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TESTING FOR MARKET ANOMALIES IN DIFFERENT SECTORS OF THE JOHANNESBURG STOCK EXCHANGE

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─Abstract ─

This study compared the performance of different asset-pricing models and their ability to account for market anomalies in different sectors of the Johannesburg Stock Exchange (JSE). The total sample size of the study consisted of 156 companies categorised into six different sectors namely, resources, consumer goods, consumer services, financial, industrial and others. Various asset-pricing models such as the Capital Asset pricing Model (CAPM), the Fama and French three-factor model and the Carhart four-factor model were used to analyse monthly data from January 2002 to December 2014. Variables used include the monthly stock return for each company and different market anomalies namely, size, value, January and momentum effects. The study revealed that whenever the asset-pricing models were not restricted, they tend to capture the market anomalies in four out of the six sectors. In contrast, when the models are restricted, they only seem to capture the anomalies in one of the six examined sectors. Thus, market anomalies are sensitive to model specifications, as restricting the models tends to reduce the likelihood of finding the presence of the market anomalies across the sectors. Our findings also show that market anomalies tend to differ across sectors and some sectors seem to be more efficient than others.

Key Words: Asset pricing model, efficient market hypothesis, market anomalies, expected return, JSE

JEL Classification: C01; G32; Z30

1. INTRODUCTION

Investors are concerned with stock returns and how they fluctuate because of market risk. Investment theory states that there is a positive relationship between risk and return; this is supported by the modern portfolio theory, which suggests that market risk should be the only risk that increases expected return (Elton & Gruber, 1997). However, the modern portfolio theory fails to account for other factors that might have an effect on expected returns, other than the market risk. There are two main theories in this regard that are on opposite ends. On the one hand, there is a theory of the efficient market hypothesis (EMH), which support the notion of market risk being the sole risk factor. On the other hand, a theory known as behavioural finance, states that other risk factors, along with market risk, account for expected returns. This creates two controversial views in the investigation of the expected return (Malkiel, 1992). The first view, the EMH by Fama (1965), states that the market has large numbers of buyers and sellers who value and analyse securities with the aim of making profit. By doing so, they are able to forecast future market prices for individual stocks, since all the relevant information is freely available to all investors and is taken into account by the market. This means that market are efficient market and investors should not earn above-average returns. Furthermore, prices of securities are supposed to adjust rapidly to new information and all current stock prices should reflect all available information (Reilly & Brown, 2012). Hence, expected return is exposed to market risk only, according to the EMH approach.

Over the years, it has been discovered that stock markets contradict the assumptions of the EMH. This led to the development of a theory called behavioural finance, which known to be on opposite ends with the EMH. Behavioural finance refers to a situation where a stock or a group of stocks' performance deviates from the assumptions of the EMH because of different forces. This situation is best known as market anomalies (Latif, Arshad, Fatima & Farooq, 2011). Market anomalies are inconsistencies of asset-pricing theory and are suggestive of market inefficiency or the insufficiencies of asset-pricing models. These inefficiencies are supposed to be captured by the asset pricing models, leaving no opportunity for investors to be in a position to outperform the market (Schwert, 2003). However, previous studies (Bhandari, 1988; Fama & French, 1992&1993; Van Rensburg, 2001; Muller & Ward, 2013; Archana, Safeer & Kevin, 2014) found that anomalies such as size, value, momentum and January effect have a significant effect on stock returns. This suggests that the EMH does not hold, as the market return is affected by different market anomalies.

Market anomalies have been studied for years as researchers look for answers as to why these anomalies affect expected returns. Investors seek to answer the question of whether they should be concerned about the effect these market anomalies have on expected returns or not. Therefore, there has been no consensus on which model captures the effect of market anomalies and what impact these market anomalies have on the expected returns. This is because market anomalies change with the economic climate, stock markets, selected sample, and time periods and differ from sector to sector. Additionally, it has been argued that after-market anomalies have been analysed and documented in academic literature, they often disappear, reverse or weaken (Latif et al., 2011; Sharma, 2014). This may occur because investors tend to take advantage of these market anomalies and in turn, the anomalies lose their effect on expected returns. Consequently, the anomalies lose their predictive power once the regular patterns in returns have been established. Thus, there is no definitive conclusion on the causes of market anomalies and their effect on expected returns. Additionally, there is still a debate on the most appropriate approach for testing market anomalies and the effect of market anomalies on expected stock returns, when different sectors of the stock market are considered. Thus, a further study on the effect of market anomalies on the expected return across all the JSE sectors will shed more light on this topic. The aim of this study was therefore to compare the performance of different asset-pricing models and their ability to account for market anomalies in different sectors of the JSE.

2. LITERATURE REVIEW

For many years, EMH has been the cause of much debate in financial stock markets. This area of research has attracted many scholars (Kendall, 1953; Fama, 1965 &1970; Fama, 1970; Malkiel, 1992) for various reasons. Firstly, it was discovered that stock prices moved in a random fashion and that new information is independent from other news and arrives in a random fashion (Fama, 1970). Secondly, the EMH assumes that investors always act rationally and stock prices adjust rapidly to new information and should reflect all available information (Shleifer, 2002). Even though the debate between EMH and behavioural finance has attracted many scholars, there are still discrepancies between the two. Research has shown that though investors believe they make rational decisions in order to maximise expected utility, markets are not rational (Latif et al., 2011). As a result, investors make irrational decisions, which may lead to market inefficiency due to over- or under-pricing of stocks (De Bondt & Thaler, 1994). However, the EMH assumes that markets are efficient because all relevant information is reflected in stock prices. Behavioural finance on the other hand, considers that markets are not as efficient as the EMH suggests, and to some extent, security prices are predictable. This has been established in past studies (Bhandari 1988; Fama, 1992 & 1993; Lakonishok, Shleifer & Vishny, 1994) that markets are inefficient as expected returns were found to be higher than market returns.

A study by Jegadeesh & Titman (1993) showed that momentum strategies that buy stocks which performed well 3 to 12 months prior and sell stocks that performed badly over the same time period, have generally produced profits for the US market over a period of 3 to 12 months when using the 6-month momentum strategy. Jegadeesh & Titman (1993) established that seasonality occurred in momentum profits and that winners obtained higher mean returns than losers did in all months, except January. Conversely, the losers obtained substantial average returns in the month of January. This illustrates that using the momentum strategy can impact stock returns positively as it yields to higher expected returns. These findings are suggestive that, even though market anomalies do have an effect on returns, these returns are subjective to factors such as seasonality. A similar study was conducted by Page, Britten & Auret (2013) who established the presences of momentum on the JSE shares. Basiewicz & Auret (2009) also found that size and value effect were present on the JSE and that book-to-market was the strongest proxy for the value anomaly even after adjustments for illiquidity (Basiewicz & Auret, 2009).

Fama & French (1992) examined the role of leverage, market beta, size and book-to-market equity when combined in the cross-section expected return and established that size and book-to-market equity were able to explain the cross-sectional variation in expected return. A similar study by Bhandari (1988) found that leverage assisted in explaining the cross-section of returns. In contrast, a study conducted by Le and Song (2002) found different results by establishing that during periods of recessions value stocks acquired higher returns than growth stocks. This implies that such anomalies may be subjective to business cycle fluctuations and not only model specifications. Qureshi & Hunjra (2015) found that the Day of the week and January effect were not present on the Pakistani stock market. A recent study by Qureshi & Hunjra (2015) also indicates that the presence of market anomalies differ across markets.

It is evident that even though there are numerous theories and asset-pricing models, mispricing could lead to irregular patterns in the market, which investors can use to their advantage and obtain abnormal market returns. There has not yet been clear evidence as to what causes the presence of market anomalies, however, it is clear that they differ from markets, sectors of the stock market, economies, model specifications and in some instances asset-pricing models are unable to account for them.

3. METHODOLOGY

3.1 Data and sample period

The study adopted a quantitative research approach to examine the effects market anomalies have on expected returns across the sectors of the JSE. The sample period used consists of monthly data starting from January 2002 to December 2014. All listed companies available on the JSE Main Board were considered however, suspended companies, companies that did not stay on the mainboard for the whole sample period and companies that did meet the sample period were excluded from the sample. In total, there were 389 companies listed on the main board, 32 companies were suspended from trading and a total of 201 companies were eliminated because they were not listed for the whole sample period. Therefore, the total sample size of the study consists of 156 companies after all the adjustments. In the exclusion of companies that do not have sufficient data, this study adopted the procedure followed by Auret& Sinclaire (2006), and Basiewicz & Auret (2010). The 156 companies were categorised into six sectors. A the time of this study, the JSE Main Board had ten major sectors and we made use of the five big sectors, namely basic resources, consumer goods, consumer services, financial and industrial sectors. We then combined the remaining sectors, with the insufficient number of companies, into a single sector described as “other”.

3.2 Model specifications

This study examines the effects of market anomalies across the sectors of the JSE and compares the models against the well renowned CAPM. For the purpose of this study the CAPM is used as a benchmark throughout the paper where other asset pricing models have been used to examine the effects of market anomalies. The CAPM was chosen as a benchmark because all the models in this paper are extensions of the CAPM and thus its comparison of the different asset pricing models helps to give more insight to which model best captures the market anomalies analysed. This study made use of four asset-pricing models namely CAPM, Fama and French three factor (FF3-factor) model, Carhart four factor (C4F) model and C4F model with the inclusion of the January effect. These models are explained below.

3.2.1 Capital Asset Pricing Model (CAPM)

The CAPM is used to determine the relationship between risk and return for portfolios and individual stocks. The model uses a single risk factor known as market beta. The models applicability has been investigated over decades as a sole risk factor model (Reilly & Brown, 2012) and some weakness have been identified. In generic form, the CAPM model is described below:

$$\mathrm{R_{it}} = \mathrm{R_{ft}} + \beta_{\mathrm{mi}}(\mathrm{R_{mt}} - \mathrm{R_{ft}}) + \mathrm{e_{it}} \quad (1)$$

Where: $R_{it} =$ the excess return for company i in month t; $\mathrm{R_{ft}}$ is the risk free rate; β_{mi} is the beta coefficient of portfolio i relative to the market; $R_{mt} = (\mathrm{R_{mt}} - \mathrm{R_{ft}})$ which is the excess market return (or market risk premium) in month t and; and $\mathrm{e_{it}}$= residual term of the regression for company i in month t.

3.2.2 Fama and French three factor model (FF3-factor model)

The FF3-factor model initially developed as an alternative to the CAPM. The only modifications to the model include the use of three risk factors known as market beta, firm size and value or book-to-market equity. In the equation, FF3-factor model is presented as follows:

$$R_{it} - R_{ft} = \alpha_i + \beta_{mi}(R_{mt} - R_{ft}) + \beta_{si}SMB_t + \beta_{vi}HML_t + e_{it} \quad (2)$$

Where: SMB_t is size and HML_t is value.

The value factor (HML) was constructed from a zero-cost portfolio (constitutes combining a group of investments that produce a net value of zero) that longs (buys) securities with a high book-to-market ratio and shorts (sells) securities with a low book-to-market ratio. The size factor (SMB) constituting an investor to long a position in a portfolio of small firms and to take a short in a portfolio with large firms calculated as a return on a group if investments, which add up to zero when combined, accounting for the size premium.

The study applied the Wald coefficient restriction test to determine whether the additional two variables included to the FF3-factor model are jointly different from zero. If the coefficients are jointly different from zero, it means that size and value factors belong to the model. In order to conduct the Wald coefficient restriction test, the following hypothesises were formulated:

- Null hypothesis (Ho): $\beta_{si} = \beta_{vi} = 0$: Size and value are jointly equal to zero.
- Alternative hypothesis (Ha): $\beta_{si} \neq 0$ and $\beta_{vi} \neq 0$: Size and value are jointly different from zero.

3.2.3 The Carthart four-factor model

The C4F model is not as common as the other two aforementioned models. This model is an expansion on the FF3-factor model as it incorporates an additional factor, capturing Jegadeesh & Titman's (1993) momentum anomaly. Fama & French (1996) established that their three-factor model was unable to explain the continuation of short-term returns of Jegadeesh & Titman (1993). The momentum anomaly can be referred to as a market inefficiency due to slow reaction to information (Chan et al., 1996). The Carhart four-factor model is as follows:

$$R_{it}-R_{ft} = \alpha_i + \beta_{mi}(R_{mt} - R_{ft}) + \beta_{si}SMB_t + \beta_{vi}HML_t + \beta_{momi}MOM_t + e_{it} \qquad (3)$$

Where: MOM_t, is the momentum factor, measured by 6 and 12; and β_{momi} is the sensitivity of portfolio i's return to movements in the momentum risk premium.

The study augmented the C4F model by including an additional variable, namely the January anomaly. It has been established that various market anomalies challenge the assumptions of EMH; and another anomaly, which does this is the January effect.

4. EMPIRICAL ANALYSIS

Results for each model were estimated with restricted intercept, where the intercept was set to be the risk free rate and the unrestricted risk free, where the model automatically generated the intercept. Before estimating the asset pricing models, panel unit root test was conducted and all variables were found to be stationary at level. The pooled regression was used to estimate each model. Diagnostics tests namely, autocorrelation, multicollinearity and normality were also conducted to check for the robustness of the results and each model passed these tests.

4.1 Results of the CAPM and the FF3-factor model

This section compares the results of the CAPM and the FF3-factor model. Table 1 illustrates the results of the six sectors. The results indicate alpha and market beta are statistically significant suggesting that the CAPM account for returns across the sectors. According to the theory of EMH, it could be said that the sectors examined are efficient. However, CAPM is known as a single risk factor and thus only accounts for market risk. Hence, a low R^2 (less than 10% in all sectors) may suggest that the market does not explain much variation in share return.

The results (not reported in this paper) of the unrestricted FF3-factor model (where the model has a constant as a regression intercept) indicate that the coefficient of SMB is statistically significant in consumer services and basic resources sectors;

while the VMG coefficient is statistically significant in consumer services, basic resource and financial sectors. The results of the Wald test (not reported in paper) show that that SMB and VMG are jointly different from zero in four sectors. As a result, we reject the H_0 (at the 5% level of significance) that SMB and VMG are jointly equal to zero in these sectors. These results suggest that the EMH does not hold in these sectors. As a result, we conclude that the FF3-factor model performed better than the CAPM in four out six sectors. However, in two sectors, industrial and consumer goods, the CAPM performed better than the FF3-factor model. This implies that the EMH theory is applicable in these two sectors because the market risk is the only risk that has an effect on the sector returns.

Table 1: Results of the CAPM

	Consumer goods	**Consumer services**	**Other**	**Basic resources**	**Financials**	**Industrials**
α	0.6369***	0.5439***	0.8043***	0.8847***	0.5285***	0.6584***
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
β Mark.	0.6343***	0.5402***	0.8015***	0.8904***	0.5232***	0.6586***
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R^2	0.0956	0.0110	0.0345	0.0602	0.0071	0.0419
Adj. R^2	0.0953	0.0108	0.0341	0.0600	0.0069	0.0418
DW	2.0191	2.1799	2.2047	2.1754	2.1024	2.2169

Note:, **, *** Significant at the 10% , 5% and 1% level of significance, respectively*

Table 2 presents the results of the cross-sector analysis of the FF3-factor model with the assumption of CAPM (restricting the risk free rate). The CAPM incorporates the risk free rate as a regression intercept. Therefore, it is of importance to examine if the FF3-factor model performs better when the risk-free rate is restricted. It is evident that, at least, one of the added two variables is significant, at the10 percent level of significance, in all sectors. This is confirmed by the results of the Wald test (not included in this paper), which show that the H_0, that SMB and VMG are jointly equal from zero, is rejected at the 1% level of significance (p-values < 0.01). Thus, when the restriction is imposed in the model, the FF3-factor model tends to perform better than the CAPM in all six sectors. These results suggest that the size and value anomalies are present in all six sectors. The adjusted R^2 have also increased implying that the restricted FF3-factor model is a better model than the unrestricted FF3-factor model in capturing the effects of size and value in the JSE sectors.

Table 2: Results of the restricted FF3-factor model

	Consumer goods	Consumer services	Other	Basic resources	Financials	Industrials
Rf	0.8520***	0.9271	1.0539***	0.9557***	0.8732***	0.9869***
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
β Market	0.8508***	0.9267	1.0533***	0.9625***	0.8698***	0.9892***
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
β SMB	0.4682***	0.9110	0.6058***	0.2357**	0.6682***	0.6811***
p-value	0.0000	0.0000	0.0000	0.0014	0.0000	0.0000
β VMG	0.0169	-0.1243*	-0.1059	-0.1577*	0.1934**	0.0946
p-value	0.7672	0.0791	0.3687	0.0621	0.0268	0.1348
R^2	0.1330	0.0658	0.0497	0.0624	0.0261	0.0802
Adj. R^2	0.1319	0.0651	0.0485	0.0618	0.0256	0.0796
DW stat.	2.0755	2.2696	2.2250	2.1759	2.1211	2.2680

Note:, **, *** Significant at the 10% , 5% and 1% level of significance, respectively*

For the C4F model, the study included 6- and 12-month momentum variables to evaluate its effects both in the short and long-term horizon. The results of the unrestricted C4F model with the 6-month momentum variable show that the added factor of momentum is only significant in two sectors namely, consumer services and basic resources sectors. Similarly, the coefficient of value effect is statistically significant in these two sectors; while the coefficient for market risk premium is statistically significant in basic resources and industrial sectors. In contrast, the factor that seems to be statistically significant, in five of the six sectors, is size.

The results of the restricted C4F model with the 6-month momentum variable are summarised in Table 3. These results show that the coefficients for market and size effects become significant in all sectors suggesting that restricting the model increases the power of the market and size effects. However, the size effects becomes positive in consumer goods, "others" and basic resources, while it was negative in the unrestricted model. The important observation is that momentum effect is significant only in one of the six sectors (basic resources). From both the unrestricted and restricted C4F models, anomalies tend to be present in consumer services and basic resources; while in other sectors, the anomalies tend to change with the restriction of the model. This implies that the C4F model outperformed better than the CAPM but the effect of momentum on the stock return cannot be generalised across the sectors. The unrestricted C4F model with the 6-month momentum has higher adjusted R^2 than restricted one, implying that the unrestricted model performed better than the restricted C4F model.

Table 3: Results of the restricted C4F model (6-month momentum variable)

	Cons goos	Consumer services	Other	Basic resources	Financials	Industrials
Rf	0.8464***	0.9055***	1.0225***	0.9667***	0.8781***	0.9970***
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
β Market	0.8451***	0.9047***	1.0219***	0.9736***	0.8754***	0.9991***
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
β SMB	0.4306***	0.8858***	0.5710***	0.2818***	0.7430***	0.7065***
p-value	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000
β VMG	0.0601	-0.1159*	-0.1174	-0.1502*	0.1275	0.0696
p-value	0.3081	0.0905	0.3372	0.0841	0.1406	0.2833
β MOM6	0.0000	0.0000	0.0001	0.0000*	0.0000	0.0000
p-value	0.7831	0.5267	0.3949	0.0873	0.8755	0.2017
R^2	0.1360	0.0732	0.0495	0.0651	0.0311	0.0822
Adjust R^2	0.1345	0.0723	0.0478	0.0643	0.0304	0.0814
DW stat.	2.0698	2.2485	2.2339	2.1856	2.1794	2.2903

Note:, **, *** Significant at the 10% , 5% and 1% level of significance, respectively*

Results for the C4F model with the 12-month momentum variable, Table 4, illustrate that some market anomalies are present in the various sectors. It is evident that, in the consumer goods sector, the size anomaly is present at the10 percent level of significance. The size coefficient is statistically significant but it is negative indicating that the size anomaly has a negative effect on returns in this sector. The 12-month momentum variable is also present (significant at 5%) in this sector. In contrast, the value and market premium are both not significant at the 10 percent significance level. This implies that the value anomaly was not present in this sector. Furthermore, in the financial sector, the 12-month momentum and size anomalies were present; whereas the value anomaly was not present. However, the 12-month momentum premium has a negative effect on returns in this sector suggesting expected returns in the financial sector respond negatively to the 12-month momentum. Additionally, all coefficients are statically significant, at least at the 10 percent significance level, in the industrial sector. However, the value premium has a negative coefficient suggesting that the value premium has a negative effect on returns in the industrial sector. Finally, in the “other” sector only the value premium is significant at the 10 percent level of significance, whilst the 12-month momentum premium, market premium and the size premium are not statistically significant at the 10 percent level of significance. This implies that the 12-month momentum and size have no effect on returns in the “other” sector. This suggests that only the value anomaly is present in this sector, therefore the EMH assumptions tend to be violated in this sector.

Table 4: Results of the unrestricted C4F model with 12-month momentum

	Consumer goods	Consumer services	Other	Basic resources	Financials	Industrials
Constant	0.0128***	0.0216***	0.0225***	0.0182***	0.0219***	0.0127***
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
β Mark	0.0013	0.0031*	0.0042	0.0096***	-0.0002	0.0061***
p-value	0.3895	0.0763	0.1727	0.0000	0.9396	0.0003
β SMB	-0.1008*	0.3114***	-0.0447	-0.3863***	0.1968**	0.1124*
p-value	0.0809	0.0000	0.6922	0.0000	0.0113	0.0645
β VMG	0.0068	-0.1618**	-0.2309*	-0.1842*	0.0500	-0.0148
p-value	0.9192	0.0310	0.0825	0.0541	0.5849	0.8359
β MOM	0.0001**	0.0000*	0.0001	0.0000**	-0.0001*	0.0001***
p-value	0.0101	0.0591	0.4005	0.0158	0.0832	0.0001
R^2	0.0060***	0.0076***	0.0038*	0.0187***	0.0030***	0.0064***
Adjust R^2	0.0042	0.0066	0.0019	0.0178	0.0022	0.0055
DW stat.	1.9499	2.2193	2.2084	2.1555	2.1437	2.2105

Note:, **, *** Significant at the 10% , 5% and 1% level of significance, respectively*

The results (not reported in this paper) of the cross-sector analysis of the restricted C4F model with 12-month momentum show that the C4F model with the 12-month momentum under the CAPM assumption performs better than the unrestricted C4F model with the 12-month momentum variable because the adjusted R^2 tends to increase in each sector. Additionally, the number of significant coefficients tends to increase when the model is restricted. This implies that, when the C4F model is restricted with the risk free rate, it produces better results. These findings indicate that time-period used to measure the momentum does affect the results as the results of the 12-month momentum seem to be different from those of the 6-month momentum.

4.3 Results of the C4F model with the inclusion of January

The findings of the C4F four-factor model augmented with the January effect (C4FJ model) was applied to determine if inclusion of the January anomaly would capture additional variation missed by the size and value factors. The study uses a dummy variable for January (results are not reported in this paper). The study established that the coefficient for January effects is significant in four sector namely, consumer goods, basic resource, financial and industrial sectors. Therefore, it can be established that the C4FJ model with the 6-month momentum variable performs better at capturing the effects of size, value and 6-month momentum effects in these sectors. However, the January effect is not present in consumer services and “other” sectors. Interestingly, other anomalies in the “other” sector seem to disappear when January effect is added to the C4F model, suggesting that the CAPM performed better than the C4FJ model with the 6-month momentum in this sector. When the momentum is increased to 12 months (in Table 5) the coefficients for January effects become statically significant in all sectors, except "others". This suggests that January effects seem to be present when a 12-month momentum is utilised. Additionally, the size and momentum coefficients are significant in five of the six sectors, suggesting that size and momentum anomalies are best captured when the unrestricted C4FJ model with 12-month momentum is utilised.

Table 5: Results of the C4FJ (12-Month momentum variable)

	Consumer goods	**Consumer services**	**Other**	**Basic resources**	**Financials**	**Industrials**
Constant	0.0117***	0.0241***	0.0222***	0.0169***	0.0239***	0.0138***
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
β Market	0.0015	0.0036**	0.0042	0.0093***	0.0001	0.0064***
p-value	0.3412	0.0386	0.1789	0.0000	0.9529	0.0002
β SMB	-0.0983*	0.3319***	-0.0467	-0.399***	0.2102***	0.1213**
p-value	0.0887	0.0000	0.6803	0.0000	0.0070	0.0467
β VMG	-0.0054	-0.1919**	-0.2280*	-0.1656*	0.0289	-0.0279
p-value	0.9368	0.0108	0.0882	0.0847	0.7538	0.6983
β MOM12	0.0001***	0.0000**	0.0001	0.0000***	-0.0001*	0.0001***
p-value	0.0067	0.0431	0.3955	0.0059	0.0569	0.0001
β JAN	0.0117*	-0.029***	0.0029	0.0195**	-0.0201**	-0.0129*
p-value	0.0829	0.0001	0.8278	0.0446	0.0274	0.0699
R^2	0.0073***	0.0117***	0.0038	0.0196***	0.0039***	0.0071***
Adj. R^2	0.0051	0.0104	0.0015	0.0185	0.0030	0.0060
DW stat.	1.9498	2.2179	2.2085	2.1565	2.1434	2.2086

Note:, **, *** Significant at the 10% , 5% and 1% level of significance, respectively*

Results of the restricted C4FJ model with 12-month momentum revealed that when this model is restricted coefficient for market and size premiums become significant in all six sectors. However, value, momentum and January effects are not significant in five of the six sectors. This means that the restricted C4FJ model with 12-month momentum captured market anomalies but did not capture value, momentum and calendar (January) anomalies. These results indicate that market anomalies are sensitive to the restriction of the constant in the asset pricing model.

5. DISCUSSION

It is evident from the above results that the assumptions of the EHM have been violated in most of the sectors of the JSE. Our findings show that size, value, 6 and 12-month momentum and the January anomalies were present during the sample size. This is indicative that there is some degree of inefficiency in the market. Furthermore, the CAPM was found to perform better in some sectors, while asset pricing models such as the FF3-factor model, C4F model and the C4FJ model also performed better in certain sectors. It has also been established that, when the FF3-factor model and the two C4F models are restricted with the risk free rate, the models are able to capture more variation in return. However, restricting the model do affect the presence momentum and January effects, across the sectors.

Our findings are similar to those of Chui & Wei (1998), who examined the relationship of expected stock returns and various market anomalies in several countries. The results by Chui & Wei (1998) indicate that market anomalies differ from market to market. These results are similar to those established in the current study where the size anomaly was found in the in the consumer goods sector but not in the financial sector. As a result, it can be said that the presences of market anomalies tend to differ from sector to sector. On January effects, our findings are similar to those of Sander & Veiderpass (2013) who established a strong turn of the year effect the turn-of-the-year in Baltic stock exchanges in all years. They also found that the turn-of-the-year effect varied by years and also by listing of each companies. The results found in the basic resource and consumer service sectors illustrate that no market anomalies were present suggesting that there is some degree of market efficiency, and that returns in January are not higher than returns in other months as suggested by the assumption of the effect. These results are closely related to those of Auret & Cline (2011), Silva (2011) and Qureshi & Hunjra (2015) in which it was evident that the January effect had no impact on stock returns.

Although there is extensive research done and being done on this topic, there has been no consensus on the effect market anomalies have on the expected returns. Our findings indicates that market anomalies change with stock markets, selected sample, model selection, economic climate of a country, time period and sectors of the securities market considered. Furthermore, in some instances it has been argued that after market anomalies have been analysed and documented in academic literature, they often disappear, reverse or weaken (Latif et al., 2011). Our findings seem to confirm that there is no definitive approach as to which methodology is the most appropriate for analysing these market anomalies, their causes and their effect on expected returns.

6. CONCLUSION AND RECOMMENDATIONS

This study established that a pattern exists in the results, where results differ across the JSE sectors and are affected by the asset-pricing model used. Whenever the FF3-factor, C4F model and C4FJ model are not restricted, they tend to capture the effects of market anomalies in four out of the six sectors. However, when the models are restricted with the risk free rate, they only seem to capture the effects in the basic resource sector. This means that using asset-pricing models where the risk free rate is restricted tends to reduce the likelihood of finding the presence of the market anomalies. Among the sectors, the consumer services sector is the only sector that had no market anomalies present when all the asset-pricing models were restricted and unrestricted. This suggests that the consumer services is the most efficient sector of the JSE and that in this the expected return is only explained by the market. It is unmistakable that the model that performs best in the consumer services sector is the CAPM, whereas in the basic resource sector the models that are able to capture the effects of market anomalies are the restricted FF3-factor model, the C4F model and the C4F model augment with the January effect. The time period used to measure anomaly also seem to contribute to the presence or the absence of this anomaly, indicating that caution should be applied in measuring momentum.

This study confirmed that market anomalies change with the selection of asset pricing model, time period and sectors of the securities market considered. It may therefore be worthwhile for researchers to look further into conditional asset pricing models, implying restricting or unrestricting certain variables in the model to determine if more useful results can be obtained. Additionally, testing for adaptive market hypothesis (disappearing and weakening of the market anomalies) across the JSE sectors may shed more light on the topic of market anomalies in the South African context.

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