

Aftermarket price performance of initial public offerings on the JSE

1. INTRODUCTION

The objective of any initial public offering (IPO) is to achieve the highest value for the issuer while ensuring a buoyant start to secondary trading and strong long-term (aftermarket) performance. A share is underpriced if its offer price at the IPO is lower than the closing price on the first day of trade. The problem of underpricing has been extensively researched and clearly indicates some loss of value to the issuer. However, underpricing can act as a positive signal and thereby support secondary market trading and aftermarket performance. Under-performance in the aftermarket will affect the firm's ability to raise further capital and can therefore be a more significant factor than underpricing. This study examines aftermarket performance and the factors that influence it.

2. LITERATURE REVIEW

Under normal market conditions, if an IPO is overpriced, only uninformed investors will submit purchase orders and consequently will be awarded 100% of the shares. Typically, these shares subsequently trade at a discount in the aftermarket. Some companies underprice their shares in order to induce informed investors to purchase their shares. Therefore, underpricing could also be perceived as compensation to investors for the cost of becoming informed i.e. performing security analysis etc. On the contrary, Ibbotson (1975) speculated that IPOs may not be underpriced and that instead, the initial aftermarket period may actually be overpriced. The poor long-run performance of IPOs would then indicate that in spite of the short run underpricing phenomenon, the cost of equity for young growth firms is not excessively high.

Ritter (1984) defined a hot issue period as a period during which the return on the first day of trading ("initial" or "opening" premium) on new listings is high, and a cold issue period as a period during which the initial premia on new listings are low. The existence of hot and cold issue periods is likely to impact differently on the aftermarket performance of new listings.

Ibbotson, Sindelaar, & Ritter (1994), Bhana (1989) and Macdonald & Fisher (1972) argued that whilst significant high initial returns would be identified for hot issue periods, this would not be the case with aftermarket returns. In contrast, Lawson (1996)

showed that the aftermarket (up to 1 year) performance of shares for hot issue periods was significantly higher than that observed for cold issue periods on the Johannesburg Stock Exchange (JSE).

Using the method proposed by Macdonald & Fisher (1972), Bradfield & Hampton (1989) concluded that shares with high opening premia did generally have relatively higher abnormal returns in their respective aftermarket periods (less than 1 year). This would support the belief noted by Bradfield & Hampton (1989:85) that "in order for a share to have a successful performance after listing, it should make its debut with a relatively large opening premium".

Reilly and Hatfield (1969) have suggested that the short-term price adjustment after the offering could be continued through the long-term as the market continues to recognise and adjust for the underpricing. This suggests positive excess returns in the aftermarket.

Bhana (1989), in his research into market efficiency on the JSE, noted that investors who acquired shares in new issues in the secondary market received negative returns for a one-year holding period. He ascribed this under performance over the 12 months to (semi strong) market efficiency because the results were associated with the market correction for the initial over reaction, which resulted in shares opening above the issue price.

Ibbotson (1975:258) concluded that there were "very few, if any, departures from market efficiency in the aftermarket". He observed slightly higher performance in the second to sixth month after listing. However, taking advantage of these insignificant positive abnormal returns would not be profitable due to transaction costs.

Newly listed companies might be expected to have higher risk than average market risk. Therefore, the risk needs to be taken into account when measuring share performance in order to avoid overstating performance results. Ibbotson (1975) showed that the systematic risk of new issues is greater than the market risk and that this systematic risk reduces as the issues become seasoned. Bradfield & Hampton (1989) found that the opening premia on the JSE were not affected by systematic risk as measured by β . They also found that risk adjusted aftermarket excess returns to first day purchasers who held their position for a year thereafter, averaged 29%. They assumed that the share β values were stationary over the period of their study. Returns were positive for both cold and

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hot issue periods.

A lot of research into the aftermarket performance of shares in other countries exists. In the USA, Ritter (1991) found that the matching firm-adjusted cumulative average returns, exclusive of initial returns, decline to -29.1% by the end of month 36 after an IPO. Loughran & Ritter (1995) report that IPOs in the USA underperformed by 7% per year in the first five years after issuing. In their comparison between companies that issued shares in IPOs and non-issuers, they state (p23) that "... based on the realized returns, an investor would have had to invest 44 percent more money in the issuers than in non-issuers of the same size in order to have the same wealth five years after the offering date."

Jain & Kane (1994) state that more than 50% of IPOs in their sample had a subsequent deterioration in aftermarket performance. Ibbotson's work (1975) indicated negative risk adjusted aftermarket performance in the USA. However, he believed that this was a correction to the initial underpricing of shares and that there was no departure from market efficiency in the aftermarket.

In the 1980's the UK was the world's third largest capital market. Research by Levis (1993), in the UK for the period 1980 - 1988, showed a gradual and steady decline in IPO performance for a period of up to 36 months. The level of IPO underperformance was both statistically and economically significant. The magnitude of underperformance was dependent on the benchmark used. Levis suggested that underperformance in the aftermarket continued beyond the 36 months. However, he argued that the average underperformance of new issues in the UK was not as excessive as in the U.S.A. Furthermore, unlike in the U.S.A., his findings did not indicate a systematic relationship between annual volume of IPOs and aftermarket performance. Levis also found that the size of the issue was an important determinant of long run performance. He observed a positive correlation between size of issue and level of aftermarket performance.

Aggarwal, Leal & Hernandez (1993) studied the aftermarket performance of initial public offerings in Latin America between 1980 and 1990. They found that in Brazil, investors who purchased shares in the aftermarket at the closing price on the first trading day, and held them for one year, received mean and median excess returns of -9.0% and -51.1%, respectively. The mean excess returns became -34.9% and -47.0% for two and three year holding periods respectively. Similar trends were observed in the Mexican and Chilean markets. However, these researchers warn that interpretation of the results should be done cautiously since the samples studied were small and the economies investigated were prone to high inflation. Other anomalies exist in the

Latin American markets such as the small number of listed shares and low levels of trading liquidity.

3. PUBLISHED METHODS USED TO MEASURE LONG RUN PERFORMANCE

In several instances, published results showing long run positive excess returns have led to follow-up studies, which in turn revealed that the initial results were sensitive to the test methodology applied.

Kothari & Warner (1997) simulated long run performance of shares in the USA and warned that conclusions from existing long-horizon studies could be erroneous. They noted that many tests are "mis specified", and that both positive and negative abnormal performances following simulated events persist for a long time. Furthermore, their findings together with those of Barber & Lyon (1997) indicated that the direction and magnitude of bias in long run studies can be sensitive to sample characteristics such as book to market, size, exchange listing and time period. They showed that the bias towards over rejection is related to both sample selection and survival (e.g. requiring prior return data i.e. event survival). The bias can cause estimated post event abnormal returns to be systematically positive in random samples. These researchers also indicated that long-horizon buy and hold abnormal returns were significantly right skewed while cumulative abnormal returns were not.

Two procedures are used to determine long run performance namely i) cumulated abnormal returns (CAR) and ii) buy and hold abnormal returns (BHAR). In the CAR procedure, the monthly excess returns are added together over a defined period. If R_{it} is the month t simple return on sample firm i , $E(R_{it})$ is the expected return in month t of the sample firm i , then the abnormal return in month t , AR_{it} would be given by

$$AR_{it} = R_{it} - E(R_{it}) \quad \dots (1)$$

The cumulative abnormal returns would then be given by

$$CAR_{it} = \sum_{t=1}^{\tau} AR_{it} \quad \dots (2)$$

The return on a buy-and-hold investment in the sample firm i less the return on a buy and hold investment in an asset / portfolio with an appropriate expected buy-and-hold return (ie the BHAR) is given by the following

$$BHAR_{it} = \prod_{t=1}^{\tau} [1 + R_{it}] - \prod_{t=1}^{\tau} [1 + E(R_{it})] \quad \dots (3)$$

The main differences between CARs and BHARs are due to the effect of compounding. CARs ignore compounding while BHARs include the effect of

compounding. Barber & Lyon (1977) advocate the use of BHARs returns instead of CARs because CARs are a biased prediction of long run BHARs i.e. CARs are subject to measurement bias. Furthermore, they believe that BHARs measure the underlying parameter of interest. Loughran & Ritter (1995) indicate that the BHAR method provides a sharper distinction between portfolios when classifying firms.

These researchers conducted simulations and event studies that required shares to have a history of at least 24 months to be included in their samples. They then used the data from the 24 months to determine pertinent regression coefficients for the shares. They thus expected the population mean of CARs and BHARs to be positively biased due to listing bias. This is because newly listed firms become part of the market index against which the sample firm's performance is measured. The inclusion of these newly listed firms in the market index and their exclusion from the potential sample can cause the population mean CAR/BHAR to depart from zero. The population mean CAR/BHARs would be positive if newly listed firms underperformed market averages while it would be negative if newly listed firms outperformed market averages.

When BHARs are calculated using an equally weighted market index, the long-run return on the index is compounded assuming monthly re-balancing of all securities constituting the index. If the consecutive monthly returns for the individual securities are correlated, the monthly re-balancing leads to bias on the population mean. This is known as re-balancing bias. Re-balancing is done by selling the gains on high performing shares and replenishing the losses on those shares that underperformed. The weaknesses are summarised in Table 1.

Table 1: Weaknesses in the excess returns measurement procedures

| | CAR | BHAR |
|-------------------|-----|------|
| Measurement bias | x | |
| New listing bias | x | x |
| Re-balancing bias | | x |

4. RETURN BENCHMARKS

A number of benchmarks can be used to measure abnormal returns. Barber & Lyon (1997) proposed the use of control firms in calculating abnormal returns. In the control firm method, sample firms are matched to control firms on the basis of specified firm characteristics such as size, book-to-market ratio and size / book-to-market ratio.

The control firm approach is ideal because both the sample and control firms must be listed in the same month thus eliminating listing bias. The re-balancing bias is also removed if both the sample and control firm returns are calculated without re-balancing. Barber & Lyon (1997) reported that identifying control firms by first filtering on size (market value of equity) and then matching on book-to-market ratio could yield test statistics that were well specified.

Various references can be used to determine the long-run abnormal returns of firms. In particular, Fama & French (1992) have shown that reference portfolios should be adjusted to control for i) size (market capitalisation), ii) book-to-market value and iii) size/book-to-market value.

Four models commonly used to estimate security-specific abnormal returns are

- Market adjusted model abnormal return given by

$$AR_{it} = R_{it} - R_{mt} \quad \dots (4)$$

where
 R_{mt} is the monthly return on the equal weighted market index in month t

- Market model abnormal return given by

$$AR_{it} = R_{it} - \alpha_i - \beta_i R_{mt} \quad \dots (5)$$

where
 α_i and β_i are market model parameter estimates obtained by regressing monthly returns for share i on the equally weighted market index returns.

- CAPM model abnormal return given by

$$AR_{it} = R_{it} - R_{ft} - \beta_i [R_{mt} - R_{ft}] \quad \dots (6)$$

where
 β_i is the slope of a regression of $(R_{it} - R_{ft})$ on $(R_{mt} - R_{ft})$ for the estimation period with the regression line going through the origin

R_{ft} is the risk free return

- Fama – French three-factor abnormal return model given by

$$AR_{it} = R_{it} - R_{ft} - \beta_{i1} [R_{mt} - R_{ft}] - \beta_{i2} HML_t - \beta_{i3} SMB_t \quad \dots (7)$$

where
 β_{i1} , β_{i2} and β_{i3} are estimated by regressing share i monthly returns against excess returns on the monthly market returns for the estimation period

HML_t is the high minus low book-to-market portfolio return in month t

SMB_t is the small minus big size portfolio return in month t.

Long horizon results are potentially very sensitive to the assumed model for generating expected returns. Fama & French (1993) report that failure to use the correct model would result in systematic biases and misspecifications. On the contrary, Kothari & Warner (1997) examined a variety of abnormal return models and found that the degree of misspecifications was not highly sensitive to the model employed. In tests for 36-month abnormal performance, using test period standard deviation, the researchers found all four models to exhibit excessive rejection frequencies over the three years. The market model performed the worst, followed by the CAPM and market adjusted models.

Fama and French indicated that the three-factor model might explain the cross-section of share returns, unlike the CAPM. An advantage of the three-factor model is that it does not require size or book-to-market data for sample firms. This means that firms without available data on the market value of equity or book-to-market ratio can be included in the analysis. Furthermore, shares of large firms (low book-to-market ratios) may closely follow the pattern observed for shares of small firms (high book-to-market ratios). The three-factor model allows for this possibility, unlike the reference portfolios.

One main disadvantage of the three-factor model is that, given four parameters in the regression, it requires at least 5 observations of monthly returns post listing. The second disadvantage is that when long horizon returns (e.g. 5 years) are considered, the regression estimates are considered stable over the estimation period. Unlike the size/book-to-market portfolios, in which a firm's portfolio assignment is allowed to change once a year, the three-factor regression model assumes that a firm's market size and book-to-market characteristics are stable over time. Another disadvantage was summarized by Loughran & Ritter (1995:44) as "to the degree that the portfolios are correlated with omitted factors, the coefficients can embody factors other than what is explicitly being controlled for."

In order to test the null hypothesis that the mean cumulative or buy-and-hold abnormal returns are equal to zero for a sample of n firms, one of the following parametric test statistics is employed.

$$t_{CAR} = \overline{CAR_{it}} / (\sigma(CAR_{it}) / \sqrt{n}) \quad \dots (8)$$

or

$$t_{BHAR} = \overline{BHAR_{it}} / (\sigma(BHAR_{it}) / \sqrt{n}) \quad \dots (9)$$

where CAR_{it} and BHAR_{it} are the sample averages and (σ(CAR_{it}) and (σ(BHAR_{it}) are the cross sectional standard deviations of abnormal returns for the sample of n firms. If the sample is drawn randomly from a normal distribution, these test statistics should follow a Student's t distribution under the null hypothesis.

The null hypothesis is inappropriately rejected if the measured average abnormal performance is systematically non zero, or the standard deviation used to calculate the test statistic is too small, or both.

5. RESEARCH HYPOTHESES

Based on the review of published literature, the main objectives of this research were formulated as follows:

- 1 To determine whether shares that list on the JSE yield risk-adjusted aftermarket abnormal returns over holding periods of 1 year, 3 years, 5 years and 10 years.
- 2 To determine whether IPO characteristics namely i) the IPO listing price, ii) the level of underpricing, iii) the amount of capital raised, iv) the volume of shares issued and v) the presence of "hot issue periods" vs. "cold issue periods" have an effect on the level of aftermarket performance.

The following hypotheses were formulated and tested:

H1 The excess aftermarket return (i.e. buy and hold abnormal return) on IPO shares is zero.

Three benchmarks were used to test this hypothesis. These were i) the CAPM model, ii) the book-to-market portfolios and iii) the size (market capitalisation) portfolios. Whilst this approach differs from the Fama and French (1993) three factor model described earlier, it did at least control for the same independent variables, albeit in a non-synchronous manner. This was necessary because of the reduced data set that would otherwise have resulted. To determine whether observed performance trends were dependent on risk as measured by β, the results of applying a β of 1 instead of the estimated share β values for all the shares in the CAPM model was also used.

H2 The aftermarket return is not associated with the initial premium.

H3 The aftermarket return is not associated with the listing price.

H4 The aftermarket performance of shares listed in hot issue periods is not significantly different from the aftermarket performance of shares listed in

cold issue periods.

H5 The aftermarket performance of shares with different initial issue volumes is not significantly different.

H6 The aftermarket performance of IPO shares with different amounts of capital raised on listing is not significantly different.

6. RESEARCH METHODOLOGY

A list of the 690 companies that listed on the JSE between 1980 and 1998 was used as data for this study. After removing companies whose weekly or monthly closing prices were unavailable on either the I-Net Bridge database or the McGregor's BFANet database, a total of 541 companies were left. These formed the bulk sample used to determine the BHAR of IPOs between 1980 and 1998.

The list contained information pertaining to the date of listing, listing prices, the number of shares issued on listing and the amount of capital raised.

The weekly and monthly share prices as well as share dividends were obtained from I-NET together with data on the All Share Index (ALSI). The McGregors BFANet database was used to obtain book-to-market ratios of all shares listed on the JSE. This database did not however provide information on shares that had been de-listed from the JSE.

The JSE Records and Statistics Department provided market capitalization values of all shares (both de-listed and currently listed) on the JSE between 1993 and 1999.

The monthly data on the RSA150 long bond rate, used as the risk free proxy, was obtained from the South African Reserve Bank, Statistics Department.

The price performance of the shares was measured over 1, 3, 5 and 10 year periods. Shares that were de-listed were analysed only for the applicable duration e.g. a company that de-listed 4 years after listing was analysed for a period of up to 3 years. The study was therefore prone to a degree of survivor bias.

The after market periods were defined as follows:

1 year: first trading day close to month end closing price, one year after listing.

3 years: first trading day close to month end closing price, three years after listing.

5 years: first trading day close to month end closing price, five years after listing.

10 years: first trading day close to month end closing price, ten years after listing.

The research employed the use of the buy and hold abnormal return (BHAR) as opposed to the cumulative abnormal return (CAR). This enabled comparison with work done by previous researchers.

Using the December data of each year between 1980 and 1998, all the shares on the JSE whose book-to-market values were available, were ranked according to the book to market values and then assigned to one of three portfolios. Monthly share returns for all shares in each portfolio were determined and the average of the monthly returns was deemed to be the portfolio monthly return. In December of each year, the book-to-market ratio of each share that listed on the JSE between 1980 and 1998 was matched with one of the book-to-market tercile portfolios. The matched portfolio's monthly returns for the subsequent 12 months were deemed to be the expected returns for the share. These expected returns were then used to calculate the expected buy and hold abnormal returns for the share.

In December of each year, between 1993 and 1998 (inclusive) all the shares listed on the JSE were arranged according to their market capitalisation values. Each share was then assigned to one of five portfolios i.e. quintile portfolios were formed. Monthly share returns for all the shares in each portfolio were determined and the average of the monthly returns was deemed to be the portfolio's monthly return. In December of each year, the market capitalization value of each IPO that listed on the JSE between 1993 and 1998 was matched with one of the 5 portfolios. The matched portfolio's monthly returns for the subsequent 12 months were then taken as the expected returns for the share. These expected returns were then used to calculate the expected buy and hold abnormal returns for the share.

The share β values were calculated by regressing the difference between the share returns and the risk free rate vs. the difference between the returns on the market and the risk free rate (i.e. $(R_{it} - R_{ft})$ vs. $(R_{mt} - R_{ft})$). The All Share Index (ALSI) was used as the proxy for the market while the yield on the R150 government bond was used as the risk free rate. 52 consecutive weekly data points were used for IPO shares in the regression, in line with Lawson (1996) and Bradfield & Hampton (1989). Negative β values and β values greater than 2 were treated as outliers. These were then changed to 0 and 2 respectively for the purpose of this research.

7. RESULTS AND DISCUSSION

Hypothesis H1: The excess aftermarket returns on IPO shares is zero.

Table 2 shows a summary of the BHAR calculations using three benchmarks, namely CAPM model with calculated β values (52 weeks data), book-to-market tercile portfolios and market capitalization quintile

portfolios. The BHAR calculations using the CAPM model with all β 's=1 are also shown in the table for comparison with the CAPM model that employs calculated β s. Matched pair t-tests were used to determine whether the levels of abnormal returns were statistically significant. Table 3 shows the expected buy and hold returns of the selected benchmarks.

Table 2: Summary of the BHAR using three benchmarks

| | | CAPM calculated β s | CAPM all β s = 1 | Book-to-Market Portfolios | Market Capitalisation Portfolios |
|-----------------|--------------------------------|---------------------------|------------------------|---------------------------|----------------------------------|
| 1 year | Level of outperformance | -3,30 % | 0,50 % | -18,56% | -30,00% |
| | Sample size | 541 | 541 | 154 | 53 |
| | Critical t ($\alpha = 0.05$) | 1,96 | 1,96 | 1,96 | 1,96 |
| | t statistic observed | -0,9933 | 0,151 | -4,1594 | -2,63 |
| | Decision (5% conf. Level) | Accept H_0 | Accept H_0 | Reject H_0 | Reject H_0 |
| 3 years | Level of outperformance | -21,47 % | -9,03 % | -21,09 % | -48,05% |
| | Sample size | 376 | 376 | 100 | 15 |
| | Critical t ($\alpha = 0.05$) | 1,96 | 1,96 | 1,96 | 1,96 |
| | t statistic observed | -2,33 | -0,9933 | -1,274 | -0,9110 |
| | Decision (5% conf. Level) | Reject H_0 | Accept H_0 | Accept H_0 | Accept H_0 |
| 5 years | Level of outperformance | -35,67% | -11,86% | -61,56% | N/A |
| | Sample size | 243 | 243 | 75 | N/A |
| | Critical t ($\alpha = 0.05$) | 1,96 | 1,96 | 1,96 | N/A |
| | t statistic observed | -2,1697 | -0,7542 | -2,0569 | N/A |
| | Decision (5% conf. Level) | Reject H_0 | Accept H_0 | Reject H_0 | N/A |
| 10 years | Level of outperformance | -87,84% | -21,62% | -320,25% | N/A |
| | Sample size | 115 | 115 | 54 | N/A |
| | Critical t ($\alpha = 0.05$) | 1,96 | 1,96 | 1,96 | N/A |
| | t statistic observed | -2,3209 | -0,5682 | -4,119 | N/A |
| | Decision (5% conf. Level) | Reject H_0 | Accept H_0 | Reject H_0 | N/A |

N/A : Not applicable because calculations were not performed due to unavailability of data

Table 3: Expected returns of benchmarks used to determine the BHARs

| | CAPM calculated β s | CAPM all β s = 1 | Book to Market Portfolios | Market Capitalisation Portfolios |
|-------------|---------------------------|------------------------|---------------------------|----------------------------------|
| 1 year BHR | 8,47% | 4,67% | 17,20% | 18,95% |
| 3 year BHR | 50,43% | 38,00% | 69,33% | 108,46% |
| 5 year BHR | 100,49% | 76,68% | 178,75% | N/A |
| 10 year BHR | 311,30% | 245,88% | 671,18% | N/A |

NA : Not applicable because calculations were not performed due to unavailability of data

What is evident from Table 2 is that the IPOs studied consistently under-performed when compared to the benchmarks selected. The level of underperformance increased with time. The underperformance based on the CAPM model with all β s =1 follows a similar trend to that based on the CAPM model with calculated β . However, for all the time periods (1 year, 3 years, 5 years and 10 years), the level of under-performance was statistically no different from the CAPM model with all β s =1. The level of under-performance as compared to the CAPM model (with the calculated β s)

was statistically insignificant for the 1 year buy and hold period only.

The samples used to determine BHAR using the book-to-market portfolios were smaller than those used in the CAPM model. This was due to the fact that the book-to-market data excluded data for companies that had de-listed from the JSE prior to the time when the data was downloaded from Macgregors' BFA Net database (July 2000). The sample sizes used to determine BHAR using the market capitalisation

benchmark were even smaller because the period considered was between 1993 and 1998, since data for this period only was available. Only the IPO shares that listed on the JSE between 1993 and 1998 could be analysed using the market capitalisation benchmark.

Only 1 year and 3 year BHAR values were calculated using the market capitalisation tercile portfolios. This was due to the fact that very few shares (less than 5) had been listed for 5 or more years on the JSE over the time period for which there was available data (1993 to 1998).

The BHAR results are comparable with those observed in other markets by various researchers. Loughran and Ritter (1995) reported that IPOs in the USA under-performed by 7% per year in the first five years after listing. Jain and Kane (1994) indicated that in their study of the USA market, more than 50% of IPOs in their sample had a subsequent deterioration in aftermarket performance. Ibbotson (1975) also indicated negative risk adjusted aftermarket returns in the USA.

Levis (1993) showed a gradual and steady decline in IPO performance in the UK between 1980 and 1988.

Aggarwal, Leal and Hernandez (1993) found that in Brazil, the BHAR for the 1, 2 and 3-year periods were -9.0%, -34.9% and -47.0% respectively. It is clear that the level of under-performance observed for the South African market is similar to that observed in other international markets.

The fact that the aftermarket performance of IPO shares was in general lower than acceptable risk adjusted benchmarks could mean that on average, the cost of raising equity was not excessively high for the companies studied¹.

Hypothesis H2: The aftermarket return is not associated with the initial premium.

Table 4 shows the results of the ANOVA analysis to determine whether aftermarket returns on IPOs that yielded different initial premia are significantly different.

It is clear from Table 4 that H_0 could not be rejected. This indicated that the mean returns of samples grouped according to levels of initial premia were not significantly different. These findings do not support the results quoted by Bradfield and Hampton (1989) that suggest that high opening premia are generally associated with a consistently superior aftermarket performance.

¹Whilst this may not be immediately obvious, it follows that if the aftermarket performance exceeded the benchmarks the IPO may have been *under priced*, effectively reducing the amount of capital raised, implying a high cost of equity.

The efficient market hypothesis suggests that subsequent market price behaviour should be independent of the initial premia after the offering. The findings could indicate that in the long term, the JSE is an efficient market. Macdonald & Fischer (1972) found slightly negative excess returns for an aftermarket period of one year. This was in spite of positive initial premia. Their study observed that a superior short-term performance of a new issue was of no value in predicting the long-term behaviour of share prices.

Hypothesis H3: The aftermarket return is not associated with the listing price.

Table 5 shows the results of the ANOVA analysis.

The progressively diminishing sample sizes presented in Table 5 for the various buy and hold return periods indicate that the analysis could have been subject to survivor bias. In order to reduce the effect of survivor bias on the results, it was decided to group the IPOs into two categories of listing price ranges namely "199c or less" and "more than 199c". The results of the t-test analysis to determine whether the BHR of the IPOs in the two groups were significantly different are presented in Table 6.

From Table 6 it is evident that the null hypothesis was rejected for 1, 3 and 10 year buy and hold periods. This showed that the mean returns of samples grouped according to listing price were significantly different for these buy and hold periods. This indicated that the aftermarket performance of IPOs was associated with the price of the listing.

Table 7 shows the level of underpricing of the IPO shares. It is evident that the shares whose listing price was within the "0 to 99 cents" range enjoyed the highest initial premia. It could therefore be argued that the aftermarket underperformance of these shares was a correction to their high initial premium.

Table 4: Results of the t-test analysis to determine whether the level of initial premia influences the aftermarket returns of IPOs

| Level of initial premia | 1 year | | | 3 years | | | 5 years | | | 10 years | | |
|------------------------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|
| | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. dev. (%) |
| 10 % or less | 132 | -1,82 | 71,7 | 88 | 12,40 | 138,3 | 56 | 50,47 | 229,5 | 29 | 129,51 | 270,0 |
| Greater than 10% | 202 | 7,18 | 92,7 | 123 | -6,81 | 112,8 | 75 | 24,12 | 212,1 | 35 | 340,51 | 377,7 |
| Critical t ($\alpha=0.05$) | 1,96 | | | 1,96 | | | 1,96 | | | 1,96 | | |
| Observed t stat. | 0,9501 | | | 1,1094 | | | 0,6385 | | | -1,8197 | | |
| Decision (5% conf. level) | Accept H ₀ | | | Accept H ₀ | | | Accept H ₀ | | | Accept H ₀ | | |

Table 5: Summary of the ANOVA analysis to determine whether the aftermarket returns of IPOs with different listing prices are significantly different

| Listing price range (cents) | 1 year | | | 3 years | | | 5 years | | | 10 years | | |
|-----------------------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|
| | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. Dev. (%) | Count | Mean BHR (%) | Std. dev. (%) |
| 0 to 99 | 126 | -7,59 | 7,29 | 91 | -15,0 | 15,65 | 53 | -2,1 | 18,57 | 25 | 382,69 | 80,26 |
| 100 to 199 | 124 | 2,93 | 7,35 | 72 | -21,2 | 17,60 | 44 | 3,52 | 20,38 | 24 | 84,33 | 81,92 |
| 200 to 499 | 91 | 26,60 | 8,57 | 58 | 83,73 | 19,61 | 38 | 43,32 | 21,93 | 18 | 167,99 | 94,60 |
| 500 or more | 38 | -8,77 | 13,26 | 25 | 16,03 | 29,86 | 16 | -12,6 | 33,80 | 7 | -25,55 | 151,59 |
| Critical F ratio | 2,64 | | | 2,65 | | | 2,66 | | | 2,74 | | |
| Observed F ratio | 3,54 | | | 6,63 | | | 1,09 | | | 3,16 | | |
| Probability level | 0,0149 | | | 0,0003 | | | 0,3538 | | | 0,0298 | | |
| Decision (5% conf. level) | Reject H ₀ | | | Reject H ₀ | | | Accept H ₀ | | | Reject H ₀ | | |

Table 6: Results of the t-test analysis to determine whether the listing price influences the aftermarket returns of IPOs

| Listing price range (cents) | 1 year | | | 3 years | | | 5 years | | | 10 years | | |
|------------------------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|
| | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. dev. (%) |
| 199c or less | 250 | -3,68 | 76,74 | 163 | -17,8 | 94,10 | 97 | 0,45 | 139,1 | 49 | 236,55 | 420,43 |
| More than 199c | 129 | 16,18 | 91,85 | 83 | 63,3 | 222,1 | 54 | 26,74 | 127,9 | 25 | 113,42 | 412,33 |
| Critical t ($\alpha=0.05$) | 1,96 | | | 1,96 | | | 1,96 | | | 1,96 | | |
| Observed t stat. | -2,1060 | | | -4,0137 | | | -1,1460 | | | -1,9998 | | |
| Decision (5% conf. level) | Reject H ₀ | | | Reject H ₀ | | | Accept H ₀ | | | Reject H ₀ | | |

Table 7: Level of underpricing (initial premia) of the IPO shares grouped by listing price

| Listing price | 0 to 99cents | 100 to 199 cents | 200 to 499 cents | 500 cents or more |
|----------------------------|-----------------------|------------------|------------------|-------------------|
| Level of underpricing | 63,04% | 40,62% | 20,04% | 3,77% |
| Sample size | 141 | 132 | 99 | 47 |
| Std. Deviation | 8,56% | 8,84% | 10,21% | 14,82% |
| Critical F ratio | 2,63 | | | |
| Observed F ratio | 5,68 | | | |
| Probability | 0 ,0008 | | | |
| Decision at 5% conf. level | Reject H ₀ | | | |

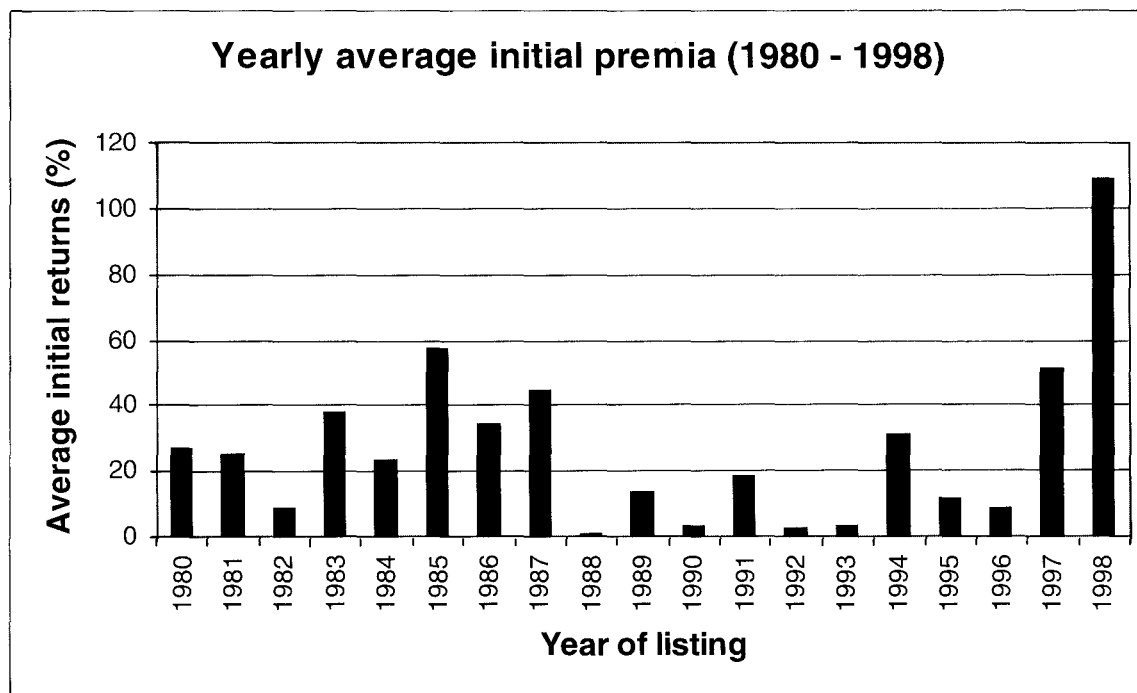
The null hypothesis H₀ stated that the level of underpricing (initial premia) yielded by IPO shares listed at different prices was not significantly different.

The alternative hypothesis H_a stated that the level of underpricing yielded by IPO shares listed at different prices was different.

Hypothesis H4: The aftermarket performance of shares listed in a hot issue period is not significantly different from the aftermarket performance of shares listed in a cold issue period.

were chosen to be calendar years whose average initial premia exceeded 26.80% and cold issue periods were chosen to be calendar years whose initial returns were less than 26.80%. According to this definition, the hot issue period between 1980 and 1998 consisted of the calendar years 1983, 1985, 1986, 1987, 1994, 1997 and 1998. The cold issue period consisted of the remainder of the years.

Figure 1 shows the yearly average initial premia for the period 1980 to 1998 with an average of 26.80%. In order to split the sample evenly, hot issue periods



Average for 1980 to 1998 :26.80%

Figure 1: Yearly average initial premia for the period 1980 to 1998

Table 8 shows the results of the two-sample t-test analysis to test whether the aftermarket performance of shares listed in a hot issue period was significantly different from the aftermarket performance of shares

listed in a cold issue period. Table 8 clearly indicates that the null hypothesis was rejected for 1, 3 and 5 year buy and hold returns. The hypothesis was accepted for the 10 year buy and hold returns,

probably due to the large standard deviation observed for the returns. The rejection of the null hypothesis indicated that the aftermarket performance of shares was significantly different depending on whether the shares were listed in a hot or cold period.

Further analysis indicated that the hot issue period consisted of a higher proportion of poorly performing shares (grouped according to listing price) compared to the cold issue period. The poorly performing shares were the ones with listing prices within the ranges "0 to 99 cents" and "500 cents or more". The shares that performed well had their listing prices within the other two price ranges. It was also noted that the hot issue period consisted of proportionally more risky IPO shares ("0 to 99 cents" group) compared to the cold issue period i.e. nearly 39% vs. 24%. Very risky shares typically enjoy high initial premia. The presence of a large amount of these shares during the hot issue periods partly explains the high initial premia observed in hot issue periods. On the other hand, the IPO shares that listed in the cold issue period had a higher proportion of shares that consistently yielded high returns in the aftermarket (the "200 to 499 cents" price range).

The IPO shares that listed in the hot issue period consistently underperformed compared to the shares that listed during the cold issue period. This result might appear to be in contradiction with Lawson's (1996) findings. Bradfield and Hampton (1989) also showed that the average excess returns for IPOs listed in the hot issue period on the JSE were significantly positive for each month over the subsequent year. They found the returns of IPOs issued during the cold issue period to exhibit a random pattern in the subsequent year of listing. However, the results of this research over a longer aftermarket period do not support their findings.

Ibbotson, Sindelaar & Ritter (1994), Bhana (1989) and McDonald & Fisher (1972) argued that whilst significant high initial returns would be identified for hot issue periods, this would not be the case with the

aftermarket returns. Ibbotson (1975) contended that negative aftermarket performance of IPOs with high initial premia was a correction to the high level of underpricing of these shares on listing. Since hot issue periods were made up of a large portion of highly underpriced risky shares, the long term aftermarket returns of the IPOs listed in hot issue periods would be expected to be low. The potentially risky shares that dominated the IPOs during the hot issue periods underperformed in the aftermarket. This could lead to a conclusion that the companies with risky shares do not necessarily face a higher cost of capital compared to other companies with less risky shares.

Bhana (1989) suggested that the market for new issues during hot issue periods was based more on speculation and rumours than on investment fundamentals. This could explain why many investors would invest in risky shares during hot issue periods. Although these shares offer above average initial premia, they subsequently underperform in the aftermarket.

Hypothesis H5: The aftermarket performance of IPOs with different initial issue volumes is not significantly different.

Table 9 shows the results of the ANOVA analysis.

It is clear from table 9 that the null hypothesis could not be rejected for any of the holding periods (1, 3, 5 and 10 years). This indicates that the long-term aftermarket performance of IPO shares was not significantly dependent on the volume of shares issued on listing.

Hypothesis H6: The aftermarket performance of IPOs with different amounts of capital raised on listing, are not significantly different.

Table 10 shows the results of the ANOVA analysis.

Table 8: Results of the two-sample t-test analysis to test whether the aftermarket performance of shares listed in a hot issue period was significantly different from the aftermarket performance of shares listed in a cold issue period.

| | 1 year | | | 3 years | | | 5 years | | | 10 years | | |
|--------------------------------|--------------|--------------|---------------|--------------|--------------|---------------|--------------|--------------|---------------|--------------|--------------|---------------|
| | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. Dev. (%) | Count | Mean BHR (%) | Std. dev. (%) |
| Hot issue period | 353 | -8,38 | 61,97 | 211 | -13,0 | 87,55 | 148 | -1,00 | 127,17 | 67 | 156,9 | 284,8 |
| Cold issue period | 183 | 18,59 | 67,65 | 156 | 31,70 | 128,54 | 95 | 100,85 | 201,68 | 38 | 201,8 | 327,5 |
| Critical t ($\alpha = 0.05$) | 1,96 | | | 1,96 | | | 1,96 | | | 1,96 | | |
| Observed t | -4,6728 | | | -3,962 | | | -4,8286 | | | -0,7064 | | |
| Decision | Reject H_0 | | | Reject H_0 | | | Reject H_0 | | | Accept H_0 | | |

Table 9: Summary of the ANOVA analysis to determine whether the volume of shares issued on listing, affects the aftermarket performance of IPO shares

| Volume of shares issued (m) | 1 year | | | 3 years | | | 5 years | | | 10 years | | |
|-----------------------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|
| | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. Dev. (%) | Count | Mean BHR (%) | Std. Dev. (%) | Count | Mean BHR (%) | Std. dev. (%) |
| Less than 15.00 | 159 | 10,70 | 6,05 | 134 | 11,89 | 12,78 | 89 | 44,22 | 25,29 | 40 | 148,93 | 53,12 |
| 15.01 to 50.00 | 115 | -7,85 | 7,11 | 101 | 3,60 | 14,73 | 68 | 61,08 | 28,94 | 30 | 269,27 | 61,34 |
| More than 50 | 179 | 1,36 | 5,70 | 64 | 56,14 | 18,50 | 35 | 103,45 | 40,33 | 14 | 165,34 | 89,79 |
| Critical F ratio | 3,02 | | | 3,03 | | | 3,04 | | | 3,11 | | |
| Observed F ratio | 2,00 | | | 2,71 | | | 0,77 | | | 1,16 | | |
| Probability level | 0,1368 | | | 0,0679 | | | 0,4627 | | | 0,3175 | | |
| Decision (5% conf. level) | Accept H ₀ | | | Accept H ₀ | | | Accept H ₀ | | | Accept H ₀ | | |

Table 10: Summary of the ANOVA analysis to determine whether the amount of capital raised on listing influences the aftermarket performance of IPO shares

| Capital Raised (Rm) | 1 year | | | 3 years | | | 5 years | | | 10 years | | |
|---------------------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|-----------------------|--------------|---------------|
| | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. dev. (%) | Count | Mean BHR (%) | Std. Dev. (%) | Count | Mean BHR (%) | Std. dev. (%) |
| 0 to 10 | 67 | -17,1 | 8,72 | 61 | -22,1 | 15,98 | 40 | -3,9 | 31,77 | 15 | 111,5 | 69,91 |
| 10.01 to 25.00 | 81 | -12,2 | 7,93 | 71 | -20,3 | 14,81 | 45 | -15,8 | 29,95 | 19 | 203,8 | 62,11 |
| 25.01 to 75.00 | 100 | 11,9 | 7,14 | 59 | 35,86 | 16,25 | 38 | 142,9 | 32,60 | 16 | 119,9 | 67,69 |
| More than 75 | 164 | 0,5 | 5,58 | 72 | 30,78 | 14,71 | 43 | 63,9 | 30,64 | 19 | 102,3 | 62,11 |
| Critical F ratio | 2,63 | | | 2,65 | | | 2,66 | | | 2,75 | | |
| Observed F ratio | 2,90 | | | 4,15 | | | 5,24 | | | 0,56 | | |
| Probability level | 0,0348 | | | 0,0068 | | | 0,0018 | | | 0,6462 | | |
| Decision (5% conf. level) | Reject H ₀ | | | Reject H ₀ | | | Reject H ₀ | | | Accept H ₀ | | |

Table 10 shows that for buy and hold periods of up to 5 years, the null hypothesis was rejected. This means that for these aftermarket periods, the mean returns of IPO shares with different amounts of capital raised on listing were significantly different. The null hypothesis for a buy and hold period of up to 10 years could not be rejected due to the high standard deviation of sample returns and small sample sizes.

Generally, these results are in agreement with the observations made by Levis (1993) on the London Stock Exchange. He found that the amount of capital raised on listing was correlated with the level of aftermarket performance.

8. CONCLUSION

The results of the research indicated that IPOs significantly under-performed in the aftermarket compared to the expected buy and hold returns of the

three benchmarks selected. The under performance was found to increase with the buy and hold period. Therefore on average, the short, medium and long-term investors on the JSE, over the period of study, received negative risk adjusted excess returns. These findings were in line with observations made on other stock markets such as the London Stock Exchange, the New York Stock Exchange and the stock market in Brazil.

Since the aftermarket returns of the shares investigated were lower than the acceptable risk adjusted benchmarks, it could be implied that on average, the cost of raising equity for these companies was low.

The findings of the research indicated that the size of the initial premia (i.e. the level of under pricing) did not significantly influence the shares' aftermarket performance. These results did not directly support the

suggestions made by other researchers that high opening premia are generally associated with a consistently superior aftermarket performance. Some researchers in the USA however, have found that in spite of high initial premia, many IPO shares had negative abnormal returns in the aftermarket.

The listing price was found to influence the aftermarket performance of IPO shares. Of all the price ranges investigated, IPOs with a listing price in the "200 to 499 cents" price range underperformed the least. These shares yielded moderate initial premia. IPO shares within the "0 to 99 cents" price range and which are generally perceived to be risky shares, did not show high returns commensurate with the high risk associated with them. It could be concluded that the potentially risky shares did not face a higher cost of capital compared to other less risky IPO shares. However, these risky shares enjoyed the highest initial premia. It appears as though investors who invested in shares with listing prices in the "500 cents or more" range paid premium prices for shares that yielded the lowest long-term returns.

The research showed that for 1, 3 and 5 year buy and hold periods, the IPOs that listed during a hot issue period yielded lower returns than IPOs that listed during a cold issue period. It is believed that one of the reasons that the hot issue period IPOs had lower returns is that they had a higher proportion (39% vs. 24%) of low priced risky shares. Although the risky shares had high initial premia, they consistently had low returns in the long-term aftermarket. On the other hand, the moderately underpriced shares enjoyed high returns.

These findings supported the results of other researchers in the USA who found that significant initial returns during hot issue periods did not extend to the long-term aftermarket.

The volume of shares issued on listing did not influence the aftermarket share performance. This was in agreement with the results of work done by other researchers who studied an aftermarket period of up to 1 year on the JSE.

For a buy and hold period of up to 5 years, it was found that the amount of capital raised on listing had a significant effect on the aftermarket performance of IPOs. IPOs that raised between R25 million and R75 million on listing consistently outperformed IPO shares that raised other amounts of capital on listing.

9. RECOMMENDATIONS FOR FURTHER RESEARCH

Studies on the long-term performance of shares are subject to a degree of survivor bias. A study aimed at quantifying the effect of survivor bias on the research

pertaining to the long-term performance of shares on the JSE would be beneficial to researchers.

The book-to-market portfolios constructed in this research excluded shares that had de-listed from the JSE. It could be of interest to future researchers to confirm the findings arrived at in this research, using the book-to-market and the market-capitalization portfolios.

It would be beneficial to determine the most reliable benchmark by comparing the three used with a more robust benchmark such as the Fama-French three-factor model.

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