Inferring The Cost Of Equity: Does The CAPM Consistently Outperform The Income And Multiples Valuation Models?

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ABSTRACT

A number of surveys reveal that a large number of analysts, valuation experts, investors, chief financial officers and finance academics employ the capital asset pricing model (CAPM) of Sharpe (1962) and Lintner (1965) to estimate the cost of equity. There are, however, a number of alternative valuation models that can be used to infer the cost of equity. These alternative equity valuation models include the constant growth dividend discount, the earnings and book market multiples, the residual income and the Ohlson and Juettner-Nauroth (2005) abnormal earnings growth (AEG) models. Using four mature retail firms listed on the Johannesburg Stock Exchange, this paper tested for the equivalence of these models to the CAPM in estimating the cost of equity. The study found that the variants of the constant growth dividend discount and the AEG models give similar estimates which are closer to those of the CAPM. The variants of the price-to-earnings market multiples, price-to-book market multiples, and residual income models all yield estimates that are higher than those of the CAPM. Finally, the estimates seem to be affected by the stability of the firm's earnings and financial position.

Keywords: Capital Asset Pricing Model; Residual Income; Ohlson and Juettner-Nauroth (2005) Abnormal Earnings Growth; Price-To-Earnings Market Multiples; Price-To-Book Value Multiples

1. INTRODUCTION

lthough Dempsey (2013, p. 7) labels it a failed revolutionary idea in corporate finance, the William Sharpe (1962) and John Lintner's (1965) capital asset pricing model (CAPM) still remains a leading model that analysts, valuation experts, investors, chief financial officers and finance academics use to calculate the cost of equity. Past surveys reveal that this model is more popular than its peers which include the Fama-French (1996) three factor model, the arbitrage pricing model and the constant growth dividend discount model. For example, a survey done by Bruner, Eads, Harris, and Higgins (1998) found that 85% of the best managed United States of America companies used the CAPM in estimating the cost of equity. A CFO survey conducted by Graham and Harvey (2001, p. 210) revealed that 73.5% of the surveyed CFOs use the CAPM in calculating the cost of equity. Welch (2008) found that 75% of finance professors recommend the use of the William Sharpe (1962) and John Lintner (1965) CAPM in calculating the cost of equity. Lastly, the Bancel and Mittoo (2014) survey of 365 European finance experts revealed that 80% of them use the CAPM to estimate the cost of equity.

From the results of these surveys, the questions that may be asked are: why is the CAPM more preferred than the other models used to estimate the cost of equity? Is it that these models yield poor estimates of the cost of equity than the CAPM or this is simply a question of practioner preference? This paper tested this hypothesis by comparing the estimates of the cost of equity for four mature retail firms listed on the Johannesburg Stock Exchange (JSE) calculated using the CAPM and the variants of the constant growth dividend discount, the earnings and book market multiples, the residual income and the abnormal earnings growth equity valuation models.

The study found persistent heterogeneity in cost of capital across all models. In all cases, the estimates of the cost of equity obtained using the variants of all models are higher than the CAPM estimates. In using the firm's sustainable growth rate as a proxy for growth, the constant growth dividend discount and the Ohlson and Juettner-Nauroth (2005)

abnormal earnings growth (AEG) yield similar estimates which are closer to those of the CAPM. The estimates of the price-to-earnings market multiples, residual income model and the price-to-book market multiples variants are higher than the estimates obtained using the CAPM, the dividend discount and the OJ (2005) AEG models. The variance of the estimates is also affected by the company's data.

The rest of the paper is structured as follows. Section 2 discusses the CAPM. The variants of the dividend discount, the market multiples, the residual income and the AEG models are discussed in Section 3. Section 4 discusses the application of the models and Section 5 presents the estimation results. Section 6 concludes the study.

2. INFERRING THE COST OF EQUITY USING THE CAPITAL ASSET PRICING MODEL

The Sharpe (1964) and Lintner (1965) capital asset pricing model (CAPM) states that the expected return from an asset is the sum of the return from the risk-free asset and the "asset's market risk premium". The asset's market risk premium is the "equity market risk premium" multiplied by the asset's systematic risk index. The equity market risk premium (EMRP) is simply the difference between the expected overall market return and the return from a risk-free security. According to Dempsey (2013, p. 7), the model asserts that equity assets are priced commensurate with a trade-off between undiversifiable risk and expectations of return. This leading model, which was derived from the works of William Sharpe (1962), John Lintner (1965), Jack Treynor (1962) and Jan Mossin (1966) is formally stated as:

$$E(r_i) = k_e = r_f + \beta_{i,m}\big[E(r_m) - E(r_f)\big] \tag{1}$$

Where $E(r_i)$ is the expected return from $stock_i$ which is the cost of equity to the firm, k_e, r_f is the risk-free rate whose proxy is normally the yield of either a 1-year or 10-year government debt instrument (Treasury Bill), β_i measures the systematic (non-diversifiable) risk of $stock_i$ relative to the market portfolio and $E(r_m)$ is the expected return from the market portfolio. The CAPM can also be expressed as:

$$k_e = r_f + \beta_i \times MRP \tag{2}$$

or,

$$k_e = r_f + ERP \tag{3}$$

Where:

$$\beta_i = equity\ beta$$

$$\big(R_m - R_f\big) = market\ risk\ premium(MRP)$$

$$\beta_i \times \big(R_m - R_f\big) = equity\ risk\ premium(ERP)$$

As discussed in the introduction, a number of surveys including those of Bruner et al. (1998), Graham and Harvey (2001, p. 210), Welch (2008) and Bancel and Mittoo (2014) reveal that this is the most widely used model in estimating the cost of equity. The alternatives to this risk-based model are the dividend discount, equity multiples, residual income and the AEG models. These models are discussed next.

3. INFERRING THE COST OF EQUITY USING
THE ALTERNATIVES EQUITY VALUATION MODELS

The cost of equity can also be inferred from the equity income-based and market multiples valuation models. These models which include the constant growth dividend discount, the earnings and book market multiples, the residual income and the AEG models, use data from the financial statements of the firm as well as the current share price. Depending on the model, the variables used include the dividend per share, the earnings per share, return on equity as well as book value per share. All these models require an estimate of growth rate which is normally estimated as the

geometric average growth over the past 5 years. For example, the dividend growth rate can be estimated as the firm's historical dividend geometric mean. This is estimated as follows.

3.1 Estimating Growth Rates

If dividend per shares (DPS) grows at a constant rate, then next year's dividend, DPS_1, can be estimated from last year's dividend per share, DPS_0 , using the model:

$$DPS_1 = DPS_0 \times (1 + g) \tag{4}$$

The dividend constant growth rate can then be estimated using:

$$g = \frac{DPS_1}{DPS_0} - 1 \tag{5}$$

In equity valuation, the growth rate is normally estimated as the geometric mean of the past 5-year dividends. Thus, in considering a 5-year growth period, the geometric mean growth in dividends is calculated as:

$$(1 + g) = \left(\frac{DPS_5}{DPS_1}\right)^{1/4} \Rightarrow g = \left(\frac{DPS_5}{DPS_1}\right)^{1/4} - 1 \tag{6}$$

This can generally be stated as:

$$g = \left(\frac{DPS_0}{DPS_{-n}}\right)^{1/n} - 1 \equiv \left[\left(\frac{Last\ dividend}{Starting\ period\ dividend}\right)^{1/no.of\ years} - 1\right] \tag{7}$$

The main problem with the dividend growth rate calculated this way is that it assumes that dividends grew at a constant rate over the last five years. This is however not normally the case as divided growth rate can change from year-to-year thus the constant growth assumption therefore rarely holds. The most suitable proxy of the firm's optimum growth rate is its sustainable growth rate (Brealey, Myers & Allen, 2008, p. 808). The sustainable growth rate is the highest growth rate that a firm can maintain without changing its capital structure. It is a more reliable measure of growth for all variables derived from the financial statements.

3.2 The Sustainable Growth Rate

The sustainable growth rate is defined as the firm's rate of dividend and earnings growth that can be sustained for a given level of return on equity assuming a constant capital structure. It is calculated from:

$$g_0 = b_0 \times ROE_0 \tag{8}$$

Where: g_0 is the firm's current sustainable growth rate; ROE_0 is the current return on equity and b_0 is the current earnings retention rate which is calculated as: $b_0 = 1 - Dividend\ payout\ ratio$.

This study used the sustainable growth rates as a proxy for growth in all the variables.

3.3 The Dividend Valuation Models

The dividend valuation models include the Gordon-Shapiro Dividend constant growth dividend discount model and its variant derived by Parrino (2005). The models, which assume a constant perpetual growth in dividends, are derived from the basic dividend valuation model which states that the current intrinsic value of a share is equal to the present value of expected dividends. The investors' required rate of return, which is the firm's cost of equity is used as the discount rate.

3.3.1 The Constant Growth Dividend Discount Model

The constant growth dividend discount model which is also called the *Gordon Dividend Valuation* or the *Gordon-Shapiro Dividend Valuation* model after Gordon and Shapiro (1956) and Gordon (1962) is formally stated as:

$$P_0 = \frac{DPS_0(1+g)}{(k_e-g)} \equiv \frac{DPS_1}{(k_e-g)} \qquad (9)$$

Where

$$DPS_1 = DPS_0 \times (1+g)$$

The cost of equity can then be calculated from:

$$k_e = \frac{DPS_0(1+g)}{P_0} + g \equiv \frac{DPS_1}{P_0} + g \qquad (10)$$

This model assumes indefinite constant growth in dividends. It simply states that the cost of equity is equal to the forward dividend yield plus the dividend growth rate in perpetuity.

3.3.2 The Alternative Constant Growth Dividend Discount Model

Parrino (2005, p. 23) presents a modified dividend discount model that uses the earnings per share (EPS) and pay-out ratio instead of the dividends. The firm's current dividend per share, DPS_0, is given by:

$$DPS_0 = EPS_0 \times (1-b_0) \qquad (11)$$

Where EPS_0 is current earnings per share and $(1-b_0)$ is the dividend pay-out ratio $((1-b_0) = \frac{D_0}{EPS_0})$ Substituting for D_0 in model 9, the constant growth dividend discount model, yields:

$$P_0 = \frac{EPS_0(1+g)\times(1-b_0)}{(k_e-g)} \equiv \frac{EPS_1 \times (1-b_0)}{(k_e-g)} \qquad (12)$$

The cost of equity is then calculated from:

$$k_e = (1-b_0) \times \frac{EPS_0(1+g)}{P_0} + g \equiv (1-b_0) \times \frac{EPS_1}{P_0} + g \qquad (13)$$

In theory, this model is equivalent to the Gordon-Shapiro constant growth model.

3.4 Market Multiples Models

The traditional market multiples models use the market multiple of a comparable firm to estimate the share value of the target firm. The main drawback of this valuation approach is that a variable of another firm is used to value the equity of another firms and this is problematic as firms differ in financial performance, risk profiles, operational efficiencies, management efficiency and effectiveness, future prospects and size. The heterogeneity in these variables across firms make it extremely difficult to find a firm that exactly match the profile of the target firm in all aspects. To resolve this dilemma, a number of researchers notably Damodaran (2006), Pinto, Henry, Robinson and Stowe (2010) and Suozzo, Cooper, Sutherland and Deng (2001) have developed modern market multiples models that use the target firm's financial data instead. These market multiples models use the firm's cost of equity, sustainable growth rate and other variables such as the firm's earnings per share (EPS), book value per share (BVS) and return on equity (ROE). Given the target firm's current share price, these models can be used to infer the firm's cost of equity. The widely used market multiples in equity valuation are the price-to-earnings and the price-to-book value multiples.

3.4.1 Price Earnings Models

According to Damodaran (2006, p. 266) and Pinto et al. (2010, p. 275), the leading P/E valuation model is obtained by dividing the basic dividend discount model 9 by the firm's leading EPS, (EPS_1):

$$\frac{P_0}{EPS_1} = PE_0 = \frac{\frac{DPS_0(1+g)}{EPS_1}}{(k_e-g)} \equiv \frac{\frac{DPS_1}{EPS_1}}{(k_e-g)} \tag{14}$$

The ratio $\frac{DPS_1}{EPS_1}$ gives the firm's pay-out ratio, $(1-b_0)$ where b is the firm's retention rate. The equation can then be simplified to:

$$\frac{P_0}{EPS_1} = PE_1 = \frac{(1-b_0)}{(k_e-g)} \tag{15}$$

The cost of equity is then calculated as:

$$k_e = (1-b_0) \times \frac{EPS_0(1+g)}{P_0} + g \equiv g + \frac{(1-b_0) \times EPS_1}{P_0} \tag{16}$$

This model is equivalent to Parrino's (2005) model 13.

Suozzo et al. (2001) on the other hand, derived an alternative P/E ratio that uses the firm's ROE and EPS. The firm's sustainable growth rate is given by:

$$g = b_0 \times ROE_0 \Rightarrow b_0 = \frac{g}{ROE_0} \tag{17}$$

The leading P/E ratio is obtained by substituting $b_0 = \frac{g}{ROE_0}$ into model 15 yields:

$$\frac{P_0}{EPS_1} = \frac{(1-\frac{g}{ROE_0})}{(k_e-g)} \tag{18}$$

This simplifies to:

$$\frac{P_0}{EPS_1} = \frac{ROE_0-g}{ROE_0 \times (k_e-g)} \tag{19}$$

The cost of equity is then calculated as:

$$k_e = g + \frac{ROE_0-g}{ROE_0 \times P_0} \times EPS_0 \times (1+g) \equiv g + \frac{ROE_0-g}{ROE_0 \times P_0} \times EPS_1 \tag{20}$$

3.4.2 The Price-to-Book (P/BV) Value of Equity Ratio

This multiple uses the book value of equity which is defined as the current share price scaled up by the book value of equity. From model 15, the current share price, P_0, is given by:

$$P_0 = \frac{(1-b_0) \times EPS_1}{(k_e-g)} \tag{21}$$

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According to Damodaran (2006, p. 266), the firm's leading P/BVS ratio is obtained by dividing model 21 by the leading book value per share, BVS_1:

$$\frac{P_0}{BVS_1} = PBVS_1 = \frac{\frac{EPS_1 \times (1-b_0)}{BVS_1}}{(k_e - g)} \tag{22}$$

The factor EPS_1/BVS_1 defines the firm's ROE_1. Since growth in EPS_0 is equal to growth in BVS_0, it follows that:

$$\frac{EPS_0 \times (1+g)}{BVS_0 \times (1+g)} = \frac{EPS_1}{BVS_1}$$

Thus:

$$\frac{EPS_0}{BVS_0} = \frac{EPS_1}{BVS_1} = ROE_1 = ROE_0$$

This therefore implies that the leading P/BVS ratio is therefore given by:

$$\frac{P_0}{BVS_1} = P/BVS_1 = \frac{ROE_0 \times (1-b_0)}{(k_e - g)} \tag{23}$$

The cost of equity is then calculated as:

$$k_e = g + \frac{ROE_1 \times (1-b_0)}{P_0} \times BVS_0 \times (1+g) \equiv g + \frac{ROE_1 \times (1-b_0)}{P_0} \times BVS_1 \tag{24}$$

Suozzo et al. (2001) derive an alternative P/BV model. The firm's sustainable growth rate is given by: $g = b_0 \times ROE_0 \Rightarrow b_0 = g/ROE_0$. Substituting for b in model 23 gives:

$$\frac{P_0}{BVS_1} = PBV_1 = \frac{ROE_1 \times (1 - \frac{g}{ROE_1})}{(k_e - g)} \tag{25}$$

This simplifies to:

$$\frac{P_0}{BVS_1} = PBV_1 = \frac{ROE_1 - g}{(k_e - g)} \tag{26}$$

The cost of equity is given by:

$$k_e = g + \frac{ROE_0 - g}{P_0} \times BVS_0 \times (1+g) \equiv g + \frac{ROE_0 - g}{P_0} \times BVS_1 \tag{27}$$

3.5 The Residual Income Valuation Model

The residual income valuation model, which is derived from the dividend discount model, was firstly introduced by Edwards and Bell (1961) in their paper- *The theory and measurement of business income*. The model was further developed Peasnell (1982), Ohlson (1995) and Feltham and Ohlson (1995). Residual income is simply defined as net income less capital charge of generating the income. According to Frankel and Lee (1998), Gebhardt, Lee and Swaminathan (2001) and Hirst and Hopkins (2000, p. 17) and Pinto et al. (2010, p. 223), the Ohlson (1995) and Feltham and Ohlson (1995) residual model can also be stated in terms of the firm's return on equity (ROE). That is:

$$P_0 = BVS_1 + \left(\frac{ROE_0 - k_e}{k_e - g}\right) \times BVS_1 \tag{28}$$

Solving for k_e and simplifying yields the model:

$$k_e = g + \frac{BVS_0 \times (1+g) \times (ROE_0 - g)}{P_0} \equiv g + \frac{BVS_1(ROE_0 - g)}{P_0} \tag{29}$$

3.6 The Ohlson and Juettner-Nauroth (2005) (OJ) Model

According to the Ohlson and Juettner-Nauroth (2005) (OJ) model, equity value consists of two components:

1. Capitalised next period earnings and,
2. The present values of all future abnormal earnings growth which are defined as the capitalised expected changes in earnings adjusted for dividends. They term these earnings the *abnormal earnings growth*.

The model allows for the relaxation of the clean surplus assumptions. Model assumes economy-wide growth rates after the two year forecast period. Gode and Mohanram (2003, p. 403) state the model as:

$$P_0 = \frac{EPS_1}{k_e} + \frac{(EPS_2 - EPS_1 - k_e(EPS_1 - DPS_1))}{k_e(k_e - g)} \tag{30}$$

Solving for the cost of equity, k_e , gives the quadratic solution:

$$k_e = \frac{(P_0 \times g + DPS_1) \pm \sqrt{(P_0 \times g + DPS_1)^2 - 4 \times P_0 \times (EPS_1 \times g - EPS_2 + EPS_1)}}{2 \times P_0} \tag{31}$$

This simplifies to:

$$k_e = \frac{(P_0 \times g + DPS_1) + \sqrt{(P_0 \times g + DPS_1)^2 - 4 \times P_0 \times (EPS_1 \times g - EPS_2 + EPS_1)}}{2 \times P_0} \tag{32}$$

4. APPLYING THE MODELS

The final models that were tested are summarised as follows:

Model 1: The capital asset pricing model (CAPM):

$$k_e = r_f + \beta_{i,m}\left[E(r_m) - E(r_f)\right] \tag{M1}$$

Model 2: The constant growth dividend discount model:

$$k_e = \frac{DPS_0(1+g)}{P_0} + g \equiv \frac{DPS_1}{P_0} + g \tag{M2}$$

Model 3: The Parrino (2005) alternative constant growth dividend discount model and the P/E multiple model:

$$k_e = (1 - b_0) \times \frac{EPS_1}{P_0} + g \equiv (1 - b_0) \times \frac{EPS_0(1+g)}{P_0} + g \tag{M3}$$

Model 4: The Suozzo et al (2001) P/E multiple model:

$$k_e = g + \frac{ROE_0 - g}{ROE_0 \times P_0} \times EPS_0 \times (1+g) \equiv g + \frac{ROE_0 - g}{ROE_0 \times P_0} \times EPS_1 \tag{M4}$$

Model 5: *The P/B multiple model:*

$$k_e = g + \frac{ROE_0 \times (1-b_0)}{P_0} \times BVS_0 \times (1+g) \equiv g + \frac{ROE_0 \times (1-b_0)}{P_0} \times BVS_1 \tag{M5}$$

Model 6: *The Suozzo et al (2001) P/B multiple model:*

$$k_e = g + \frac{ROE_0 - g}{P_0} \times BVS_0 \times (1+g) \equiv g + \frac{ROE_0 - g}{P_0} \times BVS_1 \tag{M6}$$

Model 7: *The residual income model:*

$$k_e = g + \frac{BVS_0 \times (1+g) \times (ROE_0 - g)}{P_0} \equiv g + \frac{BVS_1(ROE_0 - g)}{P_0} \tag{M7}$$

Model 8: *The OJ (2005) AEG model:*

$$k_e = \frac{(P_0 \times g + DPS_1) + \sqrt{(P_0 \times g + DPS_1)^2 - 4 \times P_0 \times (EPS_1 \times g - EPS_2 + EPS_1)}}{2 \times P_0} \tag{M8}$$

4. DATA

The models were used to estimate the cost of equity for the four leading retail JSE-listed firms. The firms used in the study were Lewis Limited, Mr Price Limited, Shoprite Limited and the Foschini Group Limited. These are all mature retail firms which are expected to have stable DPS, ROE, EPS and BVS. To eliminate the earnings distortions that may have arisen as a result of the 2007-2008 global financial crisis, the study used data for the years 2010 to 2014. All the accounting data used in the study was obtained from the McGregorBFA database. The equity betas and share prices were all obtained from The Financial Times of London database. These were downloaded on the 25th November 2014. The study used the R186 government bond as a proxy for the risk-free rate. The bond matures on 21 December 2026. Its MTM was 7.77% on the 25th November 2014.   The South African market risk premium was obtained from the Damodaran (2006) website. It is currently 7.40% and 8.44% when estimated using the Moody's currency and CDS ratings respectively. The study used 7.40%.

4.1 Hypothesis

H1: If these models are relevant, they should yield consistent estimates of the firms' cost of equity.

5. RESULTS

The summary results of all the models are contained in Table 1.0. The data and calculation details for each model are contained in Annexure 1. Although these firms are expected to be peers, their ROE, EPS, BVS, sustainable growth rates, share prices and costs of equity differ significantly. In all cases, except for Shoprite Ltd.'s estimate using the constant growth dividend valuation model, the cost of equity estimates of all models are lower than those of the CAPM. For all firms, the constant growth dividend discount model that used the firms' sustainable growth as estimated growth for dividends and the AEG model yielded similar estimates for the cost of equity and these have the minimum percentage variance from the CAPM estimates. The variants of the P/E market multiples models yielded similar results. The P/BVS market multiples variants and the residual income models also yielded similar estimates for the cost of equity.

The mean variance of the models' estimates from the CAPM are -5.91% and -6.04% for Lewis Ltd and The Foschini Group Ltd respectively. The estimates for these firms are closer to those of the CAPM. The estimates for Mr Price and Shoprite however show much higher variance of -65.30% and -37.11% respectively. In the case of Mr Price Ltd, the high variance may be due to the high estimate for the dividend and firm's sustainable growth rates which are calculated at 24.05% and 19.73% respectively. For Shoprite Ltd, the CAPM's very low estimate of 9.56% for the cost of equity is suspect as it is very close to the current risk-free rate of 7.77%. This low estimate of the cost of equity is

due to the firm's low beta of 0.2413. In summary, the estimates given by the models differ from those of the CAPM. The results are mixed with two firms having estimates that are closer to those of the CAPM.

The Table shows the models' estimated cost of equity for the four firms. The input data is contained in Annexure 1. k_e is the cost of equity estimated using a the specific model and % Var. is the models' variance from the cost of equity calculated using the CAPM. It is calculated as:

$$\%Var. = \frac{Cost\ of\ equity\ using\ CAPM - Model's\ cost\ of\ equity}{Cost\ of\ equity\ using\ CAPM} \times 100$$

Table 1.0. The cost of equity summary results

	Lewis Ltd		Mr Price Ltd		Shoprite Ltd		The Foschini Ltd	
	k_e	%Var.	k_e	%Var.	k_e	%Var.	k_e	%Var.
The CAPM Model	13.21%	0.00%	13.31%	0.00%	9.56%	0.00%	14.61%	0.00%
Income Models Using Sustainable Growth Rate								
Dividend discount model	13.31%	(0.77%)	21.83%	(63.94%)	12.87%	(34.71%)	15.24%	(4.31%)
Parrino DDM model	14.14%	(7.04%)	22.03%	(65.42%)	13.20%	(38.09%)	15.59%	(6.70%)
Suozzo et al (2001) P/E multiple model	14.14%	(7.04%)	22.03%	(65.42%)	13.20%	(38.09%)	15.59%	(6.70%)
P/B multiple model	14.34%	(8.58%)	22.12%	(66.12%)	13.19%	(38.06%)	15.60%	(6.75%)
Suozzo et al (2001) P/B multiple model	14.34%	(8.58%)	22.12%	(66.12%)	13.19%	(38.06%)	15.60%	(6.75%)
Residual income model	14.34%	(8.58%)	22.12%	(66.12%)	13.19%	(38.06%)	15.60%	(6.75%)
OJ (2005) AEG model	13.31%	(0.77%)	21.83%	(63.94%)	12.87%	(34.71%)	15.24%	(4.31%)
Average	**13.99%**	**(5.91%)**	**22.01%**	**(65.30%)**	**13.10%**	**(37.11%)**	**15.49%**	**(6.04%)**

6. CONCLUSION

The aim of this paper was to compare the estimates of the cost of equity for four mature retail firms listed on the Johannesburg Stock Exchange (JSE) calculated using the CAPM and the variants of other leading equity valuation models. The study found that the constant growth dividend discount valuation and the OJ (2005) AEG models give similar estimates which are closer to those of the CAPM. As expected, the P/E market multiples variants yield similar estimates. The residual income model gives estimates that are equal to those of the P/B market multiples variants. The models' estimates for Lewis Ltd and The Foschini Group Ltd are closer to the CAPM estimates than those of Mr Price and Shoprite Ltd. The high sustainable growth rate of Mr Price and the low beta for Shoprite may explain the high variance of the models' estimates from the CAPM. This study is however very limited as it only used four firms to test for the equivalence of the models. Future studies may extend this study by using a larger samples to test for the equivalence of these models.

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ANNEXURE 1

The firms' sustainable growth rates are given below. These are calculated as:

$$g_0 = ROE_0 \times b_0$$

Where: g_0 is the firm's sustainable growth; ROE return on equity and b is the earnings retention rate which is calculated as:

$$b_0 = 1 - Dividend\ payout\ ratio$$

Table 2.0. Estimating the Firms' Sustainable Growth Rates

	Lewis	Mr Price	Shoprite	The Foschini
Dividend pay-out ratio (%)	54.19%	58.57%	49.65%	54.93%
Retention rate (%)	45.81%	41.43%	50.35%	45.07%
Current ROE (%)	15.77%	47.62%	21.66%	25.73%
Sustainable growth rate%	**7.22%**	**19.73%**	**10.91%**	**11.60%**

ESTIMATING THE COST OF EQUITY

The capital asset pricing model (CAPM) of William Sharpe (1962) and John Lintner (1965) is stated as:

$$k_e = r_f + \beta_{i,m}\left[E(r_m) - E(r_f)\right] \tag{1}$$

$$Equity\ market\ risk\ premium = \left[E(r_m) - E(r_f)\right]$$

$$Equity\ risk\ premium = \beta_{i,m}\left[E(r_m) - E(r_f)\right]$$

Table 3.0. Estimating the Cost of Equity Using the Capital Asset Pricing Model

	Lewis	Mr Price	Shoprite	The Foschini
Risk-free rate (%)	7.77%	7.77%	7.77%	7.77%
Average market return (%)	15.17%	15.17%	15.17%	15.17%
Equity market risk premium (%)	7.40%	7.40%	7.40%	7.40%
Beta	0.7352	0.7493	0.2413	0.9245
Equity Risk premium (%)	5.44%	5.54%	1.79%	6.84%
Cost of equity	**13.21%**	**13.31%**	**9.56%**	**14.61%**

The constant growth dividend discount model:

$$k_e = \frac{D_0(1+g)}{P_0} + g \equiv \frac{D_1}{P_0} + g \tag{2}$$

$$DPS_1 = DPS_0 \times (1 + g$$

Table 3.1. Estimating the Cost of Equity Using the Constant Growth Dividend Discount Model

	Lewis	Mr Price	Shoprite	The Foschini
Current share price (cents)	7 739.00	23 363.00	16 778.00	13 949.00
Current dividend paid (cents)	439.45	409.70	297.50	455.60
Sustainable growth rate (SGR) %	7.22%	19.73%	10.91%	11.60%
Cost of equity: SGR	**13.31%**	**21.83%**	**12.87%**	**15.24%**

The Parrino (2005) alternative constant growth dividend discount model and the P/E multiple model:

$$k_e = (1 - b) \times \frac{EPS_1}{P_0} + g \equiv (1 - b) \times \frac{EPS_0(1+g)}{P_0} + g \tag{3}$$

$$EPS_1 = EPS_0 \times (1 + g)$$

Table 3.2. Estimating the Cost of Equity Using the Parrino (2005) Alternative to the Constant Growth Dividend Discount and the P/E Multiple Model

	Lewis	Mr Price	Shoprite	The Foschini
Current share price (cents)	7 739.00	23 363.00	16 778.00	13 949.00
Current EPS (cents)	921.10	765.10	697.60	908.90
Dividend pay-out ratio (%)	54.19%	58.57%	49.65%	54.93%
Sustainable growth rate (SGR) %	7.22%	19.73%	10.91%	11.60%
Cost of equity: SGR	**14.14%**	**22.03%**	**13.20%**	**15.59%**

The Suozzo et al. (2001) P/E multiple model:

$$k_e = g + \frac{ROE_0 - g}{ROE_0 \times P_0} \times EPS_0 \times (1 + g) \equiv g + \frac{ROE_0 - g}{ROE_0 \times P_0} \times EPS_1 \tag{4}$$

$$EPS_1 = EPS_0 \times (1 + g)$$

Table 3.3. Estimating the Cost of Equity Using the Suozzo et al (2001) P/E Market Multiples Model

	Lewis	Mr Price	Shoprite	The Foschini
Current share price (cents)	7 739.00	23 363.00	16 778.00	13 949.00
Current EPS (cents)	921.10	765.10	697.60	908.90
Current ROE (%)	15.77%	47.62%	21.66%	25.73%
Sustainable growth rate (SGR) %	7.22%	19.73%	10.91%	11.60%
Cost of equity: SGR	**14.14%**	**22.03%**	**13.20%**	**15.59%**

The P/B multiple model:

$$k_e = g + \frac{ROE_0 \times (1-b)}{P_0} \times BVS_1 \tag{5}$$

$$BVS_1 = BVS_0 \times (1 + g)$$

Table 3.4. Estimating the Cost of Equity Using the P/B Market Multiples Model

	Lewis	Mr Price	Shoprite	The Foschini
Current ROE (%)	15.77%	47.62%	21.66%	25.73%
Sustainable growth rate (SGR) %	7.22%	19.73%	10.91%	11.60%
Dividend pay-out ratio (%)	54.19%	58.57%	49.65%	54.93%
Current BVS (cents)	6 012.76	1 671.99	3 217.27	3 539.04
Current share price (cents)	7 739.00	23 363.00	16 778.00	13 949.00
Cost of equity: SGR	**14.34%**	**22.12%**	**13.19%**	**15.60%**

                                       The Clute Institute

The Suozzo et al (2001) P/B multiple model:

$$k_e = \ g + \frac{ROE_0 - g}{P_0} \times BVS_0 \times (1 + g) \equiv \ g + \frac{ROE_0 - g}{P_0} \times BVS_1 \tag{6}$$

$$BVS_1 = BVS_0 \times (1 + g)$$

Table 3.5. Estimating the Cost of Equity Using the Suozzo et al (2001) P/B Market Multiples Model

	Lewis	Mr Price	Shoprite	The Foschini
Current share price (cents)	7 739.00	23 363.00	16 778.00	13 949.00
Current BVS (cents)	6 012.76	1 671.99	3 217.27	3 539.04
Current ROE (%)	15.77%	47.62%	21.66%	25.73%
Sustainable growth rate (SGR) %	7.22%	19.73%	10.91%	11.60%
Cost of equity: SGR	**14.34%**	**22.12%**	**13.19%**	**15.60%**

The residual income model:

$$k_e = g + \frac{BVS_0 \times (1+g) \times (ROE_0 - g)}{P_0} \equiv g + \frac{BVS_1 \times (ROE_0 - g)}{P_0} \tag{7}$$

$$BVS_1 = BVS_0 \times (1 + g)$$

Table 3.6. Estimating the Cost of Equity Using the Residual Income Model

	Lewis	Mr Price	Shoprite	The Foschini
Current ROE (%)	15.77%	47.62%	21.66%	25.73%
Sustainable growth rate (SGR) %	7.22%	19.73%	10.91%	11.60%
Current BVS (cents)	6 012.76	1 671.99	3 217.27	3 539.04
Current share price (cents)	7 739.00	23 363.00	16 778.00	13 949.00
Cost of equity: SGR	**14.34%**	**22.12%**	**13.19%**	**15.60%**

The OJ (2005) AEG model is expressed as:

$$k_e = \frac{(P_0 \times g_p + DPS_1) + \sqrt{(P_0 \times g_p + DPS_1)^2 - 4 \times P_0 \times (EPS_1 \times g_p - EPS_2 + EPS_1)}}{2 \times P_0}$$

$$DPS_1 \equiv Dividend\ per\ share_{2015} = Dividend\ per\ share_{2014} \times (1 + g)$$

$$EPS_1 \equiv EPS_{2015} = EPS_{2014} \times (1 + g)$$

$$EPS_2 \equiv EPS_{2016} = EPS_{2015} \times (1 + g) \equiv EPS_{2014} \times (1 + g)^2$$

Table 3.7. Estimating the Cost of Equity Using the OJ (2005) AEG Model

	Lewis	Mr Price	Shoprite	The Foschini
Dividend per share (cents): 2014	439.45	409.70	297.50	455.60
Dividend per share (cents): 2015	471.20	490.53	329.94	508.43
EPS (cents): 2014	921.10	765.10	697.60	908.90
EPS (cents): 2015	987.64	916.05	773.68	1 014.30
EPS (cents): 2016	1 058.99	1 096.77	858.05	1 131.92
Current share price (cents)	7 739.00	23 363.00	16 778.00	13 949.00
Sustainable growth rate (SGR) %	7.22%	19.73%	10.91%	11.60%
Cost of equity: SGR	**13.31**	**21.83%**	**12.87%**	**15.24%**

NOTES