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Empirical analysis of capital assets pricing model (CAPM) as a tool for valuation of a company's returns

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ABSTRACT

This research is aimed to look at the correlation between risks and expected returns as measured by Beta values of Barclays Plc and J. Sainsbury Plc both listed on the London Stock Exchange using FSTE 100 index market share price index. The Beta values were empirically analyzed, assessed and compared with the use regression analysis. The result of the findings revealed the Beta values of 0.66 and 1.68 for Sainsbury and Barclays Plc respectively with a correlation of 31.03%. This connote that Sainsbury Plc Beta values is less than one (β<1), therefore the stock price is less volatile than the greater market as a whole. While Barclays, however, had a Beta value, which is greater than one (β>1), this is regarded as aggressive shares and tends to exhibit augmented return movements compared to the index. The study also showed that the Barclays required rate of return (26.56%) is higher than that of Sainsbury Plc (10.72%) and that the Capital Asset Pricing Model (CAPM) still stands as a model that is widely used for valuation of a company's investment and therefore recommended for the calculation of cost of capital as a tool for investment appraisal.

Keywords: Beta values, capital asset pricing model, company valuation, investment appraisal.

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INTRODUCTION

Long before any financial theories, rational investors have strong tenets that maintaining a diversified portfolio will minimize risk while maintaining a sustainable level of returns. Markowitz (1991) in his portfolio theory argues that an investor who is risk-averse with a given two identical investments, will choose a security with lower risk and higher returns.

Portfolio theory as aged as the mountains provides investors the shock absorber with uncertainty about future investment by diversifying sources of income on different assets or investments which are less risky, (Arnold, 2013: 223). This was supported by an old adage "don't put all your eggs in one basket" but diversify. This concept is known as Modern Portfolio Theory (MPT) and best described by Omisore et al. (2012) as the best possible investor diversification strategy for optimum returns and understanding the correlation between risk and returns (Markowitz, 1991).

Diversification of investment often reduces the standard deviation (risk), however, outcomes of some academic research revealed that Standard deviation (risk measurement) cannot be relied upon especially when an investor want to create a large portfolios full of diversification with elimination of risk factors. Elton and Goruber (1997) stated that the most of the gain to be had from diversification come from adding just the very first few stocks to a portfolio. These results confirmed by other researcher in 1998s and 1990s that the purchase of between 8 and 20 stocks is enough. Hence, Capital Asset Pricing Model (CAPM) is a measure for calculation of the required rate of return for any risky investment. The required rate of return is the increase in value; an investor expects to see based on the inherent risk level of the investment.

Arnold (2013:p269) opined that the principal idea behind CAPM is that systematic risk which is measured

by beta, is the only factor that can affect the level of return required on a share for a completely diversified investor.

Brief historical background of the two companies

Sainsbury Plc

Sainsbury Plc, one of the oldest food retailers in the UK with subsidiaries that engage in the sales of grocery related products across the country (Sainsbury history, 2016). The company founded by husband and wife (John & Mary Sainsbury) in 1869 in London runs a variety of store layouts, including suitability and supermarkets with online grocery with range of products. As of June 2015, it has 1,312 supermarkets while it stood as the third largest supermarket chain in the United Kingdom (Sainsbury Financial Information, 2016).

Sainsbury a constituent member of the FTSE 100 was listed on London Stock Exchange 11 July 1975 and as FTSE Sector-Food & Drug Retailer (Sainsbury Closing Price, 2011-2015).

The sales revenue of the company stood at £23.775 billion and a net profit after tax (£166 million) as of 14 March 2015. To its credit, Sainsbury has an asset base totaling £16.537 billion (Sainsbury Financial Statistics, 2016).

Barclays Plc

Barclays is a multinational financial institution that engages in a universal banking, which was founded in 17 November 1690 (Barclays History, 2016). It has spanned the business of banking for more than 325 years. The company has its headquarter in London and is involved in rendering financial services ranging from banking operations, retail, wholesale banking, mortgage services, assets management and credit card services. Barclays operates across the world in over 50 countries with almost 48 million customers. The company has a historical record of deploying the first cash machine dispenser in 1967 and equally makes several acquisitions of some companies (Barclays corporate information, 2016). The company, a constituent member of the FTSE 100 index as FTSE Sector-Banks was listed on the London Stock Exchange on 31 December 1953. Barclays with an operating income of £2.073 billion and an asset base of £1.120 trillion with various divisions (Barclays Closing Price, 2011-2015).

Objective of the study

The study is aimed to show how Beta value result generated is used to calculate the required rate of return for selected companies, with comparisons and comments as well as the applicability of CAPM to the valuation of the companies' returns and as a tool for appraising investment.

LITERATURE REVIEW

Andre (2004) reported that the Capital Asset Pricing Model (CAPM) tells us that to calculate the expected return of a stock, investors need know two things: the risk premium of the overall equity market *EM_rf* (assuming that equities are the only risky assets) and the stock's beta versus the market. The stock's risk premium is determined by the component of its return that perfectly correlates with the market—that is, the extent to which the stock is a substitute for investing in the market. The component of the stock's return that is uncorrelated with the market can be diversified away and does not command a risk premium.

Beta satisfies this requirement. For example, if two stocks have market betas of 0.8 and 1.4, respectively, then the market beta of a 50/50 portfolio of these stocks is 1.1, the average of the two stock betas. Moreover, the capitalization-weighted average of the market betas of all stocks is the beta of the market versus itself. The average stock therefore has a market beta of 1.0.

Galagedera and Faff (2003) investigated the usefulness of a conditional three-beta model as a security return generating process. Their results overwhelmingly suggest that the betas in the low, usual and high volatility regimes are positive and significant, most of the security/ portfolio betas were not found to be significantly different in the three regimes.

Theoretical framework

Arnold (2013: 286) provided that the degree at which risk tends to move with a particular share is highly significant in a financial market. This is necessary as a rational investor is only concerned with full-diversified investment because market price and return fluctuation on any of the portfolio do not affect the whole selection of assets. For this purpose, a new investment tool (systematic risk) for measuring such risk is considered as standard deviation can no longer be relied upon.

This systematic risk is defined by CAPM as Beta (β) which is the slope of regression line which does not measure risk in complete terms, but as a risk gauge which reflects the extent to which the return on the single asset changes with the return on the market (Pike and Neale, 2003: 342). Beta as an indicator measures the covariance between the returns on a company's share with the returns of the market stock as a whole (Arnold, 2013: 286).

Investors who are fully diversified would like to expand their portfolio large enough to eliminate the unsystematic

Table 1. Classification of beta values.

Measures	Classification	Interpretation
β = 1	Neutral shares	A 1 percent change in the market index return generally leads to a 1 percent change in the return on a specific share.
0 < β <	Defensive shares	A 1 percent change in the market index return generally leads to a less than 1 percent change in the return on a specific share.
B > 1	Aggressive shares	A 1 percent change in the market index return generally leads to a greater return than 1 percent on a specific share.

Source: Arnold (2013).

risk, which deals with the individual companies' gains and losses, while leaving the investor to deal with the systematic risk of portfolios. Moreso, Zhang (2005) provides an elegant explanation within the framework of the neoclassical theory of investment. It is more costly for value firms to downsize their capital assets because they are typically burdened with more unproductive capital.

Consequently, Welch (2008) finds out that about 75.0% of finance professors recommend using the CAPM to estimate the cost of capital for capital budgeting.

Basic features of beta

The Beta value of a share shows the changes a particular share to general market movement. The basic features of Beta as provided by Arnold (2013: 289) are stated in Table 1.

Calculating beta

CAPM assumed that the amount of individual investor risks added to the market portfolio could be defined as all the investors hold the market portfolio. Arnold (2013) affirms that investments, which move a lot, according to the market portfolio, have a higher risk than investments, which move a little with the market portfolio. Therefore, a fully diversified investor would like to erase those investment movements, which are not related to the market portfolio's movement.

METHODOLOGY

For this purpose Sainsbury (food and drug retailers) and Barclays (banks) both constituents of the FTSE 100 index, quoted on the London Stock Exchange and operate in different sectors of the economy using their monthly share price data for the period of five (5) years from 1st January, 2011 to 31st December, 2015 (FTSE, 2011-2015).

The two companies have been selected because they are from different sectors of the UK economy, hence it will help in a broad range of data analysis. The spreadsheet would be used to calculate adjusted monthly returns sourced from FSTE 100 index while SPSS would be used to calculate Beta and coefficient values.

Analytical techniques

CAPM illustrates the market risk as Beta, where the formula of Beta (β) is:

$$\beta = \frac{\text{Cov (Stock, Market)}}{\text{Var (Market)}}$$

For the purpose of this study, Beta values for FTSE 100 index, Sainsbury and Barclays shall be based on the monthly-adjusted closing prices for a 5-year period ranging from 1 January 2011 to 31 December 2015. The monthly returns for the two companies and FTSE 100 index is calculated by dividing the latest monthly-adjusted closing price by the previous month adjusted closing price and then subtract it by 1.

The 5 years monthly data was generated from the historical data in http://finance.yahoo.com and downloaded to spread sheet for sorting. Monthly returns of each company were calculated and analyzed. From FTSE 100 index, adjusted closing price data for the same period were taken and added to spread sheet.

Beta value for the two companies is calculated in different ways to confirm correctness of the values. They are as follows:

1. Beta value through Regression analysis (Appendix 1)

2. Beta value through slope (Appendix 2 and Figures 1 and 2).

3. Beta value through formula $\beta = \frac{\text{Cov (Stock, Market)}}{\text{Var (Market)}}$ (Table 2 for figures calculated from spreadsheet in Appendix 1).

Table 2. Summarized calculated data for the two companies.

Share	Beta	Average returns (%)	Variance (%)	Std. dev.	Covariance (%)	Correlation
Sainsbury (Stock)	0.66	0.08	0.31	5.57	0.19	31.03
Barclays (Stock)	1.68	0.28	0.82	9.06	0.07	
FTSE 100 index (Market)	N/A	0.16	0.11	3.34	N/A	N/A

Source: Researchers computation (2017).

RESULTS

From the Table 2, the Beta value for Sainsbury is 0.66 or otherwise expressed as 66%, while the Beta value of Barclays is 1.68 or otherwise expressed as 168%. The Beta value for a company share indicates the sensitivity of that share to general market movement (Arnold, 2013) and provides that any investment with a Beta value less than one (β<1), the stock price is less volatile than the greater market.

In this case, Sainsbury has Beta values that are less than one and are regarded as defensive shares, will vary less than the market as a whole. Thus, if the market is rising, shares in Sainsbury will not enjoy the same level of increase. However, should the market ever suffer a downward movement, for every 10 percent decline in shares generally, Sainsbury will, according to CAPM theory, give a return decline of only 6.8 per cent (Arnold, 2013).

Barclays however had a Beta value, which is greater than one (β>1), regarded as aggressive shares and tends to exhibit augmented return movements compared to the index. CAPM theory affirms that when the market index return rises by, say, 10 percent, the returns on Barclays shares will tend to rise by 16.8 percent. Equally, if the market falls by 10 percent, the returns on Barclay's shares will tend to fall by 16.8 percent.

Beta value comparison

From Table 2, the following comparisons are summarized below:

1. Barclays beta value is greater than 1 (β>1) while the Sainsbury Beta value is less than 1 (β<1).
2. Barclays beta value is classified as aggressive shares, while the Sainsbury beta value is classified as defensive shares.
3. A 1 percent change in the market index return generally leads to a greater return than 1 percent on Barclays share while a 1 percent change in the market index return generally leads to a less than 1 percent change in the return on Sainsbury share.

Figure 1 shows that Sainsbury returns vary with FTSE 100 index market returns. The graph contains the linear tread lines and Beta with R squared values at the top right hand corner, which is the same figure, obtained through SPSS for regression analysis as contained in Appendix 1. The regression line shows as Sainsbury returns vary with FTSE market returns and is sloping upwards, which tells us that as FSTE market returns tends to increase on the x-axis Sainsbury returns tends to also increase on the y-axis.

Figure 2 shows that Barclays stock returns varies with FTSE 100 index market returns. The graph contains the linear tread lines and Beta with R squared values at the top right hand corner, which is the same figure, obtained through SPSS for regression analysis as contained in Appendix 1. The regression line shows as Barclays returns vary with FTSE market returns and is sloping upwards, which tells us that as FSTE market returns tends to increase on the x-axis, Barclays returns tends to also increase on the y-axis. The slope of the regression line for Sainsbury is less than the slope of the regression line that belong Barclays stock.

In the equation above, Y represents Barclays stock returns while X represents FTSE market returns. Hence, for every increase in 1 percent of X returns, there is also a 1.675 percent increase for Y returns.

Calculation of required rate of return

The calculation of Required Rate of Return (RRR) by shareholders of any company requires the application of CAPM formula. The RRR sets the minimum return an investor should accept, given all other options and the capital structure of the firm. The following components are required information needed:

1. Risk-free rate – Rate that explains the expected growth rate of market variables in a risk. For this research, it is obtained from the past LIBOR (Appendix 3)
2. Market return-it is the average of FTSE 100 market return of the security market line (Appendix 2) which is 0.16%.

No investment is very free, as government, bonds even at times default on loan repayment and defer interest payments. The LIBOR for this research, which is the risk free rate, is 0.47 per cent (Appendix 3).

Expected Return = Risk free rate + Beta x the average risk premium for a share (expected return on the market

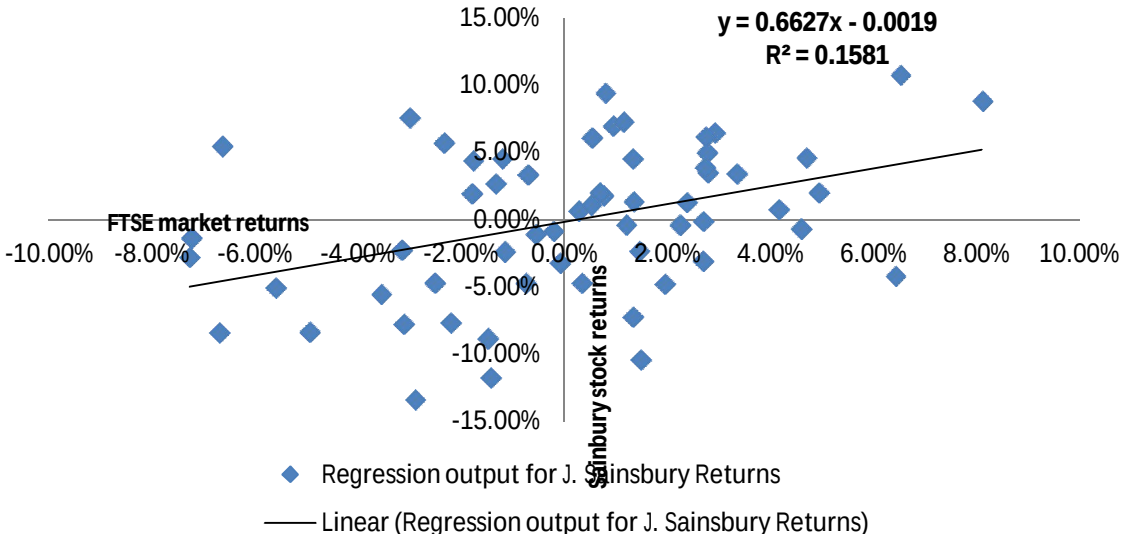

Figure 1. Regression output for Sainsbury stock returns. Source: Researchers computation (2017).

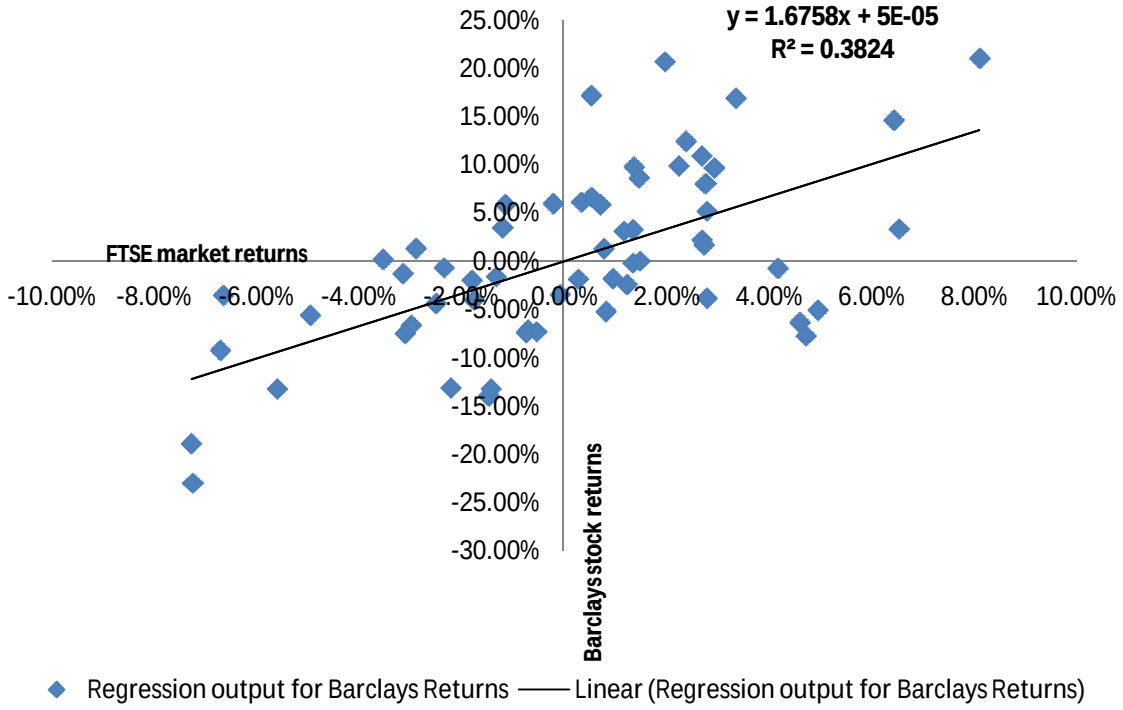

Figure 2. Regression output for Barclays stock returns. Source: Researchers computation (2017).

minus the risk free rate)

Or

$r_j = r_f + \beta\ (r_m - r_f)$

where:

r_j – Expected Return

r_f – Risk free rate

β - Beta

$r_m - r_f$ – Expected market return

The following assumptions on determination of required rate of return as identified by Arnold (2013) as discussed below:

1. Investors seem to be rational, always aiming to void

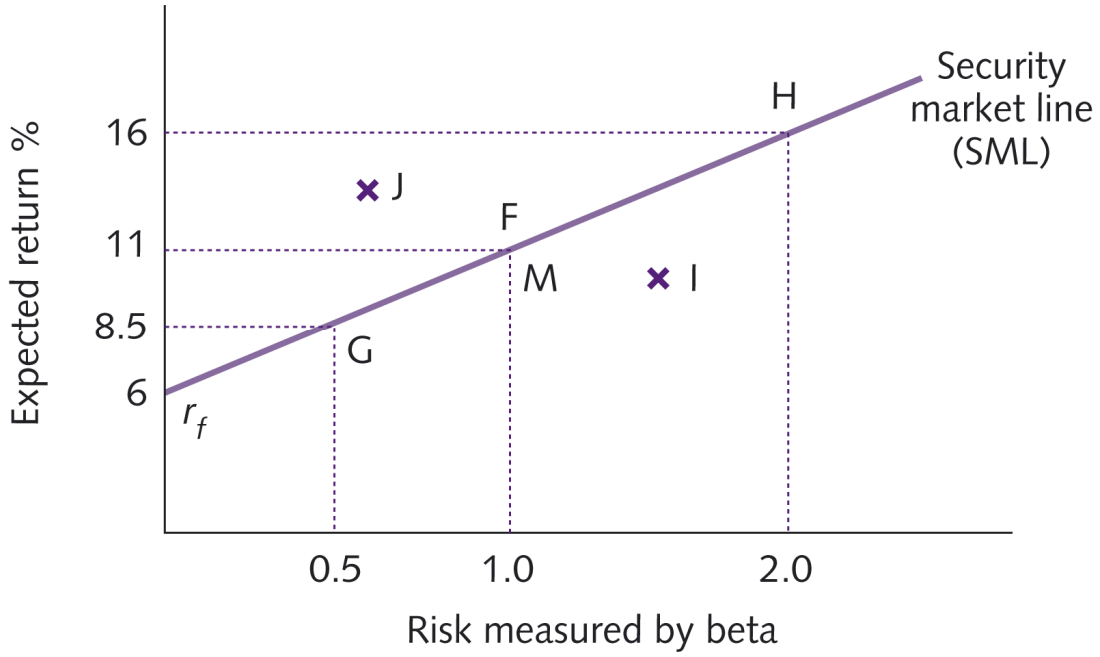

Figure 3. Risk measured by beta. Source: Arnold (2013).

risk but want higher returns from investment.
2. Investors are able to assess returns and risk. This is possible because of the free availability of financial information and the ability to make a forecast.
3. No tax deduction or transactions. This cannot always be true because capital gains tax and withholding tax are related deductions to return.
4. All investors have the potential to borrow or lend at the risk-free rate of interest. This also cannot be because investors are on the trend for higher returns and will always want to lend at rates higher than risk-free rate if possible and vice-versa.
5. All investments stand the chance of being traded with divisibility (it is possible, but not in all cases, especially when an investor wants a higher rate of return, he will want trade it without any fraction).

The required rate of return for Sainsbury:

$R_{Sainsbury} = 0.47 + 0.66\ (16 - 0.47) = 10.72\%$

The required rate of return for Barclays

$R_{Sainsbury} = 0.47 + 1.68\ (16 - 0.47) = 26.56\%$

The results above show that Barclays has a higher rate of return, higher risk and higher Beta value when compared to Sainsbury. An average investor will indicate a strong interest in a company that has a higher rate of return because it gives a better opportunity for their investment decision making. However, for the purpose of fully diversified investment, a rational investor can think of investing in the two companies in order to share risk.

DISCUSSION

CAPM as a model that represents the association between risk as measured by Beta and expected return. For this relationship, investors are concerned about whether the expected return meets the required rate of return or not.

For a detail analysis of this relationship, Arnold (2013) provides that an assumed SML as presented in Figure 3 show how faultlessly correlated is the market return (r_m) at point M on a Beta value of 1.0 which is expected to produce a yearly return of 11 percent with a risk free-rate of return of 6 percent.

The rate of expected returns on SML can be obtained with the following calculation:

$r_j = r_f + \beta\ (r_m - r_f)$

Muhammed et al. (2012) conducted a study, which investigated the assessment and testing of CAPM, the research that is evidenced on a study involving KSE-Pakistan, highlighted countries where the validity and applicability of CAPM has been tested. It was revealed that the model was tested, found useful and supported results in Japan, US, Pakistan, Greece, Sweden and South African while investors were adequately compensated for the systematic risk.

However, he further stated (quoting the results of researchers) that the validity of the model did not support the result of tests when applied to two different countries at the same time because the model did not support the concept of high risk and high returns.

Though many researchers has continued to test the validity of CAPM and its applicability to valuation of companies returns, critics have identified some shortcomings at stated by Pike and Neale (2003: 357):

1. CAPM relies on LIBOR or Treasury Bills rates as determination of a risk-free rate which is in doubt whether it really exists or not.
2. The model is found to make of use market returns index as a benchmark against all stock. It is assumed that the market returns index might be inefficient.
3. CAPM is considered to be excessively not being flexible as it can only be applied to securities leaving tangible assets.
4. Instability of Beta through time (David, 2008).

CAPM has also been found useful as a tool for appraising investment. Arnold (2013) opines that the overall risk and returns on the equity finance of a company is determined by the portfolio of investments and their associated systematic risk, which is determined by Beta. CAPM becomes applicable for managerial decision making when a company is engaged in additional capital investment, which had a much higher degree of risk than the average in the existing set, which provides the company to choose investment with higher returns.

Additionally, CAPM as a tool for investment appraisal allows companies to deal with investments with a differing level of risk and a differing level of gearing for a good decision making (Konstantinos, 2012).

Conclusion

Without any gainsaying, it can be concluded that CAPM has been found useful in its application to companies' investment valuation and tool for appraising investment since William Sharpe has propagated the model in 1964 as it was able to clearly explain the relationship between systematic risk and expected return, however many doubts and shortcomings has been linked to its achievement and led to questioning of its approach by critics. Despite the shortcomings, it still stands as a model that is widely used for valuation of a company's investment, calculation of cost of capital and investment appraisal as confirmed in the study of Frida (2014).

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APPENDICES

Appendix 1

Regression analysis for Barclays Plc

Model summary

Model	R	R Square	Adjusted R Square	Std. error of the estimate
1	.618[a]	.382	.372	7.24480%

a. Predictors: (Constant), FSTE

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1852.691	1	1852.691	35.298	.000[b]
	Residual	2991.770	57	52.487		
	Total	4844.461	58			

a. Dependent Variable: Barclays
b. Predictors: (Constant), FSTE

Regression analysis for J. Sainsbury Plc

Model summary

Model	R	R Square	Adjusted R Square	Std. error of the estimate
1	.398[a]	.158	.143	5.20162%

a. Predictors: (Constant), FSTE

ANOVA[a]

Model		Sum of squares	Df	Mean square	F	Sig.
1	Regression	289.689	1	289.689	10.707	.002[b]
	Residual	1542.239	57	27.057		
	Total	1831.928	58			

a. Dependent Variable: J. Sainsbury
b. Predictors: (Constant), FSTE.

APPENDIX 2

MONTHLY RETURNS CALCULATION

Date	Adj. Close FSTE 100	Monthly Returns for FSTE	Adj. Close BARCLAYS	Monthly Returns for Barclays	Adj. Close J.SAINSBURY	Monthly Returns for J.SAINSBURY	FSTE 100 diff_sqd	AVG	Barclays diff_sqd	AVG	J.Sainsbury diff_sqd	AVG
01/12/2015	6,242.30	-1.79%	214.50	-1.93%	258.80	1.97%	0.04%	0.11%	0.05%	0.82%	0.04%	0.31%
02/11/2015	6,356.10	-0.08%	218.72	-3.38%	253.80	-3.20%	0.00%		0.13%		0.10%	
01/10/2015	6,361.10	4.94%	226.36	-4.98%	262.20	2.07%	0.23%		0.28%		0.05%	
01/09/2015	6,061.60	-2.98%	238.22	-6.62%	256.88	7.54%	0.10%		0.48%		0.58%	
03/08/2015	6,247.90	-6.70%	255.10	-9.20%	238.87	-8.38%	0.47%		0.90%		0.69%	
01/07/2015	6,696.30	2.69%	280.93	10.92%	260.72	-0.15%	0.06%		1.13%		0.00%	
01/06/2015	6,521.00	-6.63%	253.27	-3.52%	261.12	5.44%	0.46%		0.14%		0.31%	
01/05/2015	6,984.40	0.34%	262.51	6.18%	247.63	-4.70%	0.00%		0.35%		0.21%	
01/04/2015	6,960.60	2.77%	247.22	5.23%	259.84	4.98%	0.07%		0.25%		0.26%	
02/03/2015	6,773.00	-2.50%	234.92	-4.29%	247.52	-4.67%	0.07%		0.21%		0.21%	
02/02/2015	6,946.70	2.92%	245.45	9.72%	259.65	6.46%	0.08%		0.89%		0.43%	
02/01/2015	6,749.40	2.79%	223.72	-3.84%	243.89	3.53%	0.07%		0.17%		0.13%	
01/12/2014	6,566.10	-2.33%	232.65	-0.67%	235.58	5.70%	0.06%		0.01%		0.33%	
03/11/2014	6,722.60	2.69%	234.23	2.24%	222.88	-3.08%	0.06%		0.04%		0.09%	
01/10/2014	6,546.50	-1.15%	229.10	5.87%	229.97	-2.39%	0.02%		0.31%		0.05%	
01/09/2014	6,622.70	-2.89%	216.40	1.34%	235.59	-13.37%	0.09%		0.01%		1.77%	
01/08/2014	6,819.80	1.33%	213.55	-0.10%	271.94	-7.22%	0.01%		0.00%		0.51%	
01/07/2014	6,730.10	-0.20%	213.77	6.06%	293.11	-0.82%	0.00%		0.33%		0.01%	
02/06/2014	6,743.90	-1.47%	201.55	-13.85%	295.55	-8.84%	0.03%		1.99%		0.77%	
01/05/2014	6,844.50	0.95%	233.94	-1.68%	324.21	6.98%	0.01%		0.04%		0.50%	
01/04/2014	6,780.00	2.75%	237.93	8.06%	303.06	6.20%	0.07%		0.60%		0.39%	
03/03/2014	6,598.40	-3.10%	220.20	-7.42%	285.36	-7.73%	0.11%		0.59%		0.59%	
03/02/2014	6,809.70	4.60%	237.84	-6.23%	309.29	-0.67%	0.20%		0.42%		0.00%	
01/01/2014	6,510.40	-3.54%	253.64	0.20%	311.36	-5.51%	0.14%		0.00%		0.29%	
02/12/2013	6,749.10	1.48%	253.13	0.09%	329.51	-10.41%	0.02%		0.00%		1.07%	
01/11/2013	6,650.60	-1.20%	252.90	3.53%	367.79	4.54%	0.02%		0.11%		0.21%	
01/10/2013	6,731.40	4.17%	244.26	-0.72%	351.81	0.77%	0.16%		0.01%		0.01%	
02/09/2013	6,462.20	0.77%	246.02	1.44%	349.14	1.79%	0.00%		0.01%		0.04%	
01/08/2013	6,412.90	-3.14%	242.54	-1.20%	342.99	-2.29%	0.11%		0.02%		0.05%	
01/07/2013	6,621.10	6.53%	245.50	3.39%	351.01	10.78%	0.40%		0.10%		1.18%	
03/06/2013	6,215.50	-5.58%	237.44	-13.11%	316.86	-5.08%	0.33%		1.79%		0.25%	
01/05/2013	6,583.10	2.38%	273.26	12.50%	333.80	1.30%	0.05%		1.49%		0.02%	
01/04/2013	6,430.10	0.29%	242.90	-1.75%	329.50	0.69%	0.00%		0.04%		0.01%	
01/03/2013	6,411.70	0.80%	247.23	-5.16%	327.25	9.46%	0.00%		0.30%		0.91%	

01/02/2013	6,360.80	1.34%	260.69	3.33%	298.98	4.57%	0.01%		0.09%		0.22%	
01/01/2013	6,276.90	6.43%	252.28	14.71%	285.93	-4.17%	0.39%		2.08%		0.17%	
03/12/2012	5,897.80	0.53%	219.93	6.67%	298.38	1.08%	0.00%		0.41%		0.01%	
01/11/2012	5,866.80	1.45%	206.18	8.67%	295.18	-2.31%	0.02%		0.70%		0.05%	
01/10/2012	5,782.70	0.71%	189.73	5.89%	302.17	2.04%	0.00%		0.31%		0.05%	
03/09/2012	5,742.10	0.54%	179.18	17.24%	296.12	6.07%	0.00%		2.88%		0.38%	
01/08/2012	5,711.50	1.35%	152.83	9.81%	279.16	1.33%	0.01%		0.91%		0.02%	
02/07/2012	5,635.30	1.15%	139.17	3.16%	275.50	7.27%	0.01%		0.08%		0.54%	
01/06/2012	5,571.20	4.70%	134.91	-7.63%	256.83	4.62%	0.21%		0.63%		0.22%	
01/05/2012	5,320.90	-7.27%	146.05	-18.79%	245.50	-2.81%	0.55%		3.64%		0.07%	
02/04/2012	5,737.80	-0.53%	179.84	-7.23%	252.60	-1.09%	0.00%		0.56%		0.01%	
01/03/2012	5,768.50	-1.75%	193.85	-3.98%	255.39	4.36%	0.04%		0.18%		0.20%	
01/02/2012	5,871.50	3.34%	201.88	16.97%	244.72	3.43%	0.10%		2.79%		0.12%	
02/01/2012	5,681.60	1.96%	172.59	20.73%	236.60	-4.79%	0.03%		4.18%		0.22%	
01/12/2011	5,572.30	1.22%	142.95	-2.33%	248.50	-0.36%	0.01%		0.07%		0.00%	
01/11/2011	5,505.40	-0.70%	146.36	-7.09%	249.40	3.33%	0.01%		0.54%		0.12%	
03/10/2011	5,544.20	8.11%	157.54	21.04%	241.36	8.84%	0.63%		4.31%		0.80%	
01/09/2011	5,128.50	-4.93%	130.15	-5.50%	221.75	-8.37%	0.26%		0.33%		0.69%	
01/08/2011	5,394.50	-7.23%	137.73	-22.91%	242.01	-1.38%	0.55%		5.38%		0.02%	
01/07/2011	5,815.20	-2.19%	178.67	-13.04%	245.40	-7.68%	0.06%		1.77%		0.58%	
01/06/2011	5,945.70	-0.74%	205.47	-7.30%	265.81	-4.69%	0.01%		0.57%		0.21%	
02/05/2011	5,990.00	-1.32%	221.66	-1.59%	278.89	2.70%	0.02%		0.03%		0.08%	
01/04/2011	6,069.90	2.73%	225.23	1.71%	271.56	3.88%	0.07%		0.02%		0.16%	
01/03/2011	5,908.80	-1.42%	221.44	-13.23%	261.42	-11.76%	0.03%		1.82%		1.37%	
01/02/2011	5,994.00	2.24%	255.19	9.91%	296.27	-0.39%	0.04%		0.93%		0.00%	
03/01/2011	5,862.90		232.18		297.44							
Average returns =	**(market returns)**	**0.16%**		0.28%		-0.08%						
Variance		0.11%		0.82%		0.31%						
Std Deviation		3.34%		9.06%		5.57%						
another for std		3.34%		9.06%		5.57%						
Covariance				0.19%		0.07%						
correlation				31.03%								
Beta by formula				**1.68**		**0.66**						
Beta slope				**1.68**		**0.66**						

APPENDIX 3					
LIBOR INTEREST RATES					
	%	**%**	**%**	**%**	**%**
	First	**Last**	**High**	**Low**	**Average**
December, 2015	0.481	0.446	0.482	0.479	0.482
December, 2014	0.468	0.453	0.469	0.453	0.467
December, 2013	0.468	0.382	0.468	0.382	0.463
December, 2012	0.48	0.472	0.48	0.472	0.48
December, 2011	0.582	0.583	0.583	0.58	0.581
	2.479	2.336	2.482	2.366	2.473
Average	0.496	**0.4672**	0.496	0.473	0.4946

FTSE PUBLICATIONS

FTSE 100

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Indicative Index Weight Data as at Closing on 31 December 2015

Constituent	Index weight (%)	Country
3i Group	0.29	UNITED KINGDOM
Aberdeen Asset Management	0.18	UNITED KINGDOM
Admiral Group	0.2	UNITED KINGDOM
Anglo American	0.24	UNITED KINGDOM
Antofagasta	0.1	UNITED KINGDOM
ARM Holdings	0.91	UNITED KINGDOM
Ashtead Group	0.35	UNITED KINGDOM
Associated British Foods	0.72	UNITED KINGDOM
AstraZeneca	3.62	UNITED KINGDOM
Aviva	1.3	UNITED KINGDOM
Babcock International Group	0.32	UNITED KINGDOM
BAE Systems	0.96	UNITED KINGDOM
Barclays	2.28	UNITED KINGDOM
Barratt Developments	0.39	UNITED KINGDOM
Berkeley Group Holdings	0.29	UNITED KINGDOM
BG Group	2.06	UNITED KINGDOM
BHP Billiton	1	UNITED KINGDOM
BP	4.01	UNITED KINGDOM
British American Tobacco	4.36	UNITED KINGDOM
British Land Co	0.5	UNITED KINGDOM
BT Group	2.45	UNITED KINGDOM

Constituent	Index weight (%)	Country
Fresnillo	0.07	UNITED KINGDOM
GKN	0.33	UNITED KINGDOM
GlaxoSmithKline	4.14	UNITED KINGDOM
Glencore	0.65	UNITED KINGDOM
Hammerson	0.29	UNITED KINGDOM
Hargreaves Lansdown	0.2	UNITED KINGDOM
Hikma Pharmaceuticals	0.19	UNITED KINGDOM
HSBC Hldgs	6.5	UNITED KINGDOM
Imperial Tobacco Group	2.15	UNITED KINGDOM
Inmarsat	0.32	UNITED KINGDOM
InterContinental Hotels Group	0.39	UNITED KINGDOM
International Consolidated Airlines Group	0.69	UNITED KINGDOM
Intertek Group	0.28	UNITED KINGDOM
Intu Properties	0.18	UNITED KINGDOM
ITV	0.64	UNITED KINGDOM
Johnson Matthey	0.34	UNITED KINGDOM
Kingfisher	0.48	UNITED KINGDOM
Land Securities Group	0.57	UNITED KINGDOM
Legal & General Group	0.99	UNITED KINGDOM
Lloyds Banking Group	2.9	UNITED KINGDOM
London Stock Exchange Group	0.53	UNITED KINGDOM

Constituent	Index weight (%)	Country
Rolls-Royce Holdings	0.66	UNITED KINGDOM
Royal Bank Of Scotland Group	0.61	UNITED KINGDOM
Royal Dutch Shell A	3.73	UNITED KINGDOM
Royal Dutch Shell B	2.33	UNITED KINGDOM
Royal Mail	0.25	UNITED KINGDOM
RSA Insurance Group	0.27	UNITED KINGDOM
SABMiller	2.39	UNITED KINGDOM
Sage Group	0.4	UNITED KINGDOM
Sainsbury (J)	0.23	UNITED KINGDOM
Schroders	0.21	UNITED KINGDOM
Severn Trent	0.32	UNITED KINGDOM
Shire	1.71	UNITED KINGDOM
Sky	0.72	UNITED KINGDOM
Smith & Nephew	0.67	UNITED KINGDOM
Smiths Group	0.23	UNITED KINGDOM
Sports Direct International	0.09	UNITED KINGDOM
SSE	0.94	UNITED KINGDOM
St.James Place	0.32	UNITED KINGDOM
Standard Chartered	0.94	UNITED KINGDOM
Standard Life	0.47	UNITED KINGDOM
Taylor Wimpey	0.41	UNITED KINGDOM