reported between -7 percent to -8 percent for all the profitability portfolios. This indicates a weak profitability effect on excess returns. However, there is a notable fluctuation in the excess returns to the level of profitability.

**Table 1:** Average Excess Returns and Standard Deviations of Regression Portfolios

	Mean	Standard Deviation
High	-7.99	1.19
2	-7.61	1.20
3	-7.80	1.18
4	-7.12	1.20
Low	-7.34	1.17

Note: Average monthly excess returns and standard deviations for profitability portfolios formed on ROE for the period of June 2009 – December 2018, 115 months. At the end of June each year  $t$ , stocks are distributed into five profitability groups using sample 20<sup>th</sup>, 40<sup>th</sup>, 60<sup>th</sup> and 80<sup>th</sup> percentile breakpoints based on return on equity. The table shows average monthly returns in excess to the three month Treasury bill rate.

The table 2 depicts average return patterns of the risk factors. The mean return and standard deviation of the market premium is similar to the statistics of the average returns of regression portfolios. The MKT premium is negative at 8.1 percent and the standard deviation 1.349. This is of more similar to the regression portfolio returns. The size and value premium are negative for the sample. This negative trend may be because of the fact that the three month treasury bill rates are higher than the portfolio returns and market return. However, this is against the general theory and could be treated as country specific anomaly

**Table 2:** Average Excess Returns and Standard Deviations Risk Factors

	MKT	SMB	HML
$\bar{R}$	-8.14	-0.30	-0.28
$\sigma$	1.34	1.57	1.14

Note:  $R_M - R_f$  is the monthly return on the All Share Price Index minus the three-month Treasury Bill rate. At the end

of June each year, stocks are allocated to two size groups using the sample median breakpoint. Stocks are also independently distributed into three book-to-market (B/M) using 30th and 70th sample percentile breakpoints. Value factor, HML, uses six value-weight (VW) portfolios from the intersections of the size and B/M sorts.

The primary objective of the study is to investigate whether the portfolios constructed on profitability generate significant abnormal returns to investors in CSE during the period from June 2009 to December 2018. CAPM and FF3 factor (1993) are used to explain the cross sectional variation of stock returns.

The study tests five profitability portfolios for a period of 115 months from June 2009 to December 2018. The stocks are grouped into five profitability sorts based on the level of profitability. Return on equity is used to measure the profitability of the companies.

Table 3 presents the factor loadings, t value, adjusted R squared value and F statistic of Fama and French (1993) three factor model. The results indicate that the market risk premium is positive and significant at 1 percent for all five portfolios. This is similar to the finding of Thilakerathne and Jayasinghe (2014); Sooriyakumar, Sivanathan and Kandeepan (2015) and Nanayakkara (2012). However, the result contradicts with the finding of Samarakoon (1997) who revealed a negative insignificant beta in CSE and many other researchers in other economies for example, Adedokun and Olakojo (2012); Alqisie and Alqurran (2016); Bhatnagar and Ramlogan (2012); Paul and Asarebea (2013); and Shamim, Abid and Shaikh (2014). The size factor found to have a positive relationship with the excess portfolio returns of highly profitable stock. However, the effect becomes negative with lower profitable stocks. Nevertheless, the factor is not significant in any of the portfolios.

Factor loadings for HML are positive for ROE sorted and the effect is insignificant in all the portfolios. A positive value effect could be noticed but it is not significant in any of the portfolios. The positive effect of value suggest that value firms generate higher abnormal returns to investors than of growth firms in Sri Lanka. The positive relationship is witnessed by the pioneer researchers on the factor (Chan, Hamao & Lakonishok, 1991; DeBondt & Thaler, 1987; Rosenberg, Reid & Lanstein, 1985). The presence value factor could also be noticed by Shafana, Rimziya and Jariya (2013) and Riyath and Jahfer (2015) in Sri Lanka and it is mixed with positive and negative effect respectively.

**Table 3:** Three Factor Model for Profitability Sorted Portfolios (June 2009 to December 2018)

	High	2	3	4	Low
C	0.02 (0.54)	0.01 (0.60)	0.00 (0.12)	-0.00 (-0.11)	0.00 (0.12)
DMKT	0.85*** (9.02)	0.66*** (5.30)	0.87*** (13.17)	0.77*** (8.10)	0.76*** (7.38)
SMB	2.80 (0.95)	3.78 (1.51)	2.93 (1.32)	-1.12 (-0.30)	-0.81 (-0.21)
HML	4.03 (1.00)	1.21 (0.39)	3.36 (0.94)	5.23 (0.94)	5.84 (1.12)
Adj. R <sup>2</sup>	0.209	0.311	0.643	0.396	0.491
F-Statistic	7.00***	11.24***	41.79***	15.86***	22.80***

Note: Total number observation is 114. At the end of June each year t, stocks are distributed into five profitability groups using sample 20<sup>th</sup>, 40<sup>th</sup>, 60<sup>th</sup> and 80<sup>th</sup> percentile breakpoints based on return on equity, return on assets and net profit margin. C is the intercept. DMK is the first difference of average monthly return on ASPI in excess of the risk free rate. SMB is the difference between the average monthly returns on the two small and the two big size portfolios. HML is the difference between the average monthly returns on the two high B/M and the low B/M portfolios.

Newey-West t-statistic is given in parentheses. \*, \*\*, and \*\*\*\* denote statistical significance of the coefficients at the 10%, 5% and 1% significance level, respectively.

#### 4. Conclusion

The market premium found to be positive and significant in explaining the stock return variation in Sri Lanka and the influence of market premium on the cross sectional variation stock returns is robust. This further suggests that higher the beta, higher will be the excess return and implied that, higher market risk is compensated by higher stock returns in Colombo stock exchange. The findings are in line with the fundamental belief of the CAPM and consistent with Thilakerathne and Jayasinghe (2014); Sooriyakumar, Sivanathan and Kandeepan (2015) and Nanayakkara (2012) but against Samarakoon (1997) in the Sri Lankan context.

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