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Risk Return Analysis of FTSE Listed Select Stocks with FTSE100 Index

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Abstract

This paper analyses the stock returns of FTSE 100 and a sample of selected companies within the index to determine the existence of interdependence and magnitude of the same. The companies are selectively chosen from certain primary sectors based on their influence on the economy. The idea is to understand if large firms have significant effect on the index. The study involves statistical analysis representing data over a 10-year period spanning 1st November 2011 to 31st October 2021, the data include adjusted closing values of the index and the selected companies. Correlation and regression analysis is performed by taking the index as the dependent variable and the companies as the independent variable. The results are then analyzed from a variety of perspectives including skewness, kurtosis, correlation coefficients and coefficient of determination. The conclusions of the study summarize the relationship an index has with its constituents.

Keywords: FTSE 100, stock index, stock returns, regression, correlation.

I. INTRODUCTION

The FTSE 100 index is the abbreviated form of the financial times stock exchange 100 index. This index is also informally called as "Footsie", comprises 100 qualifying UK companies that are listed on the London stock exchange with the highest market capitalization calculated by multiplying the share price of the company by the total number of shares they have issued. The FTSE group which is a subsidiary of the London stock exchange, manages and maintains the index. Inclusion of a stock on the index requires a company to cater to a number of requirements that includes a full listing on the London stock exchange.

1.1. Stocks Chosen

Based on the above criteria, the following industries and companies have been chosen.
1) Financial institutions/banks: Standard Chartered and Barclays
2) Oil and gas: Royal Dutch Shell stocks, viz. A – Royal Dutch Shell and B – Shell Transport and Trading. The other company chosen is BP (formerly British petroleum).
3) Technology: Sage, one of the largest IT companies in the UK and Aviva, a technology company which has grown by acquisitions.
4) Supermarkets: Tesco, one of largest grocery and merchandize retailer in the world and Ocado group, which is primarily an online grocery and logistics company.
5) Aerospace and defense: Rolls Royce holdings and BAE systems, one of the largest defense and aerospace companies in the world.

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6) Outlier: the outlier chosen is the luxury fashion giant Burberry. Having an outlier will help us assess how its stock prices compares and correlates with the index as well as with the other companies chosen.

1.2. Analysis of Stocks

FTSE 100 consists of 100 of the largest companies within the London stock exchange. As opposed to doing an analysis of 20+ stocks within the index, a more appropriate study, would be to understand the relation between the index and each of the sectors chosen, ex.: FTSE 100 stock vs. banking sector stock. Statistical analysis of skewness and kurtosis will determine how the stock returns are placed as a measure of average returns. The other important analysis would be to measure the correlation and regression between all the chosen stocks and the index. These aspects will not only highlight the strength of the model but also how individual stocks contribute to the model.

II. LITERATURE REVIEW

Studies conducted by (Aboud & Karlsen, 2019) explores liquidity changes observed in FTSE 100 due to removal of companies. The paper considered the concept of liquidity hypothesis which proposes that a permanent change (increase or decrease) is observed in trading volume and bid/ask spread after a company is added or deleted from the index. It further proposed that there is a permanent change in the returns. There are different viewpoints as to why this happens based on several studies done in the past. McCann (2020) examined the impact of United Kingdom leaving the European union (known widely as "Brexit") on its economic and financial sectors. The paper suggested that withdrawal of stocks was a prolonged and had measurable impact on the pricing in the FTSE 100. Rosini and Shenai (2020), analyses the behavior of stock returns between 2007-2016 on the London stock exchange (LSE) through two primary indices, namely the FTSE 100 and FTSE 250. Their study found that Adaptive Market Hypothesis supports these markets to move from states of inefficiency to efficiency and vice versa.

Miller and Modigliani (1961) were the first to formally present the dividend irrelevance theory, which outlined the circumstances in which dividend policy has no impact on the firm's value. Since then, the debate over the impact of dividend policy on a company's value has raged. Their research revealed that independent of the dividend pattern delivered by a company, an investor can generate their choice of pay-out pattern. In his paper, (Banerjee, 2018) concluded that in the presence of ideal financial markets conditions, investors can convert any existing dividend stream into any desired spending pattern. As a result, a firm's worth is decided not by the dividend stream's pattern, but by the present value of future payments, regardless of the pattern.

Kai et al. (2014) explored interest between management and shareholders as the main focus. Enhancing the wealth of shareholders and managing the business properly should be the main task of managers. To do so, money generated from the business should be utilized in profitable projects. The agency issues occur when excess cash flow generated from operations is utilized in their own interest instead of shareholders' interest. To keep this in check, shareholders need to monitor managers, resulting in adddtional agency cost. Many experts have concluded that dividends have a signaling function based on Miller and Modigliani's (1961) views. Investors or future investors forecast the company's profit, which is determined by the dividend rate. Dividends must be distributed to investors or shareholders by businesses. According to Nguyen (2021), shareholders believe high dividend payments to be a sign of profitability. Dividend payments, according to Chaabouni (2017), have a signaling effect because they provide

information about the company to the market. They actually send a signal to the market. The announcement of the company's dividend raises the firm's share prices. Investors, shareholders, and future investors predict the company's status in terms of profitability based on dividend announcements. A rise in dividend payments is a positive sign for a company because it improves its goodwill and image in the eyes of customers, as well as the share price (Al-Hasan et al., 2013). Cuts in dividend payments, on the other hand, have a negative impact on a company's reputation since they send a negative message to its shareholders and cause the share price to drop.

This hypothesis was developed by Lintner (1956) and Gordon (1959), who proposed that investors are always risk-averse and prefer dividends above capital gains in the future. As a result, dividend payments have a significant impact on the market price of a stock. Investors keep an eye on the firm's dividend policy and compare dividends to capital gains when making investment selections. The bird in the hand is treated as a dividend, whereas the bird in the bush is treated as a capital gain. As a result, receiving an income now is preferable to waiting for a future gain that may contain some risk. Dividends, on the other hand, are less hazardous than capital gains.

Iminza (1997) conducted one of the studies on the information content of dividend payments and their impact on the pricing of publicly traded companies' shares. Dividend payments have a positive significant effect on stock values, according to the findings of this study. It was also shown that a significant reduction in dividend payments had a significant impact on share prices. It signifies that the value of a company's stock is affected by changes in dividend policy. Many studies have discovered that dividend changes have a significant impact on share prices, corporate performance, and stock returns (Pettit, 1972; Asquith & Mullins, 1983). Rigar and Mansouri (2003) investigated the relationship between firm performance and dividend policy. Both variables had a favourable association, according to the researchers. Tiriongo (2004) conducted research on dividend policy using the NYSE as a sample. His findings revealed that dividend policy and firm performance have a positive relationship. In Kenya, Malombe (2011) investigated the impact of dividend policy on firm performance. He drew the conclusion that in Kenya, there is a positive but minor relationship between profitability and dividend policy.

III. RESEARCH METHODOLOGY

10 years of stocks (from 1st Nov 2011 to 31st Oct 2021) have been analyzed for the aforementioned sectors and the selected companies within these sectors and regression analysis and correlation has been performed on these stocks.

3.1. Descriptive Statistics

Descriptive statistics provide a measure of how the individual companies and the index were performing over the 10 years. The extremes in the data are measured through skewness and kurtosis. Since returns are usually not expected to be normally distributed, skewness and kurtosis provide a better indication of performance and predictability for investors than the average/mean, median and standard deviation.

Table 1
Statistical Measures of Selected FTSE 100 Stocks

	FTSE 100	BAE Systems	Rolls Royce	Barclays	Standard Chartered
Mean	6692.66	392.74	235.36	171.97	740.16
Standard Error	12.15	2.20	1.42	0.68	5.23
Median	6740.92	410.72	245.57	173.56	662.83

To be continued Table 1.

	FTSE 100	BAE Systems	Rolls Royce	Barclays	Standard Chartered
Mode	5723.67	513.04	336.32	186.62	1138.04
Standard Deviation	609.52	110.37	71.24	34.36	262.48
Sample Variance	371512.53	12182.13	5075.04	1180.28	68897.03
Kurtosis	-0.78	-0.91	-0.23	-0.54	-0.95
Skewness	-0.31	-0.41	-0.72	-0.21	0.52
Range	2883.56	438.27	334.46	168.47	1054.09
Minimum	4993.89	156.07	38.98	78.90	328.57
Maximum	7877.45	594.34	373.44	247.37	1382.66
Sum	16838725.35	988144.58	592174.29	432683.04	1862231.51
Count	2516.00	2516.00	2516.00	2516.00	2516.00

IV. RESULTS AND DISCUSSIONS

It can be inferred from Table 1 that except for Standard Chartered which is skewed to the right, the remainder of the companies as well as the index itself if left skewed. Additionally, the skewness of the index, BAE systems and Barclays are > -0.5 (or closer to the median). This implies these securities are fairly symmetrical in their returns. Skewness of Rolls Royce is < -0.5 (skewed away from the median). This indicates that while most of the returns are to the right of the mean, there are extreme returns to the left. Standard Chartered exhibits a positive moderate skewness. This indicates that the some of the returns tend to be on the right of the mean while most are on the left. All the above companies along with the index exhibit a negative kurtosis. This is also referred to as a platykurtic distribution or broad/short-tailed distributions. This implies that the data distribution i.e., the returns are more concentrated towards the mean and less towards the tails. In this regard, BAE systems, Standard Chartered and to some degree, the index itself exhibit a higher platykurtic characteristic than Rolls Royce and Barclays.

Table 2
Statistical Measures of Selected FTSE 100 Stocks

	Royal Dutch Shell-A	Royal Dutch Shell-B	BP	TESCO
Mean	1518.78	1546.46	317.70	226.50
Standard Error	6.85	6.94	1.46	0.98
Median	1389.76	1425.90	294.18	223.10
Mode	1285.40	1288.40	434.82	198.13
Standard Deviation	343.51	347.92	73.25	49.30
Sample Variance	117999.82	121050.36	5366.09	2430.70
Kurtosis	-0.66	-0.68	-0.65	-0.63
Skewness	0.70	0.56	0.74	0.37
Range	1455.48	1543.18	308.04	209.84
Minimum	852.94	820.04	179.86	128.88
Maximum	2308.42	2363.22	487.90	338.72
Sum	3821242.24	3890893.03	799327.12	569881.52
Count	2516.00	2516.00	2516.00	2516.00

Table 3
Statistical Measures of Selected FTSE 100 Stocks

	OCADO	AVEVA	Sage	Burberry
Mean	728.47	1986.27	499.19	1475.50
Standard Error	13.93	17.97	3.37	6.68
Median	375.00	1556.10	552.12	1415.22

To be continued Table 3.

	OCADO	AVEVA	Sage	Burberry
Mode	284.00	2025.54	449.66	1301.75
Standard Deviation	698.97	901.52	168.96	335.01
Sample Variance	488554.56	812738.52	28548.19	112233.65
Kurtosis	0.42	-0.45	-1.32	-0.79
Skewness	1.25	0.94	-0.34	0.42
Range	2842.15	3309.26	580.78	1454.95
Minimum	52.85	910.74	197.74	829.95
Maximum	2895.00	4220.00	778.52	2284.90
Sum	1832834.46	4997463.52	1255957.19	3712347.54
Count	2516.00	2516.00	2516.00	2516.00

Results from Table 2 show that Ocado has high degree of positive skewness alluding to the fact they have extreme values to the right of the mean to a larger degree. Sage group exhibits a negatively skewed or left skewed distribution. In this group then, Sage is the only company which tends to have unpredictable returns or "Black Swan" events. Ocado is the outlier in the group by having a positive kurtosis, also known as being Leptokurtic. This signifies that the returns for this company are more concentrated towards the tail than the mean. The rest of the companies exhibit platykurtic tendencies.

Table 4

Correlation Coefficient Analysis

	FTSE 100	BAE Systems	Rolls Royce	Barclays	Standard Chartered	Royal Dutch Shell-A	Royal Dutch Shell-B	BP	TESCO	OCADO	AVEVA	Sage	Burberry
FTSE 100	1.0000												
BAE Systems	0.7049	1.0000											
Rolls Royce	0.3294	-0.3077	1.0000										
Barclays	0.2699	-0.1801	0.5487	1.0000									
Standard Chartered	-0.2652	-0.7831	0.6249	0.5253	1.0000								
Royal Dutch Shell-A	0.7963	0.5173	0.3784	-0.0582	-0.1975	1.0000							
Royal Dutch Shell-B	0.7895	0.4536	0.4618	0.0012	-0.1168	0.9927	1.0000						
BP	0.8095	0.5762	0.3356	-0.0788	-0.2668	0.9746	0.9614	1.0000					
TESCO	-0.2654	-0.5132	0.2269	0.1969	0.6901	-0.1608	-0.1300	-0.1812	1.0000				
OCADO	0.1548	0.5856	-0.6697	-0.4398	-0.6283	0.0872	-0.0077	0.1475	-0.0166	1.0000			
AVEVA	0.3054	0.6386	-0.5612	-0.3546	-0.5465	0.2440	0.1524	0.2977	0.0422	0.9124	1.0000		
Sage	0.6146	0.9134	-0.3992	-0.3571	-0.8403	0.4909	0.4146	0.5602	-0.5635	0.6142	0.6835	1.0000	
Burberry	0.7439	0.7785	-0.1195	-0.0894	-0.4811	0.6840	0.6229	0.7055	-0.1536	0.6182	0.7041	0.6984	1.0000

The correlation coefficient provides a useful view on how the individual stocks relate to one another as well to the index itself. A coefficient of 1 indicates perfect correlation wherein, the change in the returns occurs in sync. A negative coefficient on the other hands indicates that the returns are not in sync i.e., an increase in one usually means a decrease in the other and vice versa. From the results, it can be inferred that Aerospace and defense: Both BAE systems and Rolls Royce are positively correlated to the index i.e., they increase along with the index. BAE system seems to have a stronger linear relation to the index than Rolls Royce. Contra to the above, both in the individual companies have negative correlation i.e., an increase in one results in the decrease of the other. In the banking sector, Barclays has a positive correlation to the index while Standard Chartered has a negative one, however, both the banks have a positive correlation amongst themselves. In the oil and gas sector, there is an almost perfect correlation (close to 1) between both the Royal Dutch Shell companies. The same can be said about BP in conjunction with Shell. These companies exhibit an almost perfect

correlation. For supermarkets, Tesco and Ocado are slightly out of sync i.e., negatively correlated. Further, while Ocado is slightly positively correlated to the index, Tesco is negatively correlated. In the technology sector, both the IT companies are positively correlated to each other and to the index. Sage appears to be more positively correlated to the index than Aveva. Burberry is positively correlated to the index. However, being an outlier, it usually has no related to the other companies and hence its correlation varies (positive to negative) across the entire spectrum.

4.1. Regression Analysis

Regression analysis has been performed on the entire set of 12 companies and the index at a confidence level of 95%. Also performed are regression analysis of individual sectors against the index. The idea is to find statistical significance between the dependent (companies) and the independent (index) variables.

Table 5

All companies vs. Index

Regression Statistics	
Multiple R	0.97158593
R Square	**0.943979219**
Adjusted R Square	0.943710641
Standard Error	144.6105176
Observations	2516

ANOVA

	df	SS	MS	F	Significance F
Regression	12	882010761.4	73500896.78	3514.737351	**0**
Residual	2503	52343241.13	20912.20181		
Total	2515	934354002.5			

	Coefficients	Standard Error	T-Stat.	P-value	Lower 95%	Upper 95%
Intercept	2635.49427	39.52054	66.68670	0.00000	2557.99796	2712.99058
BAE Systems	1.20515	0.08931	13.49456	0.00000	1.03003	1.38028
Rolls Royce	1.52759	0.09951	15.35177	0.00000	1.33247	1.72271
Barclays	4.62494	0.13940	33.17754	0.00000	4.35159	4.89829
Standard Chartered	0.71753	0.04025	17.82556	0.00000	0.63860	0.79646
Royal Dutch Shell-A	-2.28563	0.15063	-15.17335	0.00000	-2.58101	-1.99025
Royal Dutch Shell-B	2.72165	0.14021	19.41079	0.00000	2.44671	2.99660
BP	0.00740	0.20950	0.03532	0.97183	-0.40342	0.41821
TESCO	-1.86521	0.14367	-12.98307	0.00000	-2.14693	-1.58350
OCADO	0.15610	0.01409	11.08070	0.00000	0.12847	0.18372
AVEVA	-0.04770	0.01226	-3.89136	0.00010	-0.07173	-0.02366
Sage	1.85925	0.06663	27.90408	0.00000	1.72860	1.98991
Burberry	0.42923	0.02399	17.89056	0.00000	0.38218	0.47627

Table 5 above provides a complete regression analysis of all the companies (dependent variable) along with the index (independent variable). Results from the table

reveal that the R^2 or coefficient of determination has a value of 0.94 suggesting the model is 94% strong. This further indicates that the future returns of the companies can be accurately predicted if the forecast of the index is known. the low (close to zero) significance F value further corroborates the fact that there is statistical significance between the companies and the index. From the individual p-values, we can determine that except BP, all the other companies are significant to the statistical model/relationship. From the grading of the color, we can even determine which companies are more significant than the others. The t-value further corroborates this fact. A large t-value (absolute value) indicates a significant variable. BP on the other hand, with a p-value greater than the level of significance or 0.05, does not seem to be a significant variable and thus does not contribute towards this model.

Table 6
Aerospace and Defense vs Index

Regression Statistics	
Multiple R	0.90918736
R Square	**0.826621656**
Adjusted R Square	0.82648367
Standard Error	253.8966126
Observations	2516

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	772357252.4	386178626.2	5990.656523	**0**
Residual	2513	161996750.1	64463.48989		
Total	2515	934354002.5			

	Coefficients	Standard Error	T-Stat.	P-value	Lower 95%	Upper 95%
Intercept	3545.76635	29.96663	118.32384	0.00000	3487.00454	3604.52816
BAE Systems	4.91843	0.04821	102.02326	0.00000	4.82390	5.01297
Rolls Royce	5.16310	0.07469	69.12583	0.00000	5.01663	5.30956

Table 6 concentrates on the regression model between the index and the aerospace and defense sector. Primary inferences show that the R^2 value we can determine that this model fairly strong. The low (zero) p-values indicate that both the companies are statistically significant to the regression model (as is also evident from the fairly high t-values).

Table 7
Oil and Gas vs. Index

Regression Statistics	
Multiple R	0.810623898
R Square	**0.657111104**
Adjusted R Square	0.656701603
Standard Error	357.1269447
Observations	2516

ANOVA					
	df	SS	MS	F	Significance F
Regression	3	613974390	204658130	1604.662727	0
Residual	2512	320379612.5	127539.6547		
Total	2515	934354002.5			

To be continued Table 7.

	Coefficients	Standard Error	T-Stat.	P-value	Lower 95%	Upper 95%
Intercept	4527.32879	32.49145	139.33907	0.00000	4463.61602	4591.04157
Royal Dutch Shell-A	-0.18570	0.21797	-0.85196	0.39432	-0.61313	0.24172
Royal Dutch Shell-B	0.39383	0.17494	2.25120	0.02446	0.05078	0.73687
BP	5.78642	0.44646	12.96078	0.00000	4.91096	6.66188

Table 7 provides the regression model between the index and the oil and gas sector companies. The following inferences can be drawn. The R^2 value is less than 0.7 or 70%, indicating this is not a strong model. The implication of this would be that the companies and the index' returns cannot be forecasted with high accuracy. A surprising inference from the p-value is the significance of Royal Dutch Shell-A. With its value being greater than the level of confidence i.e., 0.05, this company does not yield itself significantly to the model. On the other hand, Royal Dutch Shell-B, although being part of the same parent company, is a significant variable. BP is by far the most significant variable in this model. This is in sharp contrast to what has been established with the regression analysis of all the companies. In that, BP was the most insignificant variable, whereas, in this model it is the most significant. Mentioned below are the regression analysis done for the remainder of the sectors viz., banks (Fig. 9), technology (Fig. 10), supermarkets (Fig. 11) and the solo company for outlier analysis, Burberry (Fig. 12). All these models exhibit a low coefficient of determination (R^2), and hence do not make a strong model for regression analysis.

Table 8
Banks vs. Index

Regression Statistics	
Multiple R	0.54916787
R Square	**0.30158535**
Adjusted R Square	0.30102951
Standard Error	509.584431
Observations	2516

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	281787480	140893740	542.574521	1.344E-196
Residual	2513	652566523	259676.292		
Total	2515	934354003			

	Coefficients	Standard Error	T-Stat.	P-value	Lower 95%	Upper 95%
Intercept	5934.36154	51.91878	114.30086	0.00000	5832.55356	6036.16952
Barclays	10.02707	0.34760	28.84648	0.00000	9.34546	10.70869
Standard Chartered	-1.30525	0.04550	-28.68930	0.00000	-1.39446	-1.21603

Table 9
Technology vs. Index

Regression Statistics	
Multiple R	0.63432397
R Square	**0.4023669**
Adjusted R Square	0.40189127
Standard Error	471.386132
Observations	2516

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	375953125.9	187976563	845.960532	1.2306E-281
Residual	2513	558400876.6	222204.885		
Total	2515	934354002.5			

	Coefficients	Standard Error	T-Stat.	P-value	Lower 95%	Upper 95%
Intercept	5610.08371	29.41293	190.73529	0.0000	5552.40765	5667.75977
AVEVA	-0.14551	0.01428	-10.18706	0.0000	-0.17352	-0.11750
Sage	2.74765	0.07621	36.05240	0.0000	2.59820	2.89710

Table 10
Supermarkets vs. Index

Regression Statistics	
Multiple R	0.32245393
R Square	**0.10397654**
Adjusted R Square	0.10326343
Standard Error	577.190496
Observations	2516

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	97150895.75	48575447.9	145.807032	1.22829E-60
Residual	2513	837203106.7	333148.869		
Total	2515	934354002.5			

	Coefficients	Standard Error	T-Stat.	P-value	Lower 95%	Upper 95%
Intercept	7389.6120	55.6245	132.8482	0.0000	7280.5375	7498.6865
TESCO	-3.4978	0.2335	-14.9815	0.0000	-3.9557	-3.0400
OCADO	0.1308	0.0165	7.9453	0.0000	0.0986	0.1631

Table 11
Burberry vs. Index

Regression Statistics	
Multiple R	0.74388447
R Square	**0.5533641**
Adjusted R Square	0.55318644
Standard Error	407.427091
Observations	2516

To be continued Table 11.

ANOVA

	df	SS	MS	F	Significance F
Regression	1	517037960.1	517037960	3114.746	0
Residual	2514	417316042.4	165996.835		
Total	2515	934354002.5			

	Coef.	Standard Error	T-Stat.	P-value	Lower 95%	Upper 95%
Intercept	4695.70034	36.69175986	127.976972	0.0000	4623.751169	4767.6495
Burberry	1.35341405	0.024250426	55.8099086	0.0000	1.305861192	1.4009669

V. CONCLUSION

FTSE 100 by its very principle incorporates companies exclusively on their market capitalization. As a matter of fact, the companies comprise of 85% of London stock exchange capital. It could thus be argued that a significant relationship can be determined or observed through statistical analysis. If we look at the correlation analysis result and aggregate the coefficients across the board, we will observe that there is a net positive correlation between the FTSE 100 and its constituents. But this is not a true guide of dependency between the index and the companies.

Regression analysis allows to observe some of the relationships more closely. From the complete regression analysis of the companies, we were able to determine the significant variables and the insignificant ones. However, the results were not always in sync. Ex: BP was the most insignificant variable during a full analysis but was a significant variable when taken in the bracket of the oil and gas sector. An argument can be made that in the latter case model itself was not strong and resulting in the skewed result.

By virtue of FTSE 100 incorporating companies with market capitalization as the primary factor, it can be observed that when a group of companies are considered the relationship yields significant result. Individually most companies fare poorly when analyzed with the index. What we can say with certainty however is the fact that there are multitude of factors at play when analyzing relationships between companies and an index. The size of the sample, the precision of the estimate and low variability in data can all contribute towards differing results. However, as means to establish significance, correlation and regression are still the most important tools at our disposal.

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