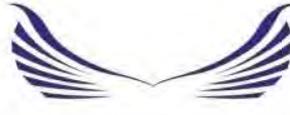




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GORDON INSTITUTE  
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# **Liquidity levels and the long-run performance of Initial Public Offerings in South Africa**

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## ABSTRACT

This study investigated the impact of the levels of liquidity of Initial Public Offering (IPO) stocks on the long-run performance of IPOs over a five year period. In addition the study sought to investigate if the levels of liquidity of IPO stock were significantly higher than non-IPO stock. The methodology used was the calendar time portfolio approach based on the Fama-French regression equation. The study found that over a five year period IPOs did not underperform or over-perform the market. In addition the study found that the liquidity levels of IPOs were not significantly higher than non-IPOs. While the lower liquidity levels help explain the fact that the IPOs did not underperform the market, they do not indicate the existence of a liquidity risk premium on the Johannesburg Stock Exchange (JSE).

**Keywords:** IPO, underperformance, calendar time portfolio approach, liquidity levels

## DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorization and consent to carry out this research.

Sangeeth Chandran

Date: \_\_\_\_\_

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Finally, to myself. Keep walking!!

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## **1. CHAPTER 1- INTRODUCTION**

### **1.1. Research title**

Liquidity Levels and the Long-Run Performance of Initial Public Offerings in South Africa.

### **1.2. Research problem**

The underperformance of Initial Public Offerings (IPOs) over a three-to-five year period after listing is an anomaly widely documented in the financial literature. However very few studies have analysed the impact of factors such as liquidity levels on the performance of IPOs over a three-to-five year period. As far as could be ascertained, no studies have been conducted in South Africa that seeks to analyse the impact of liquidity levels on the performance of IPOs over a three-to-five year period.

This study seeks to understand if IPOs continue to underperform over a five year period after listing, when measures of liquidity levels and a Carhart momentum factor have been included along with the traditional Fama-French factors. This follows from the observation that the risk associated with the levels of liquidity of IPO stock could be a possible factor capable of explaining the long-run underperformance of IPOs (Eckbo & Norli, 2001, 2005).

This research is of importance as IPOs offer private (mostly entrepreneurial) firms an opportunity to raise equity capital through the offer of shares to the public. IPOs can also play a key role when one considers the fact that South Africa needs to continuously encourage the growth and financing of entrepreneurial firms in order to emulate the economic success of other developing countries like China, Brazil and India (Brau, Ryan, & DeGraw, 2006).

Although the IPO is still one of the best ways for the entrepreneur to raise capital, the IPO markets, processes and activities, and the characteristics and performance of firms issuing IPOs have varied in different countries and at different times in history (Loughran, Ritter, & Rydqvist, 1994). Despite these differences, three anomalies commonly associated with IPOs have been the subject of extensive studies and debates. The three anomalies include the patterns of IPO issuing activity, the under-pricing of IPOs and the long-run underperformance of IPOs (Ritter & Welch, 2002).

The first anomaly that relates to the issuing activity shows that IPOs have tended to come in waves, and are characterised by what has been called hot and cold markets (Brau & Fawcett, 2006). This in turn led to the clustering of IPOs, especially amongst similar types of companies and industries, in certain periods (Lowry & Schwert, 2002). The second anomaly concerned IPO under-pricing. IPO under-pricing is the widely evidenced phenomenon where the market price at the end of the first

day of trading differs significantly more from the initial opening price of new IPOs (Ritter & Welch, 2002).

The third anomaly relates to the long-run underperformance of IPOs. Long-run performance, which deals with the stock price performance of IPOs in a period lasting from three-to-five years after the offering, is based on raw (absolute) performance, or performance relative to a benchmark (abnormal return) (Ritter & Welch, 2002). Ritter (1991) was able to show that firms significantly underperformed over a three year period after going public when compared to a set of comparable firms matched by size. He characterised this phenomenon as the long-run underperformance of IPOs.

Loughran and Ritter (1995) and Ritter's (1991) study focussed on the stocks of firms conducting IPOs in the United States of America (USA). They found that these IPOs underperformed non-IPO stocks matched on equity size. Over the years several studies have documented similar findings of IPO underperformance in different parts of the world (Aggarwal, Leal & Hernandez, 1992; Ahmad-Zaluki, 2009; Gregory, Guermat, & Al-Shawawreh, 2010; M'kombe & Ward, 2002; Page & Reyneke, 1997; Purnanandam & Swaminathan, 2004).

A number of possible sources have been identified as the cause of underperformance of IPOs. Ritter (1991) identified risk mis-measurement, bad luck and fads as the primary causes. Purnanandam

and Swaminathan (2004) find evidence of pre-offer overvaluation of IPOs, which in turn is corrected in the aftermarket, resulting in the long-run underperformance.

However, the acceptance of the IPO under-performance effect is far from universal (Ang, Gu, & Hochberg, 2007). In fact there is a growing realisation that the methodological approach and econometric method used to calculate IPO performance in terms of an appropriate investment strategy can have a direct impact on studies of long-run IPO performance (Gregory *et al.*, 2010; Ritter & Welch, 2002).

This is supported by findings that the time period being studied and the sample size being studied also have a direct bearing on the findings of IPO long-run performance studies (Ang *et al.*, 2007; Gompers & Lerner, 2003). Ang *et al.* (2007) concluded that there was clearly no unanimous agreement on the sources of underperformance of IPOs.

As a result, different researchers have continued to find other methods and ways of analysing the long-run performance of IPOs in the hope of finding a solution to a potential market anomaly. Eckbo and Norli (2001, 2005) note that the early findings of long-run underperformance of IPOs were primarily based on studies in which IPO stock were matched with equivalent non-IPO stock on the basis of size and/or book-to-market value. They correctly point out that in doing so, the matched-firm procedure might have inadvertently resulted in the omission of certain

important and intuitively possible risk factors which effectively lowers the risk of IPO stocks.

Based on this argument, Eckbo and Norli (2001, 2005) find that IPO stocks are less risky than size matched firms and use this fact to explain their lower than expected returns when compared to equivalent non-IPOs. In particular they show that in the years immediately following the issue, IPO stock have lower leverage ratios and higher liquidity (in terms of turnover and dollar volume of trade) than matched firms.

Interestingly Alli, Subrahmanyam, and Gleason (2010) indicate that “the liquidity of the JSE as a whole (measured in volume of shares traded) increased from 7.5% in 1994, to 27% in 1998, to 35% in 2000 and finally 41.6% in 2006” (p.7). Extending Acharya and Pedersen’s (2005) concept of commonality in liquidity, whereby the liquidity of stocks co-vary with the overall market liquidity, one would expect IPO stocks to become more liquid over this period. Following Amihud and Mendelson’s (1986) finding that highly liquid stocks offer lower returns, one would also expect a decline in the returns for IPO stocks based on the improved aggregate liquidity of the JSE.

However Alli *et al.* (2010) find that the IPO sample they studied has a positive long-run abnormal performance over a three year period. Similarly Mangozhe (2010) finds no evidence of underperformance for

South African IPOs. Based on Eckbo and Norli's (2001, 2005) argument, this indicates the possibility that the liquidity levels of IPO stock have remained stable or fallen, thereby allowing IPO firms to generate normal or positive returns as evidenced by Alli *et al.* (2010) and Mangozhe (2010).

As a result this study seeks to investigate the impact of the levels of liquidity on the long-run performance of IPOs. In addition the study sought to investigate if the levels of liquidity of IPO stock were significantly higher than non-IPO stock to confirm if liquidity is a priced risk factor for which a risk premium exists. If the risk associated with the levels of liquidity can be used to explain the long-run performance of IPOs, then a potential solution to the anomaly of long-run underperformance of IPOs can be clearly identified and strengthened.

### **1.3. Research aim**

Ang *et al.* (2007) indicate that the study of the long-run performance of IPOs is important, as IPO underperformance may indicate a possible informational inefficiency in the capital allocation process. In addition they motivate the need to study IPO underperformance in order to determine if it [IPO underperformance] is reflective of the influence of behavioural fads in the markets. Their final motivation for the study of the long-run performance of IPOs is based on determining the

existence of trading opportunities that produce superior abnormal performance.

This is especially important given that “over \$500 billion has been raised by IPOs over the past two decades” (Chan, Cooney, Kim, & Singh, 2008, p.46). Even more relevant is the fact that IPOs are increasingly being viewed as a popular mechanism of raising capital and funding growth for South African firms (Brau *et al.*, 2006). According to them, IPOs also have a vital role to play if South Africa is to emulate the economic performance of other emerging markets such as Brazil, India and China.

Similarly, there is a growing interest in the relationship between liquidity and the returns of IPO stocks. This is largely due to the fact that if liquidity does indeed affect returns, then from an investor’s viewpoint, the liquidity risk needs to be priced (Narayan & Zheng, 2011). They also indicate that most of the studies in this field have been conducted in the developed economies of the USA, Australia and Spain. As a result there is a growing need to understand if the general consensus from the literature, that liquidity reduces returns, applies to emerging markets like South Africa.

This is also due to the fact that the Johannesburg Stock Exchange (JSE) is unique in that unlike many other stock markets it is dominated by firms from the mining sector and the financial sector (Alli *et al.*,

2010). They also point out that the JSE is dominated by the presence of large institutional investors.

Alli *et al.* (2010) also note that the market capitalisation of the JSE has historically been dominated by a few large conglomerates. While a number of these conglomerates have embarked upon extensive unbundling and restructuring programmes, they still dominate the JSE and the sectors in which they are involved (Competition Commission, 2008).

The main aim of this study is to therefore determine if IPOs underperform or over-perform the market over a five year period when levels of liquidity are also considered besides the traditional risk factors like book-to-market value, market capitalisation and a Carhart momentum factor. In addition the study seeks to determine if the liquidity levels of IPOs are higher than the liquidity levels of matched firms and therefore provide an explanation for the long-run underperformance of IPOs that has been widely documented. This follows from the fact that there is still no clarity or agreement on what causes long-run IPO underperformance, and there is a continued need to investigate this phenomenon.

In addition most of the studies on the long-run performance of IPOs in South Africa are based on the Buy and Hold Abnormal Return (BHAR) and the Capital Asset Pricing Model (CAPM). Since researchers have

been indicating that the choice of methodology also influences the long-run performance of IPOs, this study utilises a calendar time portfolio approach based on the Fama-French three factor model to calculate the long-run performance of IPOs.

The findings of this study will be immensely valuable to potential IPO issuers in South Africa. This follows from the fact that issuers are motivated to issue IPOs in order to minimise their cost of capital, or to allow insiders and shareholders to cash out, or to facilitate takeovers and mergers and/or for strategic purposes of enhancing their reputation (Brau & Fawcett, 2006). Needless to say, continued findings of long-run underperformance of IPOs could cause potential issuers, investors and investment bankers to reconsider their investment and trading strategies.

The remainder of this report is structured as follows. Chapter 2 provides a review of the relevant literature and contextualises this study within the current debates. Chapter 3 provides an outline of the research hypotheses while Chapter 4 details the research methodology employed for this study. Chapter 5 presents the results of this study while Chapter 6 discusses this literature in terms of the existing literature review. The report concludes with Chapter 7 where the conclusions and recommendations for future studies are indicated.

## **2. CHAPTER 2-THEORY AND LITERATURE REVIEW**

### **2.1. Introduction**

The issuing of IPOs serves as one of the most important milestones in the lifecycle of companies. The following section details important aspects of IPOs including the most common phenomenon associated with IPOs. The evolution of findings on the long-run underperformance of IPOs and the various methods utilised to determine long-run performance of IPOs are also documented. In the final section the linkages between the levels of liquidity of stock and their returns is described in order to leverage this relationship to explain the long-run performance of IPOs documented in South Africa.

### **2.2. Initial public offerings**

Almost all private (mostly entrepreneurial) companies reach a stage in their lifecycle where they require additional capital to fund their growth. The two main avenues available to companies for raising capital are the issuing of debt or equity (Bodie, Kane, & Marcus, 2010). A company's choice of debt or equity depends on a number of factors and many theories exist to justify the funding decision of companies in terms of their capital structures.

The pecking order theory of capital structures states that companies first make use of internally generated earnings, followed by debt and then equity (Myers, 1984). His description of the trade-off theory on the other hand states that the capital structure of a company is the result of the optimal balance between the benefits of taxes against the costs of bankruptcy. Finally the market timing theory explains the capital structure decision as a function of companies taking advantage of market conditions to access the lowest cost source of funding (DeAngelo, DeAngelo, & Stulz, 2010)

Generally companies tend to issue debt primarily when the cost of issuing equity is more expensive. This follows from Fama and French (2002) who show that companies tend to issue equity when they are most likely overvalued. They show that since investors know that companies are over-valued, they place a discount when companies issue equities.

The use of debt in a firm's capital structure acts like a lever in the sense that it can magnify both gains and losses (Firer, Ross, Westerfield, & Jordan, 2008). They also indicate that although the financial leverage increases the potential reward to shareholders, it can also increase the potential for financial distress and business failure. Firer *et al.* (2008) also highlight that a key difference is that unlike equity holders, debt holders have a prior claim to the assets and earnings they fund.

Despite the benefits of issuing debt, private companies also have the option of raising capital by selling or floating shares for the first time to the general public through IPOs (Bodie *et al.*, 2010). Besides being a vehicle to access capital, an IPO also creates a public market where the founders and other shareholders can convert some of their wealth into cash at a future date, attract a diverse shareholder base and use the public shares as a means of facilitating acquisitions and mergers (Brau & Fawcett, 2006). As a result IPOs tend to be the single most important financing activity for most companies (Chien-Ting Lin & Shou-Ming Hsu, 2008).

The literature on IPOs has dealt extensively with the most common anomalies encountered by companies that issue IPOs, in terms of under-pricing, long-run underperformance and clustering. The first anomaly, of IPO under-pricing, is the phenomenon where the market price at the end of the first day of trading differs significantly from the initial opening price of new IPOs (Ritter & Welch, 2002). Under-pricing has been reported by several authors (Ibbotson, 1975; Logue, 1973; Reilly, 1973).

The second anomaly is that IPOs tend to come in waves and are characterised by what has been called hot and cold markets (Brau & Fawcett, 2006). This in turn leads to the clustering of IPOs, especially amongst similar types of companies in certain periods, especially if

firms rationally condition their decision to go public on the outcome of recent IPOs (Lowry & Schwert, 2002).

Further to this Ritter's (1991) influential paper was able to document a third anomaly. He showed that firms significantly underperformed over a three year period after going public, when compared to a set of comparable firms matched by size and industry. Despite these anomalies IPOs continue to be significant sources of generating capital. This was evidenced by the recent IPO by Life Healthcare in South Africa that raised R.5.26 billion in June 2010 (Mtshiya, 2010).

### **2.3. Long-run underperformance**

The investment performance of a company that issues an IPO is based on the total returns it provides in terms of capital gains and income over a period of time. Based on this a firm's abnormal return is computed by comparing its returns, over a period of time to suitable benchmarks. These benchmarks include established market indices like the Standard and Poor (S&P) 500 index or the return of a portfolio of firms with the same size and book-to-market ratio as the issuing firm (Gompers & Lerner, 2003).

In most of the literature on long-run performance, there appears to be an implicit understanding that long-run performance covers a period between three-to-five years after the IPO (Gompers & Lerner, 2003;

Loughran & Ritter, 1995; Ritter, 1991). The choice of a five period appears to be a popular choice when measuring the beta of firms (Bodie *et al.*, 2010). They indicate that this is driven by the fact that a period of five years provides a reasonable number of observations, yet the period is not so long as to be contaminated by old and possibly no-longer relevant returns.

After Ritter's (1991) paper, Loughran and Ritter (1995) also documented underperformance of IPOs over a period of five years after listing when compared to non-issuing firms in the USA. More recently Ang *et al.* (2007) found additional evidence of long-run underperformance in the USA.

Under-performance of IPOs in the United Kingdom (UK) was also documented reflecting that underperformance was not solely a USA phenomenon (Gregory *et al.*, 2010; Khurshed, Mudambi, & Goergen, 2007). Many of these early studies had documented severe underperformance of IPOs during the past twenty years suggesting that investors may be systematically over optimistic about the prospects of companies that were issuing equity for the first time (Gompers & Lerner, 2003).

Studies in China show mixed results with Chan, Wang, and Wei (2004) examining both stock and operating performance of Chinese IPOs. Similar to the findings of Chang, Lin, Tam, & Wong (2010), they find

that A-share IPOs slightly underperform the size and/or book-to-market benchmarks while B share IPOs outperforms the benchmarks.

Here the A-share IPOs are those IPOs whose shares can only be purchased by citizens of China and are listed on the Shanghai Securities and Shenzhen Stock Exchanges. The B-share IPOs on the other hand are foreign shares which can only be purchased by foreigners in mainland China and are listed on the Shanghai Securities and Shenzhen Stock Exchanges.

Aggarwal *et al.* (1992) documented underperformance in three Latin American countries also. In both Brazil and Chile they were able to document long-run underperformance over a three year period, while in Mexico they were able to document underperformance over a period of one year after listing. Similarly Ahmad-Zaluki (2009) was able to document underperformance of Malaysian IPOs over a three year period after listing.

Studies in South Africa by Page and Reyneke (1997) using a sample of 118 IPOs listed on the JSE between 1980-1991 also document long-run underperformance over a period of four years after listing compared to matched firms by size, price to earnings ratios and the relevant JSE sector indices. M'kombe and Ward (2002) using a sample of 541 IPOs that listed between 1980-1998 show that IPOs underperform a number

of benchmarks over a one, three and five year period after listing. Their study utilised the BHAR methodology.

More recently Alli *et al.* (2010) using a sample of 141 IPOs listed on the JSE from 1995 to 2004 find positive abnormal performance using a holding period return (HPR) approach. Mangozhe (2010) using a sample of 411 IPOs listed on the JSE from 1992 to 2007 find no evidence of underperformance for South African IPOs using a calendar time approach based on the three factor Fama-French model.

The long-run underperformance evidenced in these different studies has however followed a similar pattern over the years. In particular the years of greatest IPO activity has also been associated with the most severe long-run underperformance as seen in yearly cohort studies (Brav & Gompers, 1997). They also show that venture capital backed firms outperform non-venture backed firms over a five-year period, when the returns are value weighted. In addition they point out that underperformance is characteristic of small, low book-to-market firms regardless of whether they are IPO firms or not.

Gregory *et al.* (2010) also find underperformance was concentrated among smaller firms consistent with existing literature. Authors like Lakonishok, Shleifer, and Vishny (1994) used portfolios based on price and also find that “value” stocks outperform “glamour” stocks without appreciably affecting risk.

Ritter (1991) identified risk mis-measurement, bad luck and fads as possible sources of the IPO underperformance. Since the long-run underperformance of IPOs varied amongst different industries, Ritter concluded that this was reflective of the fads hypothesis. Brav and Gompers (1997) also support this conclusion by suggesting that investor sentiment is indeed impacted by fads, and that this is one of the possible causes of IPO underperformance.

In addition they point out that behavioural economists have demonstrated that investors often violate Bayes Rule and rational choice theories when making decisions under uncertainty, thereby leading to long-run pricing anomalies especially impacting smaller firms. According to them, the source of underperformance in IPOs could be due to the fact that IPO returns are highly correlated in calendar time even if firms go public in different year.

Gregory *et al.* (2010) also indicate that the underperformance of IPOs could be explained with the behavioural timing hypothesis. The behavioural timing hypothesis was put forward by Loughran and Ritter (2000) as one of the causes of IPO under-performance. This was based on the observation of a market where firms take advantage of transitory windows of opportunity by issuing equity, when on average, they are substantially overvalued.

Gompers and Lerner (2003) argue that the IPO underperformance observed in previous studies could be a small sample effect. Purnanandam and Swaminathan (2004) on the other hand find that not only are IPOs overpriced compared to their industry peers, but that the more overpriced IPOs are also more likely to exhibit the largest initial returns and the poorest long-run performance. Similarly Derrien (2005) finds that IPOs are overpriced and the long-run performance is negatively related with individual investor's demands.

Earnings management in the year of the IPO have also been linked to long-run underperformance. Earnings management involves the manipulation or boosting of accounting earnings in the year of the IPO in order to create an illusion of inflated firm value that will attract more investors (Li, Zhang, & Zhou, 2006).

This is supported by Kao, Wu, and Yang (2009) findings that companies with better pricing period accounting performance and overoptimistic forecasts, have larger declines in post-operating profitability and worse long-run performance. Xiong, Zhou and Varshney (2010) also use short-term overvaluation to explain IPO underperformance by pointing out that markets are only temporarily fooled, and the upwards earning management has to be reversed in the post-offering period.

However the studies of IPO underperformance are not without contradictory viewpoints. Brav and Gompers (1997) showed that firms

that go public do not underperform worse than their benchmarks matched on the basis of size and book-to-market ratios. Gompers and Lerner (2003) also show that calculations using equal weighted returns in event time for IPOs do overstate the underperformance of IPOs. This is supported by Gregory *et al.* (2010) who provide evidence that underperformance of IPOs studied varied depending on the methodology used.

Gompers and Lerner (2003) convincingly show that IPOs do not underperform aggregate benchmarks using a sample of US IPOs between 1935 and 1972. They highlight that the underperformance observed in previous studies could be a small sample effect. Schultz (2003) using the „pseudo market’ hypothesis argues that measuring the performance of IPOs in event time spuriously induces IPOs to have lower average returns and claims that there is no under-performance of IPOs in calendar time. This is supported by Espenlaub, Gregory, and Tonks (2000) who indicate that tests of underperformance may be sensitive to the choice of empirical methods used to measure performance.

Moreover studies on IPO underperformance have focused on the same set of post-NASDAQ time period data, while studies in other countries are not conclusive due to the shorter time periods employed (Gompers & Lerner, 2003). They also point out that the cross-sectional correlation between IPOs in the USA and the returns of IPOs in these markets

make many of these studies inconclusive. As a result it is safe to say that the acceptance of the existence of the long-run underperformance of IPOs is far from universal (Ang *et al.*, 2007).

#### **2.4. Methods for estimating long-run performance**

Since the initial studies on long-run IPO underperformance by Ritter (1991) numerous studies on the long-run performance of IPOs have highlighted that utilising different methods and approaches of calculating returns can result in different findings. Gompers and Lerner (2003) utilising a sample of IPOs from 1935-1972, show that IPOs underperform, when performance is measured using value weighted event time BHAR.

However when they used equal weighted BHAR or Cumulative Abnormal Returns (CAR), the underperformance disappears. When they use calendar-time analysis, IPOs return as much as the market while the simple CAPM and Fama-French models results in intercepts that are not significantly positive or insignificantly different from zero.

However Brav and Gompers (1997) were able to show that using value weighted returns significantly reduced long-run underperformance relative to the benchmarks used. They indicated that if the primary concern was the investor's wealth in terms of IPO underperformance, then value weighted results are more useful than equal weighted

results. In many ways these findings are representative of Ritter and Welch's (2002) suggestion that much of the phenomenon found in the IPO literature also depended upon the time period examined.

The initial methods employed to calculate underperformance involved comparing the returns of IPO firms to one of two benchmarks that includes broad market indices like the S&P 500, or returns from industry portfolios, and size and book-to-market matched portfolios (Brav & Gompers, 1997). These initial studies utilised a buy and hold investment strategy that resulted in BHARs which were regarded as being simple and representative of a traditional long horizon investor (Chan *et al.*, 2008).

Despite its easiness, BHAR suffered from the fact that the existence of cross-sectional dependences and compounding of monthly returns resulted in the BHAR overstating long-run performance (de Jong, 2007). This often led to the rejection of the null hypothesis as the usual t-statistic is biased upwards. In addition de Jong explains that the distribution of BHAR is skewed, as over the long horizon few firms have extremely high returns while the majority of the firms have moderate or negative returns.

Other long-run abnormal performance measurement tools included using CARs. The CAR methodology implicitly assumes a monthly rebalancing of the portfolio to an equal weighting of the return on event

firms (de Jong, 2007). This in turn eliminates the compounding effects of a single year's poor performance as the CARs are calculated by summing the annual abnormal returns over the three to five year periods being studied (Gompers & Lerner, 2003). Despite this they show that CARs still suffer from cross-sectional dependence.

In addition these tests of underperformance suffer from the joint hypothesis problem as the assumption of a particular asset pricing model means that tests of performance are conditional on that model correctly predicting stock market behaviour (Brav & Gompers, 1997). They point out that if the null hypothesis is rejected then either the pricing model is incorrect, or investors are irrational. This discussion is supported by Fama and French (1998) who indicate that the bad-model problem is ubiquitous but is more serious in the calculation of long term returns. They indicate that this is because of the fact that the bad-model errors in expected returns grow faster with the return horizon than the volatility of returns.

The second problem with tests of underperformance is that the distribution of long-run returns is non-standard and these typical suffer from potential biases of serial and cross-sectional dependencies and event induced variances (de Jong, 2007). However it has been shown that unbiased estimates are obtained when the returns are adjusted for size and book-to-market values for random portfolios, although they do

not address the correlation between returns when tests are predicated on an event (Brav & Gompers, 1997).

Over the long horizon the market model and the CAPM have several disadvantages in explaining returns particularly due to well known deviations in terms of size effect, book-to-market effect and momentum effect (Bodie *et al.*, 2010). As a result multi-factor asset pricing models were developed that could explain the pricing anomalies indicated in the financial economics literature. In particular Fama and French (1993) were able to explain that the pricing anomaly indicated in the financial economics literature so far was due to the fact that risk factors were not controlled entirely.

Fama and French (1993) were able to put forward their three factor model that was able to explain the cross-section of stock returns. This three factor model is widely used as a benchmark in long horizon event studies as shown in Equation 1 below (de Jong, 2007).

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_iSMB_t + h_iHML_t + \epsilon_{it} \quad \text{Equation 1}$$

The three factors included are  $R_{mt} - R_{ft}$ , which is the excess return on the equal/value weighted market portfolio;  $SMB_t$ , the return on a zero investment portfolio formed by subtracting the return on a large firm portfolio from the return on small firm portfolio and  $HML_t$ , the zero investment portfolio calculated as the return on a portfolio of high book-

to-market stocks minus the return on a portfolio of low book-to-market stocks (Brav & Gompers, 1997).

The inclusion of the size and book-to-market equity factors was due to the fact that they served as proxies for common risk factors in returns as evidenced by the fact that firms with high book-to-market ratios tend to have low earnings on assets which persisted for long periods (Fama & French, 1993).

They also showed that controlling for book-to-market equity small firms tend to have lower earnings on assets than big firms. In addition they demonstrated that by including the market factor in the form of  $R_{mt}-R_{ft}$  together with size and book-to-market factors in the time series regression, one would be able to explain the vast range of differences in average cross-sectional returns and the risk free rates across stock portfolios.

The benefit of using such a three factor pricing model based on a time series regression approach is that the time series regression slopes are factor loadings that unlike the size or book-to-market ratio have a clear interpretation as risk factor sensitivities for stocks (Fama & French, 1993). They also showed that using  $R_{it}-R_{ft}$ , the excess returns (monthly stock return minus risk free rate) as the dependent variable and either excess returns or returns on zero investment portfolios as explanatory variables have specific advantages.

When using such regressions, well specified asset pricing models produce intercepts,  $\alpha_i$  that are indistinguishable from zero (Fama & French, 1993). This intercept,  $\alpha_i$ , from the time series regression can be used as an indicator of risk adjusted performance and statistical inferences can be made which was not possible with earlier tests due to the right skewness of long horizon returns (Brav & Gompers, 1997).

Moreover by using the intercept,  $\alpha_i$ , in excess regression equations to judge asset pricing models a stringent standard is imposed which is difficult for other models to emulate (Fama & French, 1993). The disadvantage of the method however is the fact that it weights each month equally in minimising the sum of squares (Brav & Gompers, 1997).

The three factor Fama-French was modified by Carhart (1997) who developed an additional factor to capture the one year momentum anomaly. The one year momentum anomaly was first documented by Jegadeesh and Titman (1993) who find that strategies which buy stocks that have performed well in the past and sell stocks that have performed poorly in the past generate significant positive returns over a three-to-twelve month holding period.

Eckbo (2007) shows that there is ample evidence that the momentum factor helps explain the cross-section of expected stock returns. He also indicates that regardless of whether the size, book-to-market value and

momentum factors proxy for risk or indicate market inefficiency, it is essential to use them when measuring abnormal performance. In subsequent literature this momentum factor has frequently been referred to as the Carhart momentum factor.

In general Mitchell and Stafford (2000) state that the use of many of the event time methodologies described above could lead to misleading conclusions about the pervasiveness of underperformance for IPOs. In particular researchers are beginning to question the validity of the assumptions inherent in event time methodologies (Gregory *et al.*, 2010). The „pseudo market timing’ hypothesis of Shultz (2003) also questions the correctness of event time methodologies to study long-run performance of IPOs.

This is mainly due to the fact that the returns of recent IPOs may be correlated, especially if companies that have gone public recently are of the same size, industry or characteristics (Brav & Gompers, 1997). Moreover investor sentiment is likely to be market-wide rather than specific to a particular company and may cause returns to be correlated in calendar time (Brav & Gompers, 1997).

Viewing each IPO as an independent event probably overstates the significance of estimated underperformance. Together with the fact that underperformance is concentrated in time, calendar time studies have been proposed as a better approach to calculate the long term

performance of IPOs based on an investment strategy that invests in recent IPO firms (Brav & Gompers, 1997). Hoechle and Zimmermann (2009) point out that utilising a calendar time portfolio approach ensures that statistical inferences can be made even in the presence of cross-sectional or serial dependence.

Hoechle and Zimmermann (2009) describe the calendar time portfolio approach method as a two-step procedure in which the first step involves computing the average return for the cross-section of [IPO] firms. This is done by creating monthly calendar-time portfolios of firms that have issued IPOs in the past  $n$  years, where the time period  $n$  is based on the period of event performance being investigated (Mitchell & Stafford, 2000). The procedure gives a monthly time series of event portfolio returns denoted  $R_{pt}$ , which is then regressed on the three Fama-French factors as shown in Equation 2 below (de Jong, 2007):

$$R_{pt} - R_{ft} = \alpha_p + \beta_p (R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + \epsilon_{pt} \quad \text{Equation 2}$$

All the terms in Equation 2 above are defined exactly in the same way as those terms defined in Equation 1. The intercept,  $\alpha_p$ , measures the abnormal performance with respect to the three factor benchmark. The significance of the abnormal performance can be tested by the t-test for the significance of  $\alpha_p$  (de Jong, 2007).

Authors like Fama (1998) and Mitchell and Stafford (2000) have pointed that a big disadvantage of the calendar time approach comes from the fact that it is not representative of a typical investment strategy as event time studies are capable of doing. In conclusion, authors such as Dichev and Piotroski (2001) and Lyon, Barber and Tsai (1999) suggest that utilising BHAR and calendar time regressions as complements rather than substitutes should be the best way forward.

## **2.5. Levels of liquidity and IPO performance**

When calculating long-run underperformance, there is still no certainty on which risk adjustments are appropriate at the firm level (Ang *et al.*, 2007). Authors like Brav and Gompers (1997) and Brav, Geczy, and Gompers (2000) make a case for risk adjustments to equity returns on the basis of size and book-to market ratios that seem to eliminate IPO under-performance. However Eckbo and Norli (2001, 2005) have pointed out that when matching on the above characteristics, there is a possibility that intuitive and plausibly important risk factors are being omitted and results in IPOs being less risky than normal.

Eckbo and Norli (2001, 2005) advocate the use of additional risk adjustment factors in terms of leverage and liquidity to explain the long-run underperformance of IPOs. The focus of this paper is specifically on the liquidity related risk factors advocated by Eckbo and Norli (2001, 2005).

Liquidity is a broad and elusive concept that generally denotes the ability to trade large quantities [of securities] quickly, at a low cost, and without moving the price (Pastor & Stambaugh, 2003). The broadness of liquidity as a concept is evidenced when Acharya and Pedersen (2005) developed a theoretical framework that explains how asset prices are affected by liquidity risk. Their framework covers (i) the pricing of return sensitivity to market liquidity; (ii) the average liquidity pricing, and (iii) the co-movement of liquidity with returns and the prediction of future returns.

However, Acharya and Pedersen (2005) do make a clear distinction between risks due to levels of liquidity, and the liquidity risks covered in their framework. It was here that the pioneering work of Amihud and Mendelson (1986) proved to be of guidance. They had defined the level of liquidity of a security in terms of the bid-ask spread of the particular security. Their study found that investors demand a premium for less liquid stocks, so that the expected returns are negatively related to the levels of liquidity.

Since then, there has been a growing interest in the relationship between levels of liquidity and the returns of stocks, which is largely due to the fact that if levels of liquidity does affect returns, then from an investors viewpoint, the liquidity risk needs to be priced (Narayan & Zheng, 2011). This is supported by Datar, Naik, and Radcliffe (1998) who point out that since investors care about expected holding period

returns net of trading costs, less liquid (and more costly to trade) assets need to provide higher gross returns compared to more liquid assets.

One of the key challenges has been the lack of a proper definition for measures of liquidity, for the purposes of analysing the impact of levels of liquidity on stock returns. Although the quoted bid-ask spread was initially used as a measure of the level of liquidity, this measure could only capture the transaction costs (Narayan & Zheng, 2011). Stoll (1978) was one of the first to show that measures of trading activity such as the dollar trading volume and turnover could serve as proxies for liquidity.

Based on this Brennan and Subrahmanyam (1996) found that dollar trading volume was an important determinant of the measure of liquidity. They defined the dollar trading volume as the product of the closing price of a stock and the volume of that stock traded over a period. This was followed with findings by Brennan, Chordia, and Subrahmanyam (1998), who demonstrated a significant negative relation between the average returns of stock and their dollar trading volume.

The turnover rate of an asset was also proposed as a better proxy for levels of liquidity by Datar *et al.* (1998), who defined the turnover rate of a stock as the number of shares traded divided by the number of shares outstanding in that stock. They also find that the stock returns are a

decreasing function of the turnover rates even after controlling for the firm size, book-to-market value and the firm beta.

Further work by Chordia, Subrahmanyam, and Anushuman (2001) was able to establish that variables related to trading activity play an important role in the cross-section of expected returns over and above well studied effects such as size, book-to-market value and momentum. In particular their study was able to highlight that the significant negative relationship between the dollar trading volume and expected returns was consistent with Amihud and Mendelson (1986) and Brennan and Subrahmanyam (1996) findings.

On the other-hand Lee and Swaminathan (2000) argued that turnover might not be good proxy for liquidity as the relationship between turnover and expected returns depended on how well the stocks had performed in the past. They also share Berk's (1995) concern that any price related variable would be related to returns if no proper risk-adjustment was carried out. While these concerns are addressed through the use of the Fama-French factors to adjust for these risks, there is still the possibility that these measures of liquidity are actually picking up some yet unknown risk factors or behavioural anomalies (Chordia *et al.*, 2001).

Narayan and Zheng (2011) estimate the impact of liquidity on market returns to test the pricing effect of liquidity. They find mixed results for

the two key stock exchanges in China. Marshall and Young (2003) demonstrate a statistically significant negative relationship between the returns and liquidity (turnover rate) in the case of the Australian stock market. Martinez, Nieto, Rubio, and Tapia (2005) show evidence of statistically significant positive relationship between the Amihud (2002) illiquidity measure and returns on both conditional and unconditional asset pricing models in the Spanish stock market.

It appears then, that although the liquidity effect predicated by Amihud and Mendelson (1986) model appears to be robust and plays an important role in explaining the overall cross-section of asset prices, the empirical results have yielded mixed results. It also appears that turnover and the dollar value of trades as proxy measures for the level of liquidity appear to be more commonly used in most of the above studies, particularly as these measures are easily available for most stock exchanges.

Another challenge was the lack of a theoretical framework that served to link IPO performance with the above mentioned asset pricing literature. This stalemate is captured by Chordia *et al.* (2001) who were unable to provide a theoretical explanation for the relationship between liquidity and expected returns. This gap was partially bridged by Eckbo and Norli (2001, 2005) who were able to utilise an extended Fama-French three factor model with two additional liquidity factors and a Carhart momentum factor to explain the long-run performance of IPOs.

They developed liquidity factors based on turnover (defined as the number of shares traded over the month divided by the number of shares outstanding) and the dollar value of trades (defined as stock price times number of shares traded), and which are constructed in the same way that the Fama-French factors are developed (Eckbo & Norli, 2001, 2005). Such a model not only enables one to determine the long-run performance of IPOs in the presence of liquidity factors, but also determine the impact of the liquidity factors on the long-run performance of IPOs.

As far as could be ascertained, there has been no similar study in South Africa that seeks to understand the impact of the levels of liquidity on the long-run performance of IPOs. The purpose of this study is to determine exactly that.

### 3. CHAPTER 3-RESEARCH HYPOTHESES

#### 3.1. Research hypotheses

The following hypotheses and sub-hypotheses are proposed for this study:

1. Hypothesis 1 is set up to determine if IPOs underperform or overperform the market over a five year period when the original Fama-French factors are used. The null hypothesis states that the intercept,  $\alpha_p$ , which represents the average monthly abnormal return in the three factor Fama-French regression equation equals zero. This would reflect the fact that IPOs do not have abnormal returns over a five year period after listing. The alternative hypothesis is that the intercept is not equal to zero and IPOs either over-perform or underperform the market over a five year period after listing.

H0: intercept ( $\alpha_p$ ) of the abnormal return =0

H1: intercept ( $\alpha_p$ ) of the abnormal return  $\neq$  0

- 1.1. Sub-hypothesis 1.1 is set up to determine if IPOs categorised in terms of size and book-to-value portfolios underperform or overperform the market over a five year period, when the original Fama-French factors are used. The null hypothesis states that the intercept,  $\alpha_p$ , in the three factor Fama-French regression equation

equals zero. This would reflect the fact that IPOs categorised in terms of various size and book-to-market value portfolios do not have abnormal returns over a five year period after listing. The alternative hypothesis is that the intercept is not equal to zero and IPOs categorised in terms of various size and book-to-market value portfolios either over-perform or underperform the market over a five year period after listing.

H0: intercept ( $\alpha_p$ ) of the abnormal return = 0

H1: intercept ( $\alpha_p$ ) of the abnormal return  $\neq$  0

2. Hypothesis 2 is set up to determine if IPOs underperform or over-perform the market over a five year period when the extended Fama-French factors are used. The null hypothesis states that the intercept,  $\alpha_p$ , which represents the average monthly abnormal return in the extended six factor Fama-French regression equation equals zero. The three additional factors include the two levels of liquidity factors and a Carhart momentum factor. An intercept of zero would reflect the fact that IPOs do not have abnormal returns over a five year period after listing. The alternative hypothesis is that the intercept is not equal to zero and IPOs either over-perform or underperform the market over a five year period after listing.

H0: intercept ( $\alpha_p$ ) of the abnormal return = 0

H1: intercept ( $\alpha_p$ ) of the abnormal return  $\neq$  0

2.1. Sub-hypothesis 2.1 is set up to determine if IPOs categorised in terms of size and rand value of trade portfolios underperform or over-perform the market over a five year period, when the extended Fama-French factors are used. The null hypothesis states that the intercept,  $\alpha_p$ , in the extended six factor Fama-French regression equation equals zero. An intercept of zero would reflect the fact that IPOs categorised in terms of size and rand value of trade portfolios do not have abnormal returns over a five year period after listing. The alternative hypothesis is that the intercept is not equal to zero and IPOs categorised in terms of size and rand value of trade portfolios either over-perform or underperform the market over a five year period after listing.

H0: intercept ( $\alpha_p$ ) of the abnormal return = 0

H1: intercept ( $\alpha_p$ ) of the abnormal return  $\neq$  0

2.2. Sub-hypothesis 2.2 is set up to determine if IPOs categorised in terms of size and turnover portfolios underperform or over-perform the market over a five year period, when the extended Fama-French factors are used. The null hypothesis states that the intercept,  $\alpha_p$ , in the extended six factor Fama-French regression equation equals zero. An intercept of zero would reflect the fact that IPOs categorised in terms of size and turnover portfolios do not have abnormal returns over a five year period after listing. The alternative hypothesis is that the intercept is not equal to zero and IPOs categorised in terms of size and turnover portfolios either

over-perform or underperform the market over a five year period after listing.

H0: intercept ( $\alpha_p$ ) of the abnormal return =0

H1: intercept ( $\alpha_p$ ) of the abnormal return  $\neq$  0

3. Hypothesis 3 is set up determine if the liquidity levels of IPOs is significantly higher that the liquidity levels of non-IPOs in terms of rand value of trade. The null hypothesis states that the rand value of trade of IPO firms is less than or not different from the rand value of trade of non-IPO firms. The alternative hypothesis states that the rand value of trade of IPO firms is greater than the rand value of trade of non-IPO firms. This test could determine if rand value of trade measures play a key role in explaining the performance of IPOs five years after listing.

Ho: mean of rand value of trade of IPO firms  $\leq$  mean of rand value of trade of non IPO firms

H1: mean of rand value of trade of IPO firms  $>$  mean of rand value of trade of non IPO firms

4. Hypothesis 4 is set up determine if the liquidity levels of IPOs is significantly higher that the liquidity levels of non-IPOs in terms of turnover. The null hypothesis states that the turnover of IPO firms is less than or not different from the turnover of non-IPO firms. The alternative hypothesis states that the turnover of IPO firms is greater than the turnover of non-IPO firms. This test could

determine if turnover plays a key role in explaining the performance of IPOs five years after listing.

Ho: mean of turnover of IPO firms  $\leq$  mean of turnover of non IPO firms

H1: mean of turnover of IPO firms  $>$  mean of turnover of non IPO firms

## 4. CHAPTER 4-RESEARCH METHODOLOGY

### 4.1. Choice of method

The methodology followed was a quantitative study as it seeks to describe the long-run abnormal performance of IPOs in South Africa. The main reason for selecting a quantitative study was that most of the information or data required to calculate long-run abnormal performance utilised quantitative information rather than qualitative information (Blumberg, Cooper, & Schindler, 2008). Moreover, most of the literature on the long-run underperformance of IPOs was based on quantitative methods representative of the bias in the empirical finance literature towards statistical tests of significance on abnormal returns around event dates (de Jong, 2007).

A quantitative method not only enabled comparison with a variety of established market benchmarks like the All Share Index (ALSI), but also enabled simple statistical tests to be conducted to determine the significance of the tests. Moreover, the focus of this paper was to test the validity of propositions formulated in earlier papers on IPO performance and for which quantitative methods were better suited (Blumberg *et al.*, 2008). Descriptive studies were also better suited for the purposes of understanding the „what’ role and by „how much’ the levels of liquidity of IPOs affect their long-run performance (Blumberg *et al.*, 2008).

## 4.2. Scope and unit of analysis

The scope of the study was limited to analysing if the liquidity levels of IPOs could explain the long-run performance of IPOs in South Africa. In addition the study on the long-run performance of IPOs was limited to a period of five years after the IPO was issued. This was based on Bodie *et al.* (2010) observation that “a period of five years provided a reasonable number of observations while at the same time ensuring that the period was not so long to be contaminated by old and possibly no-longer relevant returns” (p. 204).

The unit of analysis were firms that issued an IPO and were listed on the JSE as this described the level at which the research was performed, and which objects were researched for the purpose of this study (Blumberg *et al.*, 2008).

## 4.3. Population

The population consisted of all firms that issued an IPO between the years 1992 and 2010 and listed on the JSE. The choice of 1992 as the beginning of the period under investigation was motivated by the fact that Page and Reyneke (1997) had analysed IPO returns over the period 1980 to 1991. As a result this study commenced from where their study stopped. Secondly it enabled a comparison with, and extension of Mangozhe (2010) findings on the analyses of IPO returns

over a period 1992 to 2007. This was done by selecting 2010 as the end of the period of investigation as it enabled the analysis of IPO returns until 2010.

#### **4.4. Sample size and method**

The sample size was limited to all IPOs that listed between 1992 and 2010 and for which relevant data existed on McGregor-BFA, I-Net Bridge and the JSE databases. The relevant data items included the monthly closing prices, monthly trading volumes, monthly market capitalisation, monthly number of shares outstanding, monthly rand value of trade and the annual book values for each IPO stock analysed. Therefore a non-probabilistic sampling procedure was used to obtain the required sample.

#### **4.5. Data gathering**

The data used was entirely secondary data that was obtained from the McGregor-BFA, I-Net Bridge and the JSE databases. Most of these data were direct market and economic data that was tracked on a periodic basis and stored on these databases. In addition to the monthly ALSI returns, the monthly risk free rate which was based on the long term government bond rate (the R153) for the entire period was sourced from Statistics South Africa. McGregor-BFA and I-Net Bridge were used as they are well known databases known for the quality of

information held and widely used by investors, companies and academics in the field.

#### **4.6. Method of analysis**

##### **4.6.1. Hypothesis 1: Determining the long-run performance of IPOs using the calendar time portfolio approach and the original Fama-French factors**

Hypothesis 1 seeks to determine if IPOs over-performed or underperformed the market over a five year period. The normal three factor Fama-French model was utilised for this purpose. However, to avoid the problems of cross-sectional dependence and serial dependence that was commonly encountered in these kinds of studies, a calendar time portfolio approach was utilised. Hoechle and Zimmermann (2009) pointed out that utilising a calendar time portfolio approach ensured that statistical inferences could be made even in the presence of cross-sectional dependence.

Hoechle and Zimmermann (2009) described the calendar time portfolio approach method as a two-step procedure in which the first step involved computing the average return for the cross-section of [IPO] firms. This was done by creating monthly calendar-time portfolios of firms that had issued IPOs in the past  $n$  years, where the time period  $n$  was based on the period of event performance being investigated

(Mitchell & Stafford, 2000). In this case the time period was five years. In the second step the risk-adjusted performance was then measured by estimating a multifactor time-series regression model like the Fama-French three factor model (Hoechle & Zimmermann, 2009).

This procedure gave a monthly time series of [IPO] portfolio returns denoted by  $R_{pt}$  which was then regressed on the three Fama-French factors as shown below (de Jong, 2007) in Equation 3.

$$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{mt} - R_{ft}) + s_pSMB_t + h_pHML_t + \epsilon_{pt} \quad \text{Equation 3}$$

In Equation 3 above  $R_{pt}$  was the monthly calendar portfolio returns for a portfolio  $p$  and  $R_{mt}$  was the monthly market returns for the market portfolio. In this case, the market portfolio  $R_{mt}$  was represented by the average monthly ALSI index.  $R_{pt}$  and  $R_{mt}$  were compared with  $R_{ft}$  which was the monthly risk free rate to obtain the respective excess returns. Here  $R_{ft}$  was based on the long term government bond rate (the R153).

$SMB_t$  and  $HML_t$  were the two factor mimicking portfolios that were created to represent the underlying risk factors. The coefficients  $\beta_p$ ,  $s_p$  and  $h_p$  defined the factor loadings due to each of these factors.  $\epsilon_{pt}$  designated the residual value for portfolio  $p$  and was defined as the difference between the actual return and expected return for portfolio  $p$ . The intercept,  $\alpha_p$ , denotes portfolio  $p$ 's expected return beyond that

induced by the broader market factor and the two additional factor mimicking factors.

Based on Fama and French (1993), Equation 3 above, entailed creating two factor mimicking or zero investment portfolios  $SMB_t$  and  $HML_t$ .  $SMB_t$  was the return on a zero investment portfolio that was formed by subtracting the return on a large firm portfolio from the return on small firm portfolio.  $HML_t$  is a zero investment portfolio calculated as the return on a portfolio of high book-to-market stocks minus the return on a portfolio of low book-to-market stocks (Fama & French, 1993).

The process of constructing the two factor mimicking portfolios was based on the independent sorting method described by Michou, Mouselli, and Stark (2007). They started the process by first of all ranking all IPOs stocks at the end of June every year on the basis of market capitalisation and dividing them into the top 50% (big stocks) and the bottom 50% (small stocks).

In addition all IPO stocks were then divided in terms of the book-to-market value in terms of the top 30% (high book-to-market value stocks), the middle 40% stocks (medium book-to-market value stocks) and the bottom 30% (low book-to-market value stocks). The three book-to-market value portfolios were then superimposed on the two size based portfolios to create six portfolios as indicated in Table 1 below.

Table 1: Six Size and book-to-market value portfolios

BL Portfolio	BM Portfolio	BH Portfolio
SL Portfolio	SM Portfolio	SH Portfolio

Here BL is a portfolio with big and low book-to-market firms, BM a portfolio with big and medium book-to-market firms and BH is a portfolio with big and high book-to-market firms. Similarly SL is a portfolio with small and low book-to-market firms, SM a portfolio with small and medium book-to-market firms while SH is a portfolio with small and high book-to-market firms.

The factor mimicking portfolio  $SMB_t$  was then created as the difference each month, between the simple average of the returns on the three small-stock portfolios and the simple average of the returns on the three big-stock portfolios in the same manner as advocated by Fama and French (1993) and Michou *et al.* (2007).

$$SMB_t = (SL+SM+SH)/3 - (BL+BM+BH)/3. \quad \text{Equation 4}$$

The factor mimicking portfolio  $HML_t$  was then created as the difference each month, between the simple average of the returns on the two high book-to-market value portfolios and the simple average of the returns on the two low book-to-market portfolios in the same manner as advocated by Fama and French (1993) and Michou *et al.* (2007).

$$HML_t = (SH+BH)/2 - (SL+BL)/2 \quad \text{Equation 5}$$

The monthly average value returns of the portfolios were then regressed on the Fama-French three factors models. If there is no abnormal performance then the intercept,  $\alpha_p$ , should be zero, and the significance of the abnormal performance is tested by the t-test for the significance of  $\alpha_p$  (de Jong, 2007). These t-tests were calculated at the 5% significance level. The linear regression function of the IBM SPSS Statistics software package, Version 19, was used to carry out the regression analysis.

#### **4.6.1.1. Sub-hypothesis 1.1: Determining the long-run performance of IPOs categorised in terms of size and book-to-market value portfolios**

Sub-hypothesis 1.1 seeks to determine if IPOs categorised in terms of size and book-to-market value portfolios over-performed or underperformed the market over a five year period. The method of analysis used to test hypothesis 1 in Section 4.6.1 applies to sub-hypothesis 1.1 as well. The only difference is that the returns of the six size and book-to-market based portfolios are used as the dependent variable instead of the excess portfolio returns ( $R_{pt}-R_{ft}$ ) in Equation 3 above. For example, the return of the BH portfolio is the average of all the stocks categorised as BH stocks in a particular calendar month. The explanatory variables are exactly the same variables used in Equation 3 above.

Section 4.6.1 shows how the size and book-to-market value portfolios BH, BM, BL, SH, SM and SL are constructed. The returns of each of these portfolios are then regressed in exactly the same manner as indicated in Section 4.6.1.

#### 4.6.2. Hypothesis 2: Determining the long-run performance of IPOs using the calendar time portfolio approach and the extended Fama-French factors

Hypothesis 2 seeks to determine if IPOs over-performed or underperformed the market over a five year period when an extended Fama-French model is used. The extended version of the Fama-French model was advocated by Eckbo and Norli (2001, 2005). Their method incorporates three additional factor mimicking portfolios,  $PVOL_t$  and  $TO_t$ , to reflect the liquidity risk factors and the  $PR1YR_t$  factor to reflect a Carhart momentum factor. In addition to the normal three Fama-French factors, the IPO stock returns were now exposed to these three additional factors as indicated in Equation 6 below.

$$R_{pt} - R_{ft} = \alpha_p + \beta_p (R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + p_p PR1YR_t + p_{v_p} PVOL_t + t_p TO_t + \epsilon_{pt}$$

Equation 6

In Equation 6 above,  $R_{pt}$  is the monthly calendar portfolio returns for a portfolio  $p$  and  $R_{mt}$  is the monthly market returns for the market portfolio. In this case the market portfolio,  $R_{mt}$ , was represented by the average

monthly ALSI index.  $R_{pt}$  and  $R_{mt}$  were compared with  $R_{ft}$  which was the monthly risk free rate to obtain the respective excess returns. Here  $R_{ft}$  was based on the long term government bond rate (the R153).

$SMB_t$  and  $HML_t$  are the two factor mimicking portfolios that were created to represent the underlying risk factors.  $TO_t$  was the factor mimicking portfolio created to represent the underlying exposure to liquidity risk due to turnover. Here turnover (TO) was defined as the number of shares traded over a month divided by the number of shares outstanding each month.

$PVOL_t$  was another factor mimicking portfolio created to represent the underlying exposure to liquidity risk due to the rand value of trade. The rand value of trade (PVOL) was defined as the monthly closing share-price times the monthly volume traded for each IPO. The PVOL measure was identified as an appropriate measure as trading volume was a strong determinant of liquidity (Brennan *et al.*, 1998).

Brennan *et al.* (1998) also point out that the data on trading volume is readily available on a monthly basis and provides a more powerful test for the liquidity hypothesis. This follows Stoll's (1978) finding that trading volume was an important determinant of the bid-ask spread. The Carhart momentum factor,  $PRYR_t$  on the other hand was a factor portfolio that served as a proxy for the momentum effects. It was defined as the average return on a „high return’ portfolio over the last

twelve months minus the average return on a „low return’ portfolio over the last twelve months.

The coefficients  $\beta_p$ ,  $s_p$ ,  $h_p$ ,  $p_p$ ,  $p_{vp}$  and  $t_p$  are defined as the factor loadings due to each of these factors.  $\epsilon_{pt}$  is designated as the residual value for portfolio  $p$  and was defined as the difference between the actual return and expected return for portfolio  $p$ . The intercept,  $\alpha_p$ , denoted portfolio  $p$ ’s expected return beyond that induced by the broader market factor and the five additional factor mimicking factors.

Eckbo and Norli (2001, 2005) show that the  $PVOL_t$  and  $TO_t$  factor mimicking portfolios are constructed in the same way as the  $SMB_t$  and HML portfolios were created for hypothesis 1 above. They start the process by first of all ranking all IPOs stocks at the end of June every year on the basis of market capitalisation and dividing them into the top 50% (big stocks) and the bottom 50% (small stocks). In addition all IPO stocks were then divided in terms of the turnover in to the top 30% (high turnover stocks), the middle 40% stocks (medium turnover stocks) and the bottom 30% (low turnover stocks).

The three turnover portfolios were then superimposed on the two size based portfolios to create six portfolios as indicated in Table 2 below.

Table 2: Six size and turnover portfolios

BLT Portfolio	BMT Portfolio	BHT Portfolio
SLT Portfolio	SMT Portfolio	SHT Portfolio

Here BLT was a portfolio with big and low turnover firms, BMT a portfolio with big and medium turnover firms and BHT was a portfolio with big and high turnover firms. Similarly SLT was a portfolio with small and low turnover firms, SMT was a portfolio with small and medium turnover firms while SHT was a portfolio with small and high turnover firms.

The factor mimicking portfolio  $TO_t$  was then constructed as the difference between the equal weighted average return on the two portfolios with low turnover and the equal weighted average return on the two portfolios with high turnover as advocated by Eckbo and Norli (2001, 2005).

$$TO_t = (SLT+BLT)/2-(SHT+BHT)/2 \quad \text{Equation 7}$$

The construction of the factor mimicking portfolio  $PVOL_t$  was done in a similar manner as advocated by Eckbo and Norli (2001, 2005). The process begins with the ranking of all IPOs stocks at the end of June every year on the basis of market capitalisation and dividing them into the top 50% (big stocks) and the bottom 50% (small stocks). In addition all IPO stocks were then divided in terms of the monthly rand value of trade in terms of the top 30% (high monthly rand value of trade stocks), the middle 40% stocks (medium monthly rand value of trade stocks) and the bottom 30% (low monthly rand value of trade stocks).

The three monthly rand value of trade portfolios were then superimposed on the two size based portfolios to create six portfolios as indicated in Table 3 below.

Table 3: Six size and rand value of trade portfolios

BLV Portfolio	BMV Portfolio	BHV Portfolio
SLV Portfolio	SMV Portfolio	SHV Portfolio

Here BLV was a portfolio with big and low rand value of trade firms, BMV a portfolio with big and medium rand value of trade firms and BHV was a portfolio with big and high rand value of trade firms. Similarly SLV was a portfolio with small and low rand value of trade firms, SMV a portfolio with small and medium rand value of trade firms and SHV was a portfolio with small and high rand value of trade firms.

The factor mimicking portfolio  $PVOL_t$  was then constructed as the difference between the equal weighted average return on the two portfolios with low monthly rand value of trade and the equal weighted average return on the two portfolios with high monthly rand value of trade as advocated by Eckbo and Norli (2001, 2005).

$$PVOL_t = (SLV + BLV) / 2 - (SHV + BHV) / 2 \quad \text{Equation 8}$$

The  $PRYR_t$  was a momentum mimicking portfolio similar to the Carhart momentum factor (Eckbo & Norli, 2001, 2005). Each month a high-performance portfolio of “winners” and low-performance portfolio of “losers” was created based on the buy and hold returns over the

previous 12 months as described by Eckbo and Norli (2001, 2005). The portfolio of winners contained the third of the firms which had the highest buy and hold return while the portfolio of losers contained the third of the firms with the lowest buy and hold returns.

The portfolio returns were equally weighted and  $PRYR_t$  was the return on the portfolio long on the winner portfolio and short on the loser portfolio. This was indicative of a zero-investment portfolio strategy in which a shorting of some IPO stocks in the portfolio was used to fund the long position in the portfolio.

Similar to hypothesis 1 above, provided that there is no abnormal performance, then the intercept,  $\alpha_p$ , for Equation 6 above would be zero, and the significance of the abnormal performance could be tested by the t-test for the significance of  $\alpha_p$  (de Jong, 2007). However if the intercept,  $\alpha_p$ , was not zero, the deviation from the original Fama-French calculations in hypothesis 1 would give a degree of indication as to the role that these liquidity factors played in the long-run abnormal performance of IPOs. All tests are based on the 5% significance level. The linear regression function of the IBM SPSS Statistics software package, Version 19, was used to carry out the regression analysis.

#### **4.6.2.1. Sub-hypothesis 2.1: Determining the long-run performance of IPOs categorised in terms of size and rand value of trade portfolios**

Hypothesis 2.1 seeks to determine if IPOs over-performed or underperformed the market over a five year period when categorised in terms of six size and rand value of trade based portfolios. The method of analysis used to test hypothesis 2 in Section 4.6.2 applies to sub-hypothesis 2.1 as well. The only difference is that the returns of the six size and rand value of trade based portfolios are used as the dependent variable instead of the excess portfolio returns ( $R_{pt}-R_{ft}$ ) in Equation 6 above. The explanatory variables are exactly the same variables as in Equation 6 above.

Section 4.6.2 shows how these six size and rand value of trade based portfolios BHV, BMV, BLV, SHV, SMV and SLV are constructed. The returns of each of these portfolios are then regressed in exactly the same manner as indicated in Section 4.6.2.

#### **4.6.2.2. Sub-hypothesis 2.2: Determining the long-run performance of IPOs categorised in terms of size and turnover portfolios**

Hypothesis 2.2 seeks to determine if IPOs over-performed or underperformed the market over a five year period when categorised in terms of six size and turnover based portfolios. The extended six factor Fama-French model was utilised for this purpose. The method of

analysis used to test hypothesis 2 in Section 4.6.2 applies to sub-hypothesis 2.2 as well. The only difference is that the returns of the six size and turnover based portfolios are used as the dependent variable instead of the excess portfolio returns ( $R_{pt}-R_{ft}$ ) in Equation 6 above. The explanatory variables are exactly the same variables in Equation 6 above.

Section 4.6.2 shows how these six size and turnover based portfolios BHT, BMT, BLT, SHT, SMT and SLT are constructed. The returns of each of these portfolios are then regressed in exactly the same manner as indicated in Section 4.6.2.

#### **4.6.3. Hypothesis 3: Comparing the rand value of trade of IPOs and Non-IPOs**

Hypothesis 3 seeks to determine if the liquidity levels of IPOs in terms of rand value of trade is significantly different from the liquidity levels of non-IPOs in terms of rand value of trade. For hypothesis 3, IPO firms were matched for size and book-to-market values to relevant firms. The procedure followed was exactly in the manner indicated by Eckbo and Norli (2001, 2005). This involved the selection of size-matched firms from all firms listed on the JSE at the end of the year prior to the IPO and that were not in the sample of IPOs for a period of five years prior to the offer date. This was necessary as data on industry peers in the private sector was not easily available in South Africa.

Eckbo and Norli (2001, 2005) selected the size-matched firm as the firm closest in market capitalisation to the issuer after the offering date. “When matching for size and book-to-market values, the same set of [JSE] firms above were used and subsets of firms that had an equity market value within 30% of the equity market value of the issuer was selected” (p.5). The subsets were then ranked according to the book-to-market values. They then define the size and book-to-market matched firm as that firm with a book-to market value, measured at the end of the five years prior to the issue year that is closest to the issuer’s value.

The liquidity measures in terms of average values of monthly rand value of trade were calculated for the IPOs ( $PVOL_{IPO}$ ) and the matched firms ( $PVOL_{MATCHED}$ ) each year. A paired two sample test of difference between the means of these two liquidity measures based on the following null and alternate hypotheses was conducted as indicated in Equations 9 and 10.

$$\text{Null Hypothesis } H_0 : \mu_{PVOL(IPO)} \leq \mu_{PVOL(Matched)} \quad \text{Equation 9}$$

$$\text{Alternate Hypothesis } H_1 : \mu_{PVOL(IPO)} > \mu_{PVOL(Matched)} \quad \text{Equation 10}$$

Here  $\mu_{PVOL(IPO)}$  was the mean average of the rand value of trade for all IPOs over the period.  $\mu_{PVOL(IPO)}$  was compared with  $\mu_{PVOL(Matched)}$ , which was the mean average of the rand value of trade of the matched firms over the period. The use of the paired two sample test was due to

the fact that a deliberate attempt was being made here to match the observations in the two samples (Albright, Winston, & Zappe, 2009).

The use of the one tailed t-test was to confirm if the rand value of trade of the sample of IPOs was significantly more than the rand value of trade of the matched firms. The test-statistic for the paired sample test of difference between means was given below in Equation 11 and had  $n-1$  degrees of freedom.

$$t - value = \frac{\bar{D} - D_o}{S_D / \sqrt{n}} \quad \text{Equation 11}$$

Here the t-value provided the t-statistic required for the t-test, while  $\bar{D}$  is the sample mean difference between the two samples and  $D_o$  is the hypothesised difference between the means of the two samples. In this context  $S_D$  was defined as the sample standard deviation of the mean differences. The level of significance for these tests was based on an  $\alpha = .05$ .

If indeed the null hypotheses proved to be true, then these findings would be able to explain the findings of positive abnormal performance by Alli *et al.* (2010) for IPOs listed on the JSE over the period 1995-2004. It would also explain the findings of Mangozhe (2010) who found no evidence of underperformance for IPOs listed on the JSE over the period 1992 to 2007. The paired sample t-test tool of the IBM SPSS Statistics software package, Version 19, was used to carry out this test.

#### 4.6.4. Hypothesis 4: Comparing the turnover of IPOs and Non-IPOs

Hypothesis 4 seeks to determine if the liquidity levels of IPOs in terms of turnover is significantly different from the liquidity levels of non-IPOs in terms of turnover. For hypothesis 4, IPO firms were matched for size and book-to-market values to relevant firms. The procedure followed was exactly in the manner indicated by Eckbo and Norli (2001, 2005). This procedure is detailed in Section 4.6.3 above.

Based on this, the liquidity measures in terms of average values of monthly turnover were calculated for the IPOs ( $TO_{IPO}$ ) and the matched firms ( $TO_{MATCHED}$ ) every year. A paired two sample test of difference between the means of these two liquidity measures based on the following null and alternate hypotheses was conducted as indicated in Equations 12-13.

$$\text{Null Hypothesis } H_0: \mu_{TO(IPO)} \leq \mu_{TO(Matched)} \quad \text{Equation 12}$$

$$\text{Alternate Hypothesis } H_1: \mu_{TO(IPO)} > \mu_{TO(Matched)} \quad \text{Equation 13}$$

Here  $\mu_{TO(IPO)}$  is the mean average of the turnover of the issuer firm over the period.  $\mu_{TO(IPO)}$  is compared with  $\mu_{TO(Matched)}$ , which is the mean average of the turnover of the matched firm over period. The use of the paired two sample test was due to the fact that a deliberate attempt was being made here to match the observations in the two samples (Albright *et al.*, 2009).

The use of the one tailed t-test was to confirm if the turnover measures of the sample of IPOs was significantly more than the turnover measures of the matched firms. The test-statistic for the paired sample test of difference between means is defined exactly in the same manner as Equation 11 above. The level of significance for this test was based on an  $\alpha = .05$ .

If indeed the null hypotheses proved to be true, then these findings would be able to explain the findings of positive abnormal performance by Alli *et al.* (2010) for IPOs listed on the JSE over the period 1995-2004. It would also explain the findings of Mangozhe (2010) who found no evidence of underperformance for IPOs listed on the JSE over the period 1992 to 2007. The paired sample t-test tool of the IBM SPSS Statistics software package, Version 19, was used to carry out this test.

#### **4.7. Methodology for description of the sample**

The descriptive and correlation tool of the IBM SPSS Statistics software package, Version 19, was used to describe the sample. The key measures that were calculated were the mean values, the minimum values, maximum values of the relevant data items. This included the monthly market capitalisation, the annual book value, the monthly book-to-market value, the monthly rand value of trade, the monthly turnover, the monthly number of shares outstanding and the number of shares traded per month.

In addition the mean values of the six extended Fama-French factors that included the excess market return  $R_{mt}-R_{ft}$ , the  $SMB_t$  portfolio, the  $HML_t$  portfolio, the  $PRYR_t$  portfolio, the  $TO_t$  portfolio and the  $PVOL_t$  portfolios were calculated in order to determine their contribution towards the long-run performance of IPOs. Finally a pair-wise correlation matrix was developed to analyse the relationship between these factors.

The importance of understanding the means of the factors follows from Michou *et al.* (2007) argument that for a factor to capture risk, a positive mean must be expected over a substantial period of time. They also advocate the need to understand the correlation between these factors due to the similar manners in which they are constructed.

#### **4.8. Limitations of the research**

The key limitation of this research was that it was limited to IPOs listed on the JSE. The number of IPO listings on the JSE, over the years, was a mere fraction of those listed on the highly sophisticated and developed stock exchanges in the USA and the UK. As a result the sample size of IPOs used for this study was much smaller than the samples used in studies in these countries. It is for this very reason that firms from the financial and mining sector were included in this study, as otherwise the sample size would be too small for the purposes of this study.

The study also departs from the initial studies of Eckbo and Norli (2001, 2005) in the sense that IPO stocks exposure to leverage based risk factors were not analysed. One of the key reasons was the availability of key macroeconomic data and the limited time span for the completion of this study. Only liquidity based risk factors were analysed in this study as the overall conclusion of Eckbo and Norli (2005) was that a macro-model based on leverage related risk factors had lower explanatory power than the liquidity based model.

Despite this they indicated that there was evidence that IPO returns respond to leverage based risk factors. As a result there is room for future studies to analyse the combined effects of IPO stocks exposure to liquidity and leverage based risk factors.

## **5. CHAPTER 5- RESULTS**

### **5.1. Introduction**

The results of this study are presented in this chapter. These results are based on the hypotheses discussed in Chapter 3. A detailed description of the sample characteristics and the descriptive statistics is provided before the results are presented.

A database of all IPOs that listed over the period between 1992 and 2010 was obtained from the JSE. Based on this list there were a total of 511 companies that listed during this period. A detailed search was then conducted on McGregor-BFA and I-Net Bridge to obtain all relevant data items for those companies on the list obtained from the JSE. The data items of interest included the monthly number of shares issued, the monthly number of shares traded, the monthly rand value of trade, the monthly closing share-price, the monthly market capitalization and the annual book value.

It became apparent that obtaining the relevant data items on these companies would not be an easy task as in many instances there was simply no information at all on some of these companies. This resulted in 37 companies being omitted from the study. A further problem compounding the search for data was that 99 companies had changed names or JSE ticker symbols since listing. This required that detailed

searches were conducted outside the above databases to obtain the new names or JSE ticker symbol of affected companies.

This search was conducted by means of the Google search engine and the Sharenet financial database. Based on this process a further 13 companies had to be omitted, either because relevant data items could not be obtained or because their details did not perfectly match the listed company.

The number of companies that delisted over the period of the study totalled 284 companies. This resulted in 20 companies with very short listing periods of less than a year being omitted from this study. The final set of IPO companies that were used for this study amounting to 441 companies. The use of the calendar time portfolio approach further meant that companies that did not have the full set of data items required to create the proxy portfolios were also omitted from the study.

In total 162 companies were omitted through this process resulting in 279 companies being utilized for the purpose of this study. Moreover, since the number of firms in the event portfolio changed through time, there was a need to mitigate for heteroskedasticity by requiring at least 10 firms in the event portfolio at each point of time (Mitchell & Stafford, 2000). This meant that months with less than 10 companies in the portfolio were omitted from the study.

All qualifying companies, including resource and financial companies, were included in this study to ensure adequate coverage and representation of the companies listed on the JSE (Van Rensburg, 2002). This also ensured that the sample size was adequate enough to create the proxy portfolios as required in the calendar time portfolio approach. Table 4 provides a breakdown of the IPO listing over the period 1992 to 2010. It is noticed that the years with the largest number of IPO listings was 1998 and 1999. The years with lowest number of IPO listings are 2009 and 2003.

Table 4: Breakdown of IPO listings per year

<b>Year</b>	<b>Number of IPOs listed per year</b>	<b>Number of IPOs included in the final sample</b>
1992	13	2
1993	17	7
1994	25	6
1995	33	15
1996	34	25
1997	64	34
1998	103	49
1999	76	33
2000	17	6
2001	10	8
2002	9	8
2003	8	5
2004	11	7
2005	14	8
2006	20	15
2007	24	21
2008	16	14
2009	5	5
2010	12	11
<b>Total</b>	<b>511</b>	<b>279</b>

## 5.2. Sample description

Table 5 highlights the key descriptive statistics of the IPO sample being studied. The total number of observations on which this descriptive data is based upon amounts to 204 months excluding the months in which there are less than ten stocks.

Table 5: Descriptive statistics of the IPO sample

Monthly Data Items	Mean	Minimum	Maximum	Standard Deviation
Market capitalisation	R4,931,351,705	R316,542	R5,477,720,000,000	77,552,154,198
Book value	R1,473,821,739	R151,000	R55,271,000,000	2,580,018,223
Turnover (TO)	0.023	0	1.768520879	0.027
Rand value of trade (PVOL)	R10,891,074,712	R0	R3,231,159,026,600	40,224,536,522
Previous 12 months return	0.977%	-4.312%	102.703%	0.186
Volume traded per month	6,166,014	0	584,969,700	12,054,345
Number of shares outstanding	224,602,764	70,000	3,836,641,280	136,382,422
Book-to-market value	1.221796183	0	198.264	3.077

It is clear that there is a huge variation between the means and the minimum and maximum values for each and every one of these data items of interest. In particular the standard deviations of the monthly market capitalisation, the monthly rand value of trade and the volume of shares traded in a month for IPOs also show very high standard deviations. Since these data items are directly used in the creation of five of the proxy portfolios, it stands to state that these variations could play a key role in determining the final results.

The basic descriptive statistics of all the extended Fama-French factors is provided in Table 6 below. For most factors the number of observations is close to 204, although it immediately becomes apparent that the descriptive statistics of the  $PVOL_t$  factor are based on a mere 118 observations due to missing data.

Table 6: Descriptive statistics of the extended Fama-French factors

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
$SMB_t$	196	0.037	0.399	11.793	0.174	151.748	0.346
$HML_t$	196	-0.137	0.445	-6.632	0.174	52.288	0.346
$TO_t$	196	-0.039	0.279	4.882	0.174	79.888	0.346
$PVOL_t$	118	-0.038	0.471	-2.014	0.223	51.855	0.442
$PRYR_t$	203	0.096	0.119	0.345	0.171	15.401	0.340
$R_{mt}-R_{ft}$	204	0.001	0.057	-0.795	0.170	3.611	0.339

It becomes apparent that contrary to expectations the  $HML_t$ ,  $TO_t$  and  $PVOL_t$  proxy portfolios have negative mean values of -0.137, -0.039 and -0.038 respectively. This indicates that for this particular IPO sample, IPOs with low book-to-market values derived a higher return than high book-to market value IPOs. Similarly it indicates that IPOs with high turnover (or rand value of trade) derived a higher level of return compared to IPOs with low turnover (or rand value of trade).

This fact in itself indicates that for this particular IPO sample the evidence against a liquidity premium and a book-to-market effect is getting stronger. This follows from the observation that the means

$[TO_t (-0.039)]$  and  $[PVOL_t (-0.038)]$  are also the average risk premium per unit of factor, that will be contributed towards the average monthly return (Fama & French, 1993). Interestingly the  $PRYR_t$  portfolio with a mean of 0.096 yields a higher mean return compared to the  $SMB_t$  portfolio with a mean return of 0.037. The  $HML_t$  portfolio seems to have the lowest mean return of -0.137 with a standard deviation of 0.445.

It also becomes apparent that all the factors are subject to high kurtosis and skewness. The  $SMB_t$  portfolio leads with a very high skewness of 11.793 and a kurtosis of 151.78. Interestingly all the proxy portfolios constructed from the size based portfolio seem to exhibit these features as the  $HML_t$  portfolio, the  $TO_t$  portfolio and the  $PVOL_t$  portfolio also display high kurtosis and skewness.

Table 7 below provides the pair-wise correlations between the extended Fama-French factors. Perhaps reflective of the fact that they are both constructed in the same way, and capture the same liquidity risks, the  $TO_t$  and  $PVOL_t$  portfolios are positively related.

Table 7: Correlations of the extended Fama-French factors

	$R_{mt}-R_{ft}$	$SMB_t$	$HML_t$	$PRYR$	$TO_t$	$PVOL_t$
$R_{mt}-R_{ft}$	1					
$SMB_t$	-0.031	1				
$HML_t$	-0.133	-0.708**	1			
$PRYR_t$	0.081	-0.396**	0.055	1		
$TO_t$	-0.174	0.577**	0.056	-0.462**	1	
$PVOL_t$	-0.060	0.461**	0.016	-0.660**	0.667**	1

\* Correlation is significant at the 0.05 level (2-tailed)

\*\* Correlation is significant at the 0.01 level (2-tailed)

Contrary to expectations the  $TO_t$  and  $PVOL_t$  portfolios are not positively related to the  $HML_t$  portfolio, reflective of the similar manner in which they has been constructed relative to the size based portfolios. The  $TO_t$  and  $PVOL_t$  portfolios are also positively related to the  $SMB_t$  portfolio. Interestingly both  $TO_t$  and  $PVOL_t$  portfolios are negatively related to the  $PRYR_t$  portfolio. The  $PRYR_t$  portfolio has a negative correlation with the  $SMB_t$  portfolio while finally the  $SMB_t$  portfolio is negatively related to the  $HML_t$  portfolio.

The high correlation between the  $SMB_t$  portfolio and the  $HML_t$  portfolio is worrying as Fama and French (1993) indicate that well constructed proxy portfolios should have very low correlations. This seems to indicate that the returns of the  $HML_t$  portfolio are not entirely independent of the  $SMB_t$  portfolio.

### **5.3. Applying the calendar time portfolio approach to calculate the long-run performance of IPOs**

The key objective of this study was to determine if IPOs underperformed over a five year period when the calendar time portfolio approach was used. In addition the study sought to determine the impact of the levels of liquidity on the long run performance of IPOs over a period of five years. This was done by first of all analysing if IPO stocks had higher liquidity levels compared to non-IPO stocks in terms of turnover (TO) and rand value of trade (PVOL). Finally the study

included the levels of liquidity factors ( $PVOL_t$  and  $TO_t$ ) and a Carhart momentum factor ( $PRYR_t$ ) as part of the extended Fama-French factors to determine their impact on the long run performance of IPOs over a five year period.

Constructing monthly calendar time portfolios involved creating portfolios that contained all companies that listed during the last five years. Microsoft Excel was used to create a template where monthly portfolios were constructed for each year between 1992 and 2010. For each company that was listed over the previous five years, the monthly closing price, the monthly market capitalisation, the monthly book value, the return over the past twelve months, the volume of shares traded over the last month and finally the number of shares outstanding each month was sourced from the McGregor-BFA database. The monthly book value of a company was assumed to be the same as the annual book value obtained from the respective balance sheets.

The number of shares outstanding each month, the number of shares traded each month and the monthly closing price of each stock was then used to calculate the turnover (TO) and rand value of trade (PVOL) variables as indicated in Section 4.6.2. Similarly the monthly market capitalisation and monthly book value was used to obtain the monthly book-to-market value.

Following Eckbo and Norli (2001, 2005) all the stocks were then ranked on the basis of market capitalisation into the top 50% (big stocks) and the bottom 50% (small stocks). In addition all stocks were then divided in terms of the book-to-market values, turnover and rand value of trade in to the top 30% (high stocks), the middle 40% stocks (medium stocks) and the bottom 30% (low stocks) as described in Section 4.6.2.

#### **5.4. The long-run performance of IPOs using the calendar time portfolio approach and the original Fama-French factors**

##### **5.4.1. Total IPO sample for the period 1992 to 2010**

Hypothesis 1 sought to determine if IPOs that listed between 1992 and 2010 underperformed or over-performed the market over a five year period when the calendar time portfolio approach based on the three factor Fama-French regression equation was used. In this regression, the monthly excess portfolio return,  $R_{pt}-R_{ft}$ , for each month in the period between 1992 and 2010 was regressed on the monthly excess market-return,  $R_{pt}-R_{ft}$ , and the  $SMB_t$  and  $HML_t$  proxy portfolios for the period. The results of this regression equation are shown in Table 8 below.

The intercept,  $\alpha_p$ , indicates a value of -0.002, which at first sight suggests that the sample of IPO underperformed the market over a period of five years. This finding is however not significant and the null hypothesis of  $\alpha_p$  being zero cannot be rejected at the 5% level of

significance. This follows from the small t-value (-0.334) and the correspondingly high p-value (0.739) that indicates that  $\alpha_p$  is not significantly different from zero.

Table 8: Results of the regression of the total IPO portfolios on the original Fama-French factors

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.967	0.936	0.935	0.060

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	-0.002	0.005	-0.334	0.739	-0.011	0.008
$R_{mt}-R_{ft}$	0.811*	0.076	10.681	0.001	0.661	0.960
$SMB_t$	0.631*	0.016	40.347	0.001	0.600	0.661
$HML_t$	0.083*	0.014	5.833	0.001	0.055	0.110

\*Significant at 5% level of significance

However, all the coefficients of all the explanatory factors are significant at the 5% level of significance. The coefficient of the  $R_{mt}-R_{ft}$  factor is 0.811 with a large t-value of 10.681 and a small p-value of 0.001. The  $SMB_t$  portfolio has a coefficient of 0.631 with a comparatively larger t-value of 40.347 and a small p-value of 0.001. Finally the  $HML_t$  portfolio has a coefficient of 0.083 with a comparatively smaller t-value of 5.833 and a small p-value of 0.001. Each of these three explanatory factors has t-values that are at least five standard errors away from zero indicating that they have a strong ability to explain the excess returns of the portfolios.

The model shows that the  $R_{mt}-R_{ft}$  factor is capable of explaining most of the IPO excess returns followed by the  $SMB_t$  and  $HML_t$  proxy portfolios.

The R-square value of 0.936 is indicative of the fact that the model has a very high explanatory power for the above set of returns. This fact is supported by the Standard Error of Estimate which has a small value of 0.060.

In summary, there is no evidence to support the hypothesis that IPOs that listed between 1992 and 2010 underperformed or over-performed the market over a period of five years after listing. However all three Fama-French factors maintain their significantly strong ability to explain the returns of IPO stock over this period.

#### **5.4.2. IPO portfolios in terms of size and book-to-market value**

Naturally the next step would be to investigate if the IPO stock underperformed or over-performed the market over a five year period when categorised in terms of the size and book-to-market values. The results of regressing the returns of the six different portfolios BH, BM, BL, SH, SM and SL for each month over the period between 1992 and 2010 on the monthly excess market-return,  $R_{mt}-R_{ft}$ , the  $SMB_t$  and the  $HML_t$  proxy portfolios are discussed in the following sections.

##### **5.4.2.1. BH portfolio**

The BH portfolio represents IPO stocks that belong to the big stocks portfolio as well as the high book-to-market value portfolio as described

in Section 4.6.1. The results of the regression equation are presented in Table 9 below.

The positive value of  $\alpha_p$  (0.001) appears to show that IPO stocks that belong to the BH portfolio have over-performed the market over the period 1992-to-2010. However this finding is not significant and the null hypothesis of  $\alpha_p$  being zero cannot be rejected at the 5% level of significance. This follows from the small t-value (0.168) and correspondingly high p-value (0.866) that indicates that  $\alpha_p$  is not significantly different from zero.

Table 9: Results of the regression of the BH portfolio on the original Fama-French factors

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.594	0.353	0.342	0.064			

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.001	0.005	0.168	0.866	-0.009	0.010
$R_{mt}-R_{ft}$	0.760*	0.080	9.474	0.001	0.602	0.918
$SMB_t$	-0.033*	0.017	-2.011	0.046	-0.066	-0.001
$HML_t$	-0.00002	0.015	-0.001	0.999	-0.030	0.029

\*Significant at 5% level of significance

When compared to the total IPO portfolio, the coefficient of the  $R_{mt}-R_{ft}$  factor remains significant with a lower value of 0.760. The t-value reduces to 9.474 with a small p-value of 0.001. The  $SMB_t$  portfolio now has a significantly negative coefficient of -0.033 indicative of a size effect. The t-value is now -2.011 with a p-value of 0.046. However the  $HML_t$  proxy portfolio loses its ability to explain the BH portfolio returns

as its coefficient is now an insignificant  $-0.00002$  with a small  $t$ -value of  $-0.001$  and a high  $p$ -value of  $0.999$ .

The  $R$ -square value now drops to  $0.353$  compared to  $0.936$  for the total IPO portfolio. This is indicative of the fact that the model does not do a very good job of explaining the above set of returns. This is supported by the Standard Error of Estimate which has now increased slightly to  $0.064$  from  $0.060$  for the total IPO sample.

In summary, there is no evidence to support the hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the BH portfolio, underperformed or over-performed the market over a period of five years after listing. While  $R_{mt}-R_{ft}$  and  $SMB_t$  retains their significant ability to explain the returns of the BH portfolio, the  $HML_t$  portfolio becomes insignificant in explaining the returns of the BH portfolio.

#### **5.4.2.2. BM portfolio**

The BM portfolio represents IPO stocks that belong to the big stocks portfolio as well as the medium book-to-market value portfolio. The results of the regression equation are presented in Table 10 below.

Table 10: Results of the regression of the BM portfolio on the original Fama-French factors

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.906	0.821	0.819	0.077

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.026*	0.006	4.443	0.001	0.014	0.038
$R_{mt}-R_{ft}$	0.942*	0.096	9.764	0.001	0.751	1.132
$SMB_t$	0.492*	0.020	24.771	0.001	0.453	0.531
$HML_t$	0.137*	0.018	7.625	0.001	0.102	0.173

\*Significant at 5% level of significance

The positive value of  $\alpha_p$  (0.026) shows that IPO stocks that belong to the BM portfolio have over-performed the market with an average annual abnormal performance of 0.312% over the period 1992-to-2010. This finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This follows from the high t-value (4.443) and the correspondingly low p-value (0.001) that indicates that  $\alpha_p$  is significantly different from zero.

When compared to the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remains significant with a higher value of 0.942. The t-value reduces slightly to 9.764 with a small p-value of 0.001. The  $SMB_t$  portfolio is significant with a coefficient of 0.492 and large t-value of 24.771 and a small p-value of 0.001. The  $HML_t$  portfolio is significant with a coefficient of 0.137 due to the slightly higher t-value of 7.625 and a small p-value of 0.001. The coefficient and significance of the  $HML_t$  portfolio shows the existence of a book-to-market effect in the explanation of the BM portfolio returns.

The R-square value is now 0.821 compared to 0.936 for the total IPO portfolio. Despite the lower value this is still indicative of the fact that the model does a good job of explaining the above set of returns. This is supported by the Standard Error of Estimate which has now increased to 0.077 compared to 0.060 for the total IPO sample.

In summary, there is evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the BM portfolio, over-performed the market over a period of five years after listing with an average annual abnormal performance of 0.312% . Moreover all three Fama-French factors retain their significant ability to explain the returns of the BM portfolio.

#### **5.4.2.3. BL portfolio**

The BL portfolio represents IPO stocks that belong to the big stocks portfolio as well as the low book-to-market value portfolio. The results of the regression equation are presented in Table 11 below. The positive value of  $\alpha_p$  (0.025) shows that IPO stocks that belong to the BL portfolio have over-performed the market with an average annual abnormal performance of 0.300% over the period 1992-to-2010. This finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This follows the high t-value (5.005) and the correspondingly low p-value (0.001) that indicates that  $\alpha_p$  is significantly different from zero.

Table 11: Results of the regression of the BL portfolio on the original Fama-French factors

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.626	0.392	0.383	0.065

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.025*	0.005	5.005	0.001	0.015	0.034
$R_{mt}-R_{ft}$	0.753*	0.081	9.247	0.001	0.593	0.914
$SMB_t$	0.007	0.017	0.426	0.670	-0.026	0.040
$HML_t$	-0.046*	0.015	-3.015	0.003	-0.076	-0.016

\*Significant at 5% level of significance

When compared to the total IPO portfolio, the coefficient of the  $R_{mt}-R_{ft}$  remains significant with a lower value of 0.753. The t-value reduces slightly to 9.247 with a small p-value of 0.001. The  $HML_t$  portfolio has a negative coefficient of -0.046 that is significant with a t-value of -3.015 and a p-value of 0.003. However the  $SMB_t$  portfolio with a coefficient of 0.007 now becomes insignificant with a low t-value of 0.426 and a high p-value of 0.670.

The R-square value is now reduced to 0.392 and is indicative of the fact that the model does not do a very good job explaining the above set of returns. This is supported by the Standard Error of Estimate which has now increased slightly to 0.065 compared to 0.060 for the total IPO sample.

In summary, there is evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the BL portfolio, over-performed the market over a period of five

years after listing with an average annual abnormal performance of 0.300%. Only the  $R_{mt}-R_{ft}$  factor and the  $HML_t$  portfolio retain their significant ability to explain the returns of the BL portfolio, while the  $SMB_t$  portfolio is unable to explain the returns of the BL portfolio.

#### 5.4.2.4. SH portfolio

The SH portfolio represents IPO stocks that belong to the small stocks portfolio as well as the high book-to-market value portfolio. The results of the regression equation are presented in Table 12 below.

Table 12: Results of the regression of the SH portfolio on the original Fama-French factors

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.976	0.952	0.952	0.076			

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.008	0.006	1.432	0.154	-0.003	0.020
$R_{mt}-R_{ft}$	0.898*	0.096	9.344	0.001	0.709	1.088
$SMB_t$	1.074*	0.020	54.263	0.001	1.035	1.113
$HML_t$	0.330*	0.018	18.444	0.001	0.295	0.366

\*Significant at 5% level of significance

The positive value of  $\alpha_p$  (0.008) appears to show that IPO stocks that belong to the SH portfolio have over-performed the market over the period 1992-to-2010. This finding is however insignificant and the null hypothesis of  $\alpha_p$  being zero cannot be rejected at the 5% level of significance. This is supported by a fairly low t-value of 1.432 and a

correspondingly high p-value (0.154) that indicates that  $\alpha_p$  is not significantly different from zero.

When compared to the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remains significant with a higher value of 0.898. The t-value reduces slightly to 9.344 with a small p-value of 0.001. The  $SMB_t$  portfolio has a significant coefficient of 1.074 with a high t-value of 54.263 and a correspondingly low p-value of 0.001. The  $HML_t$  portfolio is also significant with a coefficient of 0.330 that is supported by a high t-value of 18.444 and a low p-value of 0.001. The coefficient and significance of the  $HML_t$  portfolio shows the existence of a book-to-market effect in the explanation of the SH portfolio returns. The t-values are all over nine standard errors away from zero indicating the strong ability of these factors to capture the variation in stock returns.

The R-square value now increases to 0.952 and is indicative of the fact that the model does a very job explaining the above set of returns. This is not supported by the Standard Error of Estimate which has now increased to 0.076 compared to 0.060 for the total IPO sample.

In summary, there is no evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the SH portfolio, over-performed or underperformed the market over a period of five years after listing. However all three

Fama-French factors retain a strong and significant ability to explain the returns of the SH portfolio.

#### 5.4.2.5. SM portfolio

The SM portfolio represents IPO stocks that belong to the small stocks portfolio as well as the medium book-to-market value portfolio. The results of the regression equation are presented in Table 13 below.

The positive value of  $\alpha_p$  (0.063) shows that IPO stocks that belong to the SM portfolio have over-performed the market over the period 1992-to-2010 with an average annual abnormal performance of 0.756%. This finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This is supported by a fairly high t-value of 6.192 and a correspondingly low p-value (0.001) that indicates that  $\alpha_p$  is significantly different from zero.

Table 13: Results of the regression of the SM portfolio on the original Fama-French factors

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.976	0.953	0.952	0.134			

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.063*	0.010	6.192	0.001	0.043	0.083
$R_{mt} - R_{ft}$	1.481*	0.169	8.781	0.001	1.148	1.813
$SMB_t$	1.878*	0.035	54.089	0.001	1.810	1.947
$HML_t$	0.550*	0.031	17.491	0.001	0.488	0.612

\*Significant at 5% level of significance

When compared to the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remains significant with a higher value of 1.481. The t-value reduces slightly to 8.781 with a small p-value of 0.001. The  $SMB_t$  portfolio has a significant coefficient of 1.878 with a high t-value of 54.089 and a correspondingly low p-value of 0.001. The  $HML_t$  portfolio is also significant with a coefficient of 0.550 and a high t-value of 17.491 and a low p-value of 0.001. The coefficient and significance of the  $HML_t$  proxy portfolio shows the existence of a book-to-market effect in the explanation of the SM portfolio returns. The t-values are all over eight standard errors away from zero indicating the strong ability of these factors to capture the variation in stock returns.

The R-square value now increases to 0.953 and is indicative of the fact that the model does a very job explaining the above set of returns. However this is not supported by the Standard Error of Estimate which has now increased to 0.134 compared to 0.060 for the total IPO sample.

In summary, there is strong evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the SM portfolio, over-performed the market over a period of five years after listing with an average annual abnormal return of 0.756%. Moreover all three Fama-French factors retain a strong and significant ability to explain the returns of the SM portfolio.

#### 5.4.2.6. SL portfolio

The SL portfolio represents IPO stocks that belong to the small stocks portfolio as well as the low book-to-market value portfolio. The results of the regression equation are presented in Table 14 below.

Table 14: Results of the regression of the SL portfolio on the original Fama-French factors

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.994	0.988	0.988	0.057

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	-0.020*	0.004	-4.606	0.001	-0.029	-0.012
$R_{mt}-R_{ft}$	0.076	0.072	1.052	0.294	-0.066	0.218
$SMB_t$	0.513*	0.015	34.570	0.001	0.484	0.543
$HML_t$	-0.789*	0.013	-58.701	0.001	-0.815	-0.762

\*Significant at 5% level of significance

For the first time  $\alpha_p$  has a negative value (-0.020) which shows that IPO stocks that belong to the SL portfolio have under-performed the market over the period 1992-to-2010 with an average annual abnormal performance of -0.240%. This finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This is supported by a fairly high t-value of -4.606 and a correspondingly low p-value (0.001) that indicates that  $\alpha_p$  is significantly different from zero.

Moreover when compared to the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  has reduced to a lower value of 0.076. It has now become insignificant with a low t-value of 1.052 and a high p-value of 0.294. The  $SMB_t$  portfolio has a significant coefficient of 0.513 with a high t-value of 34.570 and a correspondingly low p-value of 0.001. The  $HML_t$  portfolio is also significant with a coefficient of -0.789 and a high t-value of -58.701 and a low p-value of 0.001. The t-values are all over 34 standard errors away from zero for the  $SMB_t$  and  $HML_t$  portfolios indicating their continued strong ability to capture the variation in stock returns.

The R-square value now increases to 0.988 and is indicative of the fact that the model does a very job explaining the above set of returns. This is supported by the Standard Error of Estimate which has now decreased slightly to 0.057 compared to 0.060 for the total IPO sample.

In summary, there is strong evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the SL portfolio, underperformed the market over a period of five years after listing with an annual average abnormal return of -0.240%. Only the  $SMB_t$  and  $HML_t$  portfolios retain a strong and significant ability to explain the returns of the SL portfolio.

#### 5.4.2.7. Overall results for IPO portfolios based on size and book-to-market value

The results show that of the three Fama-French factors, the  $R_{mt}-R_{ft}$  factor remains positive and significant in all portfolios except for the SL portfolio where it loses its significance. Generally the R-square values indicate that the model does a very good job explaining the returns of the small portfolios (SH, SM and SL) compared to the big portfolios (especially the BH and BL) portfolios. The values of the intercepts for these portfolios do not reflect a monotonic (linear increase or decrease) relation from one portfolio to another portfolio.

In summary the results indicate that the null hypothesis that the average monthly abnormal return equals zero can be rejected for the BM, BL and SM portfolios as they over-perform the market with average annual abnormal performances of 0.312%, 0.300% and 0.756% respectively over the period. Similarly the null hypothesis that the average monthly abnormal return equals zero can be rejected for the SL portfolio as it under-performs the market with an average annual abnormal performance of -0.240% over the period.

## 5.5. The long-run performance of IPOs using the calendar time portfolio approach and the extended Fama-French factors

### 5.5.1. Total IPO portfolio for the period 1992 to 2010

It has already been established in Section 5.4.1 that IPOs that listed between 1992 and 2010 do not underperform or over-perform the market over a five year period after listing when the traditional Fama-French factors are used. Hypothesis 2 seeks to understand the impact on the long-run performance of IPOs when additional factors are added to the traditional Fama-French factors. In particular this study seeks to understand the impact of adding the factors associated with the levels of liquidity ( $PVOL_t$  and  $TO_t$ ) and the Carhart momentum factor ( $PRYR_t$ ) as indicated in Section 4.6.2.

The results of regressing the monthly excess portfolio returns,  $R_{pt}-R_{ft}$ , for all portfolios over the period 1992-2010 over the  $R_{mt}-R_{ft}$ , the  $SMB_t$ , the  $HML_t$ , the  $TO_t$ , the  $PVOL_t$  and the  $PRYR_t$ , proxy portfolios is shown in Table 15 below.

The intercept  $\alpha_p$  now has a positive value of 0.008 compared to the negative intercept (-0.002) that was obtained for the traditional Fama-French factors in Section 5.4.1. This suggests that the addition of the liquidity factors and the Carhart momentum factor has resulted in a positive sign for  $\alpha_p$  that appears to show that the IPOs now over-

perform the market over a five period after listing. However this finding is not significant at the 5% level of significance. This follows from the fact that the t-value is a low 1.039 with a correspondingly high p-value of 0.301. Therefore the null hypothesis that IPOs have zero average monthly abnormal returns cannot be rejected for this sample.

Table 15: Results of the regression of the total IPO portfolios on the extended Fama-French factors

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.984	0.968	0.966	0.055

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.008	0.008	1.039	0.301	-0.007	0.023
$R_{mt}-R_{ft}$	0.891*	0.081	11.026	0.001	0.731	1.051
$SMB_t$	0.520*	0.041	12.703	0.001	0.439	0.601
$HML_t$	0.011	0.030	0.361	0.719	-0.049	0.071
$PRYR_t$	-0.095	0.054	-1.755	0.082	-0.202	0.012
$TO_t$	0.089*	0.039	2.262	0.026	0.011	0.167
$PVOL_t$	0.031	0.017	1.833	0.070	-0.003	0.065

\*Significant at 5% level of significance

The addition of the new factors has also resulted in  $R_{mt}-R_{ft}$  being a stronger explanatory factor as its coefficient has increased from 0.811 to 0.891. It is still significant with a t-value of 11.026 and a p-value of 0.001. The coefficient of  $SMB_t$  on the other hand has decreased from 0.631 to 0.520, but still remains a significant explanatory factor with a t-value of 12.703 and a p-value of 0.001. While both  $R_{mt}-R_{ft}$  and  $SMB_t$  have t-values that are more than 11 standard errors away from zero,  $HML_t$  has become insignificant with a low t-value of 0.361 and a high p-

value of 0.719. The coefficient of  $HML_t$  has also reduced from 0.083 to 0.011.

Contrary to expectations the liquidity factor  $TO_t$  has a positive coefficient of 0.089 and is significant with a modest t-value of 2.262 and a low p-value of 0.026. While  $TO_t$  has a t-value that is more than two standard errors away from zero,  $PVOL_t$  has a low t-value that is less than two standard errors away from zero (1.833). Combined with a p-value of 0.070, the liquidity factor  $PVOL_t$  is weak and insignificant as an explanatory factor. The Carhart momentum factor  $PRYR_t$  with a coefficient of -0.095 is also insignificant.  $PRYR_t$  has a modest t-value of -1.755 that is less than two standard errors away from zero and a p-value of 0.082.

The addition of the liquidity factors and the Carhart momentum factor has also resulted in a higher R-square value of 0.968 compared to the value of 0.936 for the original three factor Fama-French equation. Further support that the addition of the new factors has increased the explanatory power of the model comes from the fact that the Standard Error of Estimate for the model has now decreased slightly to 0.055 from the initial value of 0.060 for the total IPO sample (using the original Fama-French factors).

In summary, IPOs that listed between 1992 and 2010 do not underperform or over-perform the market over a five year period after

listing even after the liquidity related factors and a Carhart momentum factor are considered. Of the original three Fama-French factors only the  $R_{mt}-R_{ft}$  and  $SMB_t$  factors are significant. In addition the liquidity factor  $TO_t$  is significant but has a positive relation with the  $R_{pt}-R_{ft}$ .

### **5.5.2. IPO portfolios in terms of size and rand value of trade**

Naturally the next step would be to investigate if the IPO stock underperformed or over-performed the market over a five year period when categorised in terms of size and rand value of trade (PVOL). The six different size and rand value of trade (PVOL) based portfolios are the BHV, BMV, BLV, SHV, SMV and SLV portfolios. This section presents the results of regressing the returns of the six different size and rand value of trade (PVOL) based portfolios for each month over the period between 1992 and 2010 over the extended Fama-French factors.

#### **5.5.2.1. BHV Portfolio**

The BHV portfolio represents IPO stocks that belong to the big stocks portfolio as well as the high rand value of trade portfolio. The results of the regression equation are presented in Table 16 below.

The positive value of  $\alpha_p$  (0.025) shows that IPO stocks that belong to the BHV portfolio have over-performed the market over the period

1992-to-2010 with an average annual abnormal return of 0.300%. This finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This follows from the fairly large t-value (3.321) and correspondingly low p-value (0.001) that indicates that  $\alpha_p$  is significantly different from zero.

Table 16: Results of the regression of the BHV portfolio on the extended Fama-French factors

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.754	0.569	0.546	0.055			

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.025*	0.008	3.321	0.001	0.010	0.040
$R_{mt}-R_{ft}$	0.892*	0.080	11.163	0.001	0.734	1.051
$SMB_t$	0.015	0.040	0.381	0.704	-0.065	0.096
$HML_t$	-0.009	0.030	-0.295	0.768	-0.068	0.050
$PRYR_t$	-0.075	0.053	-1.410	0.161	-0.181	0.031
$TO_t$	-0.015	0.039	-0.398	0.692	-0.093	0.062
$PVOL_t$	0.001	0.017	0.087	0.931	-0.032	0.035

\*Significant at 5% level of significance

When compared to results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remains stable and significant with a value of 0.892. The t-value remains fairly stable at 11.163 with a p-value of 0.001. None of the other factors ( $SMB_t$ ,  $HML_t$ ,  $PRYR_t$ ,  $PVOL_t$  and  $TO_t$ ) appear to have significant explanatory coefficients as they all have t-values that are less than two standard errors from zero and fairly high p-values.

The R-square value of the model now drops to 0.569 compared 0.968 for the extended Fama-French equation for the total IPO portfolio. This is indicative of the fact that the model does not do a very good job of explaining the above set of returns. This is not supported by the Standard Error of Estimate, which remains unchanged at 0.055 compared to the total IPO sample (for the extended Fama-French factors).

In summary, there is evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the BHV portfolio, over-performed the market over a period of five years after listing with an average annual abnormal return of 0.300%. Of all the explanatory factors, only  $R_{mt}-R_{ft}$  retains its significant ability to explain the returns of the BHV portfolio. In addition the extended Fama-French model is only able to explain 56.9% of the observed BHV portfolio returns.

#### **5.5.2.2. BMV Portfolio**

The BMV portfolio represents IPO stocks that belong to the big stocks portfolio as well as the medium rand value of trade portfolio. The results of the regression equation are presented in Table 17 below.

The positive value of  $\alpha_p$  (0.033) shows that IPO stocks that belong to the BMV portfolio have over-performed the market over the period

1992-to-2010 with an average annual abnormal return of 0.396%. This finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This follows from the fairly large t-value (3.238) and correspondingly low p-value (0.002) that indicates that  $\alpha_p$  is significantly different from zero.

Table 17: Results of the regression of the BMV portfolio on the extended Fama-French factors

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.965	0.930	0.927	0.074			

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.033*	0.010	3.238	0.002	0.013	0.053
$R_{mt}-R_{ft}$	1.067*	0.107	9.934	0.001	0.854	1.280
$SMB_t$	0.318*	0.054	5.848	0.001	0.210	0.426
$HML_t$	-0.020	0.040	-0.487	0.627	-0.099	0.060
$PRYR_t$	-0.104	0.072	-1.444	0.152	-0.246	0.039
$TO_t$	0.298*	0.052	5.697	0.001	0.194	0.401
$PVOL_t$	0.023	0.023	1.021	0.309	-0.022	0.068

\*Significant at 5% level of significance

When compared to the results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  has increased to a value of 1.067. The t-value has slightly reduced to 9.934 with a p-value of 0.001. The coefficient of  $SMB_t$  now has a significant value of 0.318 with a corresponding t-value of 5.848 and a p-value of 0.001. Contrary to expectations  $TO_t$  again has a significant positive coefficient (0.298) with a t-value of 5.697 and a p-value of 0.001. While the above significant factors have t-values over five standard errors, none of the other factors ( $HML_t$ ,  $PRYR_t$  and  $PVOL_t$ ) appear to have significant

explanatory coefficients as they all have t-values that are less than two standard errors from zero and fairly high p-values.

The R-square value of the model now drops to 0.930 compared to 0.968 for the extended Fama-French equation for the total IPO portfolio. Despite this, the model still does a very good job of explaining the above set of returns. This is supported by the Standard Error of Estimate which has increased to 0.074 compared to 0.055 (for the extended Fama-French factors).

In summary, there is evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the BMV portfolio, over-performed the market over a period of five years after listing with an average annual abnormal return of 0.396%. Of all the explanatory factors, only  $R_{mt}-R_{ft}$  and  $SMB_t$  retain their significant ability to explain the returns of the BMV portfolio. In addition the  $TO_t$  is significant and has a positive relation with the returns of BMV portfolio.

### 5.5.2.3. BLV Portfolio

The BLV portfolio represents IPO stocks that belong to the big stocks portfolio as well as the low rand value of trade portfolio. The results of the regression equation are presented in Table 18 below.

The positive value of  $\alpha_p$  (0.012) appears to show that IPO stocks that belong to the BLV portfolio have over-performed the market over the period 1992-to-2010. This finding is however insignificant and the null hypothesis of  $\alpha_p$  being zero cannot be rejected at the 5% level of significance. This follows from the fairly low t-value (0.875) and correspondingly high p-value (0.384) that indicates that  $\alpha_p$  is not significantly different from zero.

Table 18: Results of the regression of the BLV portfolio on the extended Fama-French factors

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.406	0.165	0.119	0.096

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.012	0.013	0.875	0.384	-0.015	0.038
$R_{mt}-R_{ft}$	0.434*	0.140	3.091	0.003	0.156	0.712
$SMB_t$	-0.183*	0.071	-2.578	0.011	-0.324	-0.042
$HML_t$	-0.123*	0.052	-2.339	0.021	-0.227	-0.019
$PRYR_t$	-0.115	0.094	-1.228	0.222	-0.301	0.071
$TO_t$	0.103	0.068	1.500	0.136	-0.033	0.238
$PVOL_t$	0.030	0.030	0.998	0.320	-0.029	0.089

\*Significant at 5% level of significance

When compared to results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remains significant with a reduced coefficient of 0.434. The t-value reduces to 3.091 with a p-value of 0.003. The coefficient of  $SMB_t$  becomes significant and negative (-0.183) and is supported by a t-value of -2.578 and a p-value of 0.011. This is supportive of a size effect in the explanation of the BHV portfolio returns. In addition the coefficient of  $HML_t$  also becomes

significant and negative (-0.123) and is supported by a t-value of -2.339 and a p-value of 0.021. None of the other factors ( $PRYR_t$ ,  $PVOL_t$  and  $TO_t$ ) have significant explanatory coefficients as they all have t-values that are less than two standard errors from zero and fairly high p-values.

The R-square value of the model now drops drastically to 0.165 compared to 0.968 for the extended Fama-French equation for the total IPO portfolio. This is indicative of the fact that the model does not do a very good job of explaining the above set of returns. This is supported by the Standard Error of Estimate which has increased to a value of 0.096 compared to 0.055 (for the extended Fama-French factors).

In summary, there is no evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the BLV portfolio, over-performed or underperformed the market over a period of five years after listing. Of all the explanatory factors, only  $R_{mt}-R_{ft}$ ,  $SMB_t$  and  $HML_t$  retain their significant ability to explain the returns of the BLV portfolio. In addition the extended Fama-French model is only able to explain 16.5% of the observed BLV portfolio returns.

#### 5.5.2.4. SHV Portfolio

The SHV portfolio represents IPO stocks that belong to the small stocks portfolio as well as the high rand value of trade portfolio. The results of the regression equation are presented in Table 19 below.

The positive value of  $\alpha_p$  (0.011) appears to show that IPO stocks that belong to the SHV portfolio have over-performed the market over the period 1992-to-2010. This finding is however insignificant and the null hypothesis of  $\alpha_p$  being zero cannot be rejected at the 5% level of significance. This follows from the fairly low t-value (0.763) and correspondingly high p-value (0.447) that indicates that  $\alpha_p$  is not significantly different from zero.

Table 19: Results of the regression of the SHV portfolio on the extended Fama-French factors

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.991	0.982	0.981	0.102

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.011	0.014	0.763	0.447	-0.017	0.039
$R_{mt}-R_{ft}$	0.340*	0.148	2.293	0.024	0.046	0.635
$SMB_t$	0.798*	0.075	10.619	0.001	0.649	0.947
$HML_t$	-0.022	0.055	-0.400	0.690	-0.132	0.088
$PRYR_t$	-0.026	0.099	-0.264	0.793	-0.223	0.170
$TO_t$	0.559*	0.072	7.743	0.001	0.416	0.702
$PVOL_t$	-1.885*	0.031	-59.932	0.001	-1.947	-1.823

\*Significant at 5% level of significance

When compared to the results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remains significant with a reduced coefficient of 0.340. The t-value reduces to 2.293 with a p-value of 0.024. The coefficient of  $SMB_t$  becomes significant with a coefficient of 0.798 that is supported by a t-value of 10.619 and a p-value of 0.001. In addition both the liquidity factors have significant coefficients.  $TO_t$  has a coefficient of 0.559 with a t-value of 7.743 and a p-value of 0.001. As expected,  $PVOL_t$  has a negative coefficient of -1.885 with a large t-value of -59.932 and a small p-value of 0.001. None of the other factors ( $PRYR_t$  and  $HML_t$ ) have significant explanatory coefficients as they all have t-values that are less than one standard error from zero and fairly high p-values.

The R-square value of the model now increases to 0.982 compared 0.968 for the extended Fama-French equation for the total IPO portfolio. This is indicative of the fact that the model does a very good job of explaining the above set of returns. This is not supported by the Standard Error of Estimate which has now increased to a value of 0.102 compared to 0.055 (for the extended Fama-French factors).

In summary, there is no evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the SHV portfolio, over-performed or underperformed the market over a period of five years after listing. Of all the explanatory factors,  $R_{mt}-R_{ft}$  and  $SMB_t$  retain their significant ability to explain the

returns of the SHV portfolio. In addition both the liquidity factors  $TO_t$  and  $PVOL_t$  are significant, with  $PVOL_t$  showing a negative relation with the SHV portfolio returns as expected.

### 5.5.2.5. SMV Portfolio

The SMV portfolio represents IPO stocks that belong to the small stocks portfolio as well as the medium rand value of trade portfolio. The results of the regression equation are presented in Table 20 below.

Table 20: Results of the regression of the SMV portfolio on the extended Fama-French factors

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.989	0.978	0.976	0.087			

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.036*	0.012	2.979	0.004	0.012	0.059
$R_{mt}-R_{ft}$	1.221*	0.126	9.664	0.001	0.971	1.471
$SMB_t$	1.088*	0.064	16.998	0.001	0.961	1.215
$HML_t$	0.040	0.047	0.857	0.393	-0.053	0.134
$PRYR_t$	-0.270*	0.084	-3.198	0.002	-0.437	-0.103
$TO_t$	-0.294*	0.061	-4.776	0.001	-0.415	-0.172
$PVOL_t$	0.238*	0.027	8.877	0.001	0.185	0.291

\*Significant at 5% level of significance

The positive value of  $\alpha_p$  (0.036) shows that IPO stocks that belong to the SMV portfolio have over-performed the market over the period 1992-to-2010 with an average annual abnormal return of 0.432%. This finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This follows from the t-value

(2.979) and the correspondingly low p-value (0.004) that indicates that the intercept  $\alpha_p$  is significantly different from zero.

When compared to results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remains significant with an increased coefficient of 1.221. The t-value is now 9.664 with a p-value of 0.001. The coefficient of  $SMB_t$  becomes significant with a coefficient of 1.088 that is supported by a t-value of -16.998 and a p-value of 0.001.

In addition both the liquidity factors have significant coefficients. As expected,  $TO_t$  has a negative coefficient of -0.294 with a t-value of -4.776 and a p-value of 0.001.  $PVOL_t$  has a coefficient of 0.238 with a t-value of 8.877 and a small p-value of 0.001. For the first time the  $PRYR_t$  factor has a significant negative coefficient of -0.270 with a t-value of -3.198 and a p-value of 0.002.  $HML_t$  is the only factor that doesn't have a significant explanatory coefficient as it has a t-value that is less than one standard error from zero and a fairly high p-value.

The R-square value of the model now increases to 0.978 compared to 0.968 for the extended Fama-French equation for the total IPO portfolio. This is indicative of the fact that the model does a very good job of explaining the above set of returns. This is not supported by the Standard Error of Estimate which has now increased to a value of 0.087 compared to 0.055 (for the extended Fama-French factors).

In summary, there is evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the SMV portfolio, over-performed the market over a period of five years after listing with an average annual abnormal return of 0.432%. Of all the explanatory factors,  $R_{mt}-R_{ft}$  and  $SMB_t$  retain their significant ability to explain the returns of the SMV portfolio. In addition both the liquidity factors  $TO_t$  and  $PVOL_t$  are significant, with  $TO_t$  showing a negative relation with the SMV portfolio returns as expected.

### 5.5.2.6. SLV Portfolio

The SLV portfolio represents IPO stocks that belong to the small stocks portfolio as well as the low rand value of trade portfolio. The results of the regression equation are presented in Table 21 below.

Table 21: Results of the regression of the SLV portfolio on the extended Fama-French factors

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.992	0.983	0.983	0.081			

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.024*	0.011	2.175	0.032	0.002	0.046
$R_{mt}-R_{ft}$	0.799*	0.118	6.790	0.001	0.566	1.032
$SMB_t$	0.997*	0.060	16.737	0.001	0.879	1.115
$HML_t$	0.092*	0.044	2.087	0.039	0.005	0.179
$PRYR_t$	0.014	0.079	.175	0.861	-0.142	0.169
$TO_t$	0.441*	0.057	7.710	0.001	0.328	0.555
$PVOL_t$	0.087*	0.025	3.477	0.001	0.037	0.136

\*Significant at 5% level of significance

The positive value of  $\alpha_p$  (0.024) shows that IPO stocks that belong to the SLV portfolio have over-performed the market over the period 1992-to-2010 with an average annual abnormal return of 0.288%. This finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This follows from the t-value (2.175) and correspondingly low p-value (0.032) that indicates that  $\alpha_p$  is significantly different from zero.

When compared to results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remain significant with a coefficient of 0.799. The t-value is now 6.790 with a p-value of 0.001. The coefficient of  $SMB_t$  becomes significant with a coefficient of 0.997 that is supported by a t-value of 16.737 and a p-value of 0.001.

The coefficient of  $HML_t$  becomes significant with a coefficient of 0.092 that is supported by a t-value of 2.087 and a p-value of 0.039. In addition both the liquidity factors have significant coefficients.  $TO_t$  has a coefficient of 0.441 with a t-value of 7.710 and a p-value of 0.001.  $PVOL_t$  has a coefficient of 0.087 with a t-value of 3.477 and a small p-value of 0.001.  $PRYR_t$  is the only factor that doesn't have a significant explanatory coefficient as it has a t-value that is less than one standard error from zero and a fairly high p-value.

The R-square value of the model now increases to its highest value of 0.983, compared to 0.968 for the extended Fama-French equation for

the total IPO portfolio. This is indicative of the fact that the model does a very good job of explaining the above set of returns. This is not supported by the Standard Error of Estimate which has increased to a value of 0.081 compared to 0.055 (for the extended Fama-French factors).

In summary, there is evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the SLV portfolio, over-performed the market over a period of five years after listing with an average annual abnormal return of 0.288%. Of all the explanatory factors,  $R_{mt}-R_{ft}$ ,  $HML_t$  and  $SMB_t$  retain their significant ability to explain the returns of the SLV portfolio. In addition both the liquidity factors  $TO_t$  and  $PVOL_t$  are significant and show a positive relation with the SLV portfolio returns.

### **5.5.3. IPO portfolios in terms of size and turnover**

The six different size and turnover (TO) based portfolios are the BHT, BMT, BLT, SHT, SMT and SLT portfolios. This section presents the results of regressing the returns of the six different size and turnover (TO) based portfolios for each month over the period between 1992 and 2010 over the extended Fama-French factors.

### 5.5.3.1. BHT Portfolio

The BHT portfolio represents IPO stocks that belong to the big stocks portfolio as well as the high turnover portfolio. The results of the regression equation are presented in Table 22 below.

The positive value of  $\alpha_p$  (0.037) show that IPO stocks that belong to the BHT portfolio have over-performed the market over the period 1992-to-2010 with an average annual abnormal return of 0.444%. This finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This follows from the fairly large t-value (3.691) and correspondingly low p-value (0.001) that indicates that  $\alpha_p$  is significantly different from zero.

Table 22: Results of the regression of the BHT portfolio on the extended Fama-French factors

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.701	0.492	0.464	0.072

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.037*	0.010	3.691	0.001	0.017	0.057
$R_{mt}-R_{ft}$	0.975*	0.106	9.241	0.001	0.766	1.184
$SMB_t$	0.052	0.053	0.971	0.334	-0.054	0.158
$HML_t$	0.003	0.039	0.082	0.934	-0.075	0.081
$PRYR_t$	-0.102	0.070	-1.448	0.151	-0.242	0.038
$TO_t$	-0.035	0.051	-0.675	0.501	-0.136	0.067
$PVOL_t$	-0.002	0.022	-0.096	0.924	-0.046	0.042

\*Significant at 5% level of significance

When compared to results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remain significant with an increased value of 0.975. The t-value is 9.241 with a p-value of 0.001. None of the other factors ( $SMB_t$ ,  $HML_t$ ,  $PRYR_t$ ,  $PVOL_t$  and  $TO_t$ ) appear to have significant explanatory coefficients as they all have t-values that are less than two standard errors from zero and fairly high p-values.

The R-square value of the model now drops to 0.492 compared to 0.968 for the extended Fama-French equation for the total IPO portfolio. This is indicative of the fact that the model does not do a very good job of explaining the above set of returns. This is supported by the Standard Error of Estimate which has increased to 0.072 compared to 0.055 (for the extended Fama-French factors).

In summary, there is evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the BHT portfolio, over-performed the market over a period of five years after listing with an average annual abnormal return of 0.444%. Of all the explanatory factors, only  $R_{mt}-R_{ft}$  retains its significant ability to explain the returns of the BHT portfolio. In addition the extended Fama-French model is only able to explain 49.2% of the observed BHT portfolio returns.

### 5.5.3.2. BMT Portfolio

The BMT portfolio represents IPO stocks that belong to the big stocks portfolio as well as the medium turnover portfolio. The results of the regression equation are presented in Table 23 below.

The positive value of  $\alpha_p$  (0.028) shows that IPO stocks that belong to the BMV portfolio have over-performed the market over the period 1992-to-2010 with an average annual abnormal return of 0.336%. This finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This follows from the fairly large t-value (3.020) and correspondingly low p-value (0.003) that indicates that  $\alpha_p$  is significantly different from zero.

Table 23: Results of the regression of the BMT portfolio on the extended Fama-French factors

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.953	0.908	0.903	0.067

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.028*	0.009	3.020	0.003	0.010	0.046
$R_{mt}-R_{ft}$	1.003*	0.098	10.238	0.001	0.809	1.198
$SMB_t$	0.303*	0.050	6.114	0.001	0.205	0.402
$HML_t$	0.023	0.037	0.630	0.530	-0.050	0.096
$PRYR_t$	-0.030	0.065	-0.454	0.651	-0.159	0.100
$TO_t$	0.171*	0.048	3.592	0.001	0.077	0.266
$PVOL_t$	0.028	0.021	1.338	0.184	-0.013	0.069

\*Significant at 5% level of significance

When compared to results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  has increased to a value of 1.003. The t-value of 10.238 with a p-value of 0.001 makes this coefficient significant. The coefficient of  $SMB_t$  now has a significant value of 0.303 with a corresponding t-value of 6.114 and a p-value of 0.001. Contrary to expectations  $TO_t$  has a significant positive coefficient (0.171) with a t-value of 3.592 and a p-value of 0.001. While the above significant factors have t-values over three standard errors, none of the other factors ( $HML_t$ ,  $PRYR_t$  and  $PVOL_t$ ) appear to have significant explanatory coefficients as they all have t-values that are less than two standard errors from zero and fairly high p-values.

The R-square value of the model now drops to 0.908 compared to 0.968 for the extended Fama-French equation for the total IPO portfolio. Despite this, the model still does a very good job of explaining the above set of returns. This is supported by the Standard Error of Estimate which has increased to 0.067 compared to 0.055 (for the extended Fama-French factors).

In summary, there is evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the BMT portfolio, over-performed the market over a period of five years after listing with an average annual abnormal return of 0.336%. Of all the explanatory factors the  $R_{mt}-R_{ft}$  and  $SMB_t$  retain their significant ability to explain the returns of the BMT portfolio. In addition

the liquidity factor  $TO_t$  is significant and has a positive relation with the returns of BMT portfolio.

### 5.5.3.3. BLT Portfolio

The BLT portfolio represents IPO stocks that belong to the big stocks portfolio as well as the low turnover portfolio. The results of the regression equation are presented in Table 24 below.

Table 24: Results of the regression of the BLT portfolio on the extended Fama-French factors

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.757	0.573	0.550	0.059			

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.013	0.008	1.642	0.103	-0.003	0.030
$R_{mt}-R_{ft}$	0.604*	0.087	6.969	0.001	0.432	0.775
$SMB_t$	-0.196*	0.044	-4.466	0.001	-0.283	-0.109
$HML_t$	-0.181*	0.032	-5.599	0.001	-0.245	-0.117
$PRYR_t$	-0.157*	0.058	-2.712	0.008	-0.271	-0.042
$TO_t$	0.261*	0.042	6.197	0.001	0.178	0.345
$PVOL_t$	0.010	0.018	0.546	0.586	-0.026	0.046

\*Significant at 5% level of significance

The positive value of  $\alpha_p$  (0.013) appears to show that IPO stocks that belong to the BLT portfolio have over-performed the market over the period 1992-to-2010. This finding is however insignificant and the null hypothesis of  $\alpha_p$  being zero cannot be rejected at the 5% level of significance. This follows from the fairly low t-value (1.642) and

correspondingly high p-value (0.103) that indicates that  $\alpha_p$  is not significantly different from zero.

When compared to results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remains significant with a reduced coefficient of 0.604. The t-value reduces to 6.969 with a p-value of 0.001. The coefficient of  $SMB_t$  becomes significant with a negative coefficient of -0.196 that is supported by a t-value of -4.466 and a p-value of 0.001. This is indicative of a size effect in the explanation of the BLT returns.  $PRYR_t$  with a negative coefficient of -0.157 is also significant with a t-value of -2.712 and a p-value of 0.008. In addition the liquidity factor  $TO_t$  also has a coefficient of 0.261 that is significant with a t-value of 6.197 and a p-value of 0.001. Only  $PVOL_t$  doesn't have a significant explanatory coefficient as its t-value is less than one standard error from zero and has a fairly high p-value.

The R-square value of the model now drops to 0.573 compared to 0.968 for the extended Fama-French equation for the total IPO portfolio. This is indicative of the fact that the model does not do a very good job of explaining the above set of returns. This is supported by the Standard Error of Estimate which has increased slightly to 0.059 compared to 0.055 (for the extended Fama-French factors).

In summary, there is no evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and

categorised under the BLT portfolio, over-performed or underperformed the market over a period of five years after listing. Of all the explanatory factors  $R_{mt}-R_{ft}$ ,  $SMB_t$ ,  $HML_t$  and  $PRYR_t$  retain their significant ability to explain the returns of the BLT portfolio. The liquidity factor  $TO_t$  is significant and has a positive relation with the returns of the BLT portfolio. In addition the extended Fama-French model is only able to explain 55.0% of the observed BLT portfolio returns.

#### 5.5.3.4. SHT Portfolio

The SHT portfolio represents IPO stocks that belong to the small stocks portfolio as well as the high turnover portfolio. The results of the regression equation are presented in Table 25 below.

Table 25: Results of the regression of the SHT portfolio on the extended Fama-French factors

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.981	0.962	0.960	0.081			

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	-0.00004	0.011	-0.004	0.997	-0.022	0.022
$R_{mt}-R_{ft}$	0.521*	0.118	4.406	0.001	0.287	0.756
$SMB_t$	0.642*	0.060	10.723	0.001	0.524	0.761
$HML_t$	-0.179*	0.044	-4.057	0.001	-0.267	-0.092
$PRYR_t$	-0.069	0.079	-0.877	0.382	-0.226	0.087
$TO_t$	-1.025*	0.058	-17.804	0.001	-1.139	-0.910
$PVOL_t$	0.084*	0.025	3.344	0.001	0.034	0.133

\*Significant at 5% level of significance

For the first time the value of  $\alpha_p$  is negative (-0.00004) and appears to show that IPO stocks that belong to the SHT portfolio have underperformed the market over the period 1992-to-2010. This finding is however insignificant and the null hypothesis of  $\alpha_p$  being zero cannot be rejected at the 5% level of significance. This follows from the fairly low t-value (-0.004) and correspondingly high p-value (0.997) that indicates that  $\alpha_p$  is not significantly different from zero.

When compared to the results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remains significant with a reduced coefficient of 0.521. The t-value reduces to 4.406 with a p-value of 0.001. The coefficient of  $SMB_t$  becomes significant with a value of 0.642 that is supported by a t-value of 10.723 and a p-value of 0.001. The coefficient of  $HML_t$  is also negative and significant with a value of -0.179 that is supported by a t-value of -4.057 and a p-value of 0.001.

In addition both the liquidity factors have significant coefficients. As expected,  $TO_t$  has a negative coefficient of -1.025 with a high t-value of -17.804 and a p-value of 0.001.  $PVOL_t$  has a coefficient of 0.084 with a t-value of 3.344 and a small p-value of 0.001.  $PRYR_t$  is the only variable that doesn't have a significant explanatory coefficient as its t-value is less than one standard error from zero and has a fairly high p-value.

The R-square value of the model reduces to 0.962 compared to 0.968 for the extended Fama-French equation for the total IPO portfolio. This is indicative of the fact that the model still does a very good job of explaining the above set of returns. This is supported by the Standard Error of Estimate which has now increased to a value of 0.081 compared to 0.055 (for the extended Fama-French factors).

In summary, there is no evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the SHT portfolio, over-performed or underperformed the market over a period of five years after listing. Of all the explanatory factors,  $R_{mt}-R_{ft}$ ,  $SMB_t$  and  $HML_t$  retain their significant ability to explain the returns of the SHT portfolio. In addition both the liquidity factors  $TO_t$  and  $PVOL_t$  are significant, with  $TO_t$  showing a negative relation with the SHV portfolio returns as expected.

#### **5.5.3.5. SMT Portfolio**

The SMT portfolio represents IPO stocks that belong to the small stocks portfolio as well as the medium turnover portfolio. The results of the regression equation are presented in Table 26 below.

The positive value of  $\alpha_p$  (0.041) shows that IPO stocks that belong to the SMT portfolio have over-performed the market over the period 1992-to-2010 with an average annual abnormal return of 0.492%. This

finding is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This follows from the t-value (3.380) and correspondingly low p-value (0.001) that indicates that  $\alpha_p$  is significantly different from zero.

Table 26: Results of the regression of the SMT portfolio on the extended Fama-French factors

Model Summary						
R	R Square	Adjusted R Square	Std. Error of the Estimate			
0.991	0.983	0.982	0.089			

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.041*	0.012	3.380	0.001	0.017	0.066
$R_{mt}-R_{ft}$	1.295*	0.129	10.048	0.001	1.040	1.551
$SMB_t$	1.323*	0.065	20.267	0.001	1.194	1.453
$HML_t$	0.291*	0.048	6.045	0.001	0.196	0.387
$PRYR_t$	-0.162	0.086	-1.876	0.063	-0.332	0.009
$TO_t$	0.246*	0.063	3.917	0.001	0.121	0.370
$PVOL_t$	0.017	0.027	0.617	0.539	-0.037	0.071

\*Significant at 5% level of significance

When compared to results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remain significant with an increased value of 1.295. The t-value is now 10.048 with a p-value of 0.001. The coefficient of  $SMB_t$  becomes significant with a value of 1.323 that is supported by a t-value of 20.267 and a p-value of 0.001.  $TO_t$  has a coefficient of 0.246 with a t-value of 3.917 and a p-value of 0.001. Both  $PVOL_t$  and  $PRYR_t$  are insignificant with t-values that are less than two standard errors from zero and with fairly high p-values.

The R-square value of the model now increases to 0.983 compared 0.968 for the extended Fama-French equation for the total IPO portfolio. This is indicative of the fact that the model does a very good job of explaining the above set of returns. This is not supported by the Standard Error of Estimate which has now increased to a value of 0.089 compared to 0.055 (for the extended Fama-French factors).

In summary, there is evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the SMT portfolio, over-performed the market over a period of five years after listing with an average annual abnormal return of 0.492%. Of all the explanatory factors,  $R_{mt}-R_{ft}$ ,  $SMB_t$  and  $HML_t$  retain their significant ability to explain the returns of the SMT portfolio. In addition the liquidity factor  $TO_t$  is significant and shows a positive relation with the SMT portfolio returns.

#### **5.5.3.6. SLT Portfolio**

The SLT portfolio represents IPO stocks that belong to the small stocks portfolio as well as the low turnover portfolio. The results of the regression equation are presented in Table 27 below.

The positive value of  $\alpha_p$  (0.023) shows that IPO stocks that belong to the SLT portfolio have over-performed the market over the period 1992-to-2010 with an average annual abnormal return of 0.276%. This finding

is significant and the null hypothesis of  $\alpha_p$  being zero can be rejected at the 5% level of significance. This follows from the t-value (2.189) and correspondingly low p-value (0.031) that indicates that  $\alpha_p$  is significantly different from zero.

Table 27: Results of the regression of the SLT portfolio on the extended Fama-French factors

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
0.993	0.986	0.986	0.077

Coefficients						
Model	Coefficients		t-value	p-value	95.0% Confidence Interval for $\beta$	
	B	Std. Error			Lower Bound	Upper Bound
$\alpha_p$	0.023*	0.011	2.189	0.031	0.002	0.045
$R_{mt}-R_{ft}$	0.893*	0.113	7.915	0.001	0.669	1.116
$SMB_t$	0.890*	0.057	15.584	0.001	0.777	1.003
$HML_t$	0.005	0.042	0.122	0.903	-0.078	0.089
$PRYR_t$	-0.014	0.075	-0.192	0.848	-0.164	0.135
$TO_t$	0.680*	0.055	12.387	0.001	0.571	0.788
$PVOL_t$	0.072*	0.024	2.998	0.003	0.024	0.119

\*Significant at 5% level of significance

When compared to results for the extended Fama-French equation for the total IPO portfolio, the coefficient of  $R_{mt}-R_{ft}$  remains fairly stable and significant with a value of 0.893. The t-value is now 7.915 with a p-value of 0.001. The coefficient of  $SMB_t$  becomes significant with a value of 0.890 that is supported by a t-value of 15.584 and a p-value of 0.001.

In addition both the liquidity factors have significant coefficients.  $TO_t$  has a coefficient of 0.680 with a t-value of 12.387 and a p-value of 0.001.  $PVOL_t$  has a coefficient of 0.072 with a t-value of 2.998 and a small p-value of 0.003. Both  $PRYR_t$  and the  $HML_t$  factors don't have significant

explanatory coefficients as they have t-values that are less than one standard error from zero and fairly high p-values.

The R-square value of the model now increases to its highest value of 0.986 compared 0.968 for the extended Fama-French equation for the total IPO portfolio. This is indicative of the fact that the model does a very good job of explaining the above set of returns. This is not supported by the Standard Error of Estimate which has increased to 0.077 compared to 0.055 (for the extended Fama-French factors).

In summary, there is evidence to support the alternative hypothesis that the returns of IPOs that listed between 1992 and 2010, and categorised under the SLT portfolio, over-performed the market over a period of five years after listing with an average annual abnormal return of 0.276%. Of all the explanatory factors,  $R_{mt}-R_{ft}$  and  $SMB_t$  retain their significant ability to explain the returns of the SLT portfolio. In addition both the liquidity factors  $TO_t$  and  $PVOL_t$  are significant and show a positive relation with the SLT portfolio returns.

#### **5.5.4. Overall results for IPO portfolios in terms of size and liquidity levels (rand value of trade and turnover)**

The results discussed in Sections 5.5.2 and 5.5.3 above indicate that the regression of the size and turnover based IPO portfolios over the extended Fama-French factors is fairly similar to the regression of IPO

based portfolios based on size and rand value of trade over the extended Fama-French factors. This becomes evident from the fact that in both cases the extended Fama-French model does a better job at explaining the returns of the small portfolios compared to the big portfolios (especially the BHT, BLT, BHV and BLV portfolios).

In addition in both sets of portfolios, the excess market return remains highly significant and positive in all portfolios. Similarly the  $PRYR_t$  portfolio also remains negative in all portfolios except the SLV portfolio. The patterns of average monthly abnormal returns are also fairly similar for comparable portfolios in both sets of portfolios. For example the BHV, BMV, SMV and SLV portfolios over-perform the market with statistically significant average annual abnormal performances of 0.300%, 0.396%, 0.432% and 0.288% respectively. Their compatriot portfolios BHT, BMT, SMT and SLT portfolios also over-perform the market with statistically significant average annual abnormal performances of 0.444%, 0.336%, 0.492% and 0.276% respectively.

Despite these patterns, the values of the intercepts for these portfolios do not reflect a monotonic (linear increase or decrease) as one moves from one portfolio to another portfolio. Interestingly both the liquidity factors  $TO_t$  and  $PVOL_t$  have significant coefficients simultaneously only in the small portfolios of SHV, SMV, SLV, SHT and SLT. The only portfolio in which  $TO_t$  is significant is the BMV, BMT, BLT and SMT portfolios.

## 5.6. Liquidity levels of IPO and Non-IPO stock

In Section 5.4 and Section 5.5 it has been established that for the total IPO sample, there is no evidence to reject the null hypothesis that the average monthly abnormal performance of IPOs is different from zero. In other words IPOs neither over-perform nor underperform the market over a five year period after listing. This fact seems to indicate that the liquidity levels of IPO stock are less than, or equal to the liquidity levels of non-IPO stock, as the risk associated with the liquidity levels has been proposed as one of the key reasons why IPOs underperform the market in the long-run (Eckbo & Norli, 2001, 2005).

This is exactly what Hypothesis 3 seeks to determine by comparing the mean liquidity levels of IPOs with non-IPOs. Section 5.6.1 compares the liquidity levels in terms of rand value of trade,  $PVOL_{IPO}$ , of IPO stock with the  $PVOL_{MATCHED}$ , of non-IPO stock. Section 5.6.2 compares the liquidity levels in terms of turnover,  $TO_{IPO}$ , of IPO stock with the  $TO_{MATCHED}$ , of non-IPO stock.

### 5.6.1. Liquidity levels of IPO and Non-IPO stock in terms of rand value of trade

Each year between 1998 and 2010 the levels of liquidity in terms of the rand value of trade,  $PVOL_{IPO}$ , is computed for all newly listed IPOs.  $PVOL_{IPO}$  is then compared to the rand value of trade of similar size

matched companies that had not issued IPOs in the previous five years ( $PVOL_{MATCHED}$ ). The one-tailed, two sample paired t-test yielded the following results indicated in Table 28 below.

Table 28: Results of the two sample paired t-tests comparing the rand value of trade of IPO firms with Non-IPO firms

Paired Differences							
Pair	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t-value	p-value
				Lower	Upper		
PVOL <sub>IPO</sub> PVOL <sub>MATCHED</sub>	1130328400	21259624000	1321008700	-1471003800	3731660600	0.856	0.393
*Significant at 5% level of significance							

Paired Samples Statistics				
Pair	Mean	N	Std. Deviation	Std. Error Mean
PVOL <sub>IPO</sub>	7117212000	259	2.4208180E10	1.5042231E9
PVOL <sub>MATCHED</sub>	5986884000	259	1.8121261E10	1.1260004E9

The results appear to show that the mean rand value of trade for IPOs,  $PVOL_{IPO}$ , is greater than the  $PVOL_{MATCHED}$  for non-IPO firms. However this finding is not significant at the 5% level of significance. This follows from the fact that the t-value is moderately small (0.856) and has a moderately large corresponding p-value (0.196) for the one-tailed test. It follows logically that the null hypothesis that the rand value of trade of IPO firms ( $PVOL_{IPO}$ ) is less than or equal to the rand value of trade of non-IPO firms ( $PVOL_{MATCHED}$ ) cannot be rejected for the sample of IPO firms that listed between 1998 and 2010.

### 5.6.2. Liquidity levels of IPO and Non-IPO stock in terms of turnover

Each year between 1998 and 2010 the levels of liquidity in terms of the turnover ( $TO_{IPO}$ ) is computed for all newly listed IPOs.  $TO_{IPO}$  is then compared to the turnover of similar size matched companies that had not issued IPOs in the previous five years ( $TO_{MATCHED}$ ). The one-tailed, two sample paired t-test yielded the following results indicated in Table 29 below.

Table 29: Results of the two sample paired t-tests comparing the turnover of IPO firms with Non-IPO firms

Paired Differences							
Pair	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t-value	p-value
				Lower	Upper		
$TO_{IPO} - TO_{MATCHED}$	0.004	0.052	0.003	-0.001	0.011	1.421	0.156

Paired Samples Statistics				
Pair	Mean	N	Std. Deviation	Std. Error Mean
$TO_{IPO} - TO_{MATCHED}$	0.029	259	0.037	0.002
$TO_{MATCHED}$	0.025	259	0.036	0.002

\*Significant at 5% level of significance

The results appear to show that the mean of the turnover,  $TO_{IPO}$ , for IPOs is marginally greater than the  $TO_{MATCHED}$  for matched firms. However this finding is not significant at the 5% level of significance. This follows from the fact that the t-value is moderately small (1.421) and has a moderately large corresponding p-value (0.078) for the one-tailed test. It follows logically that the null hypothesis that the turnover of IPO firms ( $TO_{IPO}$ ) is less than or equal to the turnover of non-IPO firms

( $TO_{\text{MATCHED}}$ ) cannot be rejected for the sample of IPO firms that listed between 1998 and 2010.

## 5.7. Summary of all results

Table 30 below highlights the summary of all the hypotheses tests conducted in this study. Using the original Fama-French factors, the results show that IPOs that listed between the years 1992 and 2010 do not underperform or over-perform over a five year period after listing. However when the IPO stocks are categorised in terms of size and book-to-market value the results indicate that the null hypothesis that the average monthly abnormal return equals zero can be rejected for the BM, BL and SM portfolios as they over-perform the market with average annual abnormal performance of 0.312%, 0.300% and 0.756% respectively over the period. Similarly the null hypothesis that the average monthly abnormal return equals zero can be rejected for the SL portfolio as it under-performs the market with an average annual abnormal performance of -0.240% over the period.

Table 30: Summary of all results

No.	Hypothesis/sub-hypothesis	Intercept ( $\alpha_\rho$ )	p-value	Results of the test
<b>Regressions based on the original Fama-French factors</b>				
1	Hypothesis 1: Null hypothesis states that the total IPO portfolio does not have abnormal returns over a five year period after listing.	-0.002	0.739	Do not reject Ho
1.1	Sub-hypothesis 1.1: Null hypothesis states that IPOs categorised as BH portfolio does not have abnormal returns over a five year period after listing.	0.001	0.866	Do not reject Ho
1.2	Sub-hypothesis 1.1: Null hypothesis states that IPOs categorised as BM portfolio does not have abnormal returns over a five year period after listing.	0.026	0.001	Reject Ho
1.3	Sub-hypothesis 1.1: Null hypothesis states that IPOs categorised as BL portfolio does not have abnormal returns over a five year period after listing.	0.025	0.001	Reject Ho
1.4	Sub-hypothesis 1.1: Null hypothesis states that IPOs categorised as SH portfolio does not have abnormal returns over a five year period after listing.	0.008	0.154	Do not reject Ho
1.5	Sub-hypothesis 1.1: Null hypothesis states that IPOs categorised as SM portfolio does not have abnormal returns over a five year period after listing.	0.063	0.001	Reject Ho
1.6	Sub-hypothesis 1.1: Null hypothesis states that IPOs categorised as SL portfolio does not have abnormal returns over a five year period after listing.	-0.020	0.001	Reject Ho
<b>Regressions based on the extended Fama-French factors</b>				
2	Hypothesis 2: Null hypothesis states that the total IPO portfolio does not have abnormal returns over a five year period after listing.	0.008	0.301	Do not reject Ho
2.1	Sub-hypothesis 2.1: Null hypothesis states that IPOs categorised as BHV portfolio does not have abnormal returns over a five year period after listing.	0.025	0.001	Reject Ho
2.2	Sub-hypothesis 2.1: Null hypothesis states that IPOs categorised as BMV portfolio does not have abnormal returns over a five year period after listing.	0.033	0.002	Reject Ho
2.3	Sub-hypothesis 2.1: Null hypothesis states that IPOs categorised as BLV portfolio does not have abnormal returns over a five year period after listing.	0.012	0.384	Do not reject Ho
2.4	Sub-hypothesis 2.1: Null hypothesis states that IPOs categorised as SHV portfolio does not have abnormal returns over a five year period after listing.	0.011	0.447	Do not reject Ho
2.5	Sub-hypothesis 2.1: Null hypothesis states that IPOs categorised as SMV portfolio does not have abnormal returns over a five year period after listing.	0.036	0.004	Reject Ho
2.6	Sub-hypothesis 2.1: Null hypothesis states that IPOs categorised as SLV portfolio does not have abnormal returns over a five year period after listing.	0.024	0.032	Reject Ho
2.7	Sub-hypothesis 2.2: Null hypothesis states that IPOs categorised as BHT portfolio does not have abnormal returns over a five year period after listing.	0.037	0.001	Reject Ho

No.	Hypothesis/sub-hypothesis	Intercept ( $\alpha_p$ )	p-value	Results of the test
2.8	Sub-hypothesis 2.2: Null hypothesis states that IPOs categorised as BMT portfolio does not have abnormal returns over a five year period after listing.	0.028	0.003	Reject Ho
2.9	Sub-hypothesis 2.2: Null hypothesis states that IPOs categorised as BLT portfolio does not have abnormal returns over a five year period after listing.	0.013	0.103	Do not reject Ho
2.10	Sub-hypothesis 2.2: Null hypothesis states that IPOs categorised as SHT portfolio does not have abnormal returns over a five year period after listing.	-0.001	0.997	Do not reject Ho
2.11	Sub-hypothesis 2.2: Null hypothesis states that IPOs categorised as SMT portfolio does not have abnormal returns over a five year period after listing.	0.041	0.001	Reject Ho
2.12	Sub-hypothesis 2.2: Null hypothesis states that IPOs categorised as SLT portfolio does not have abnormal returns over a five year period after listing.	0.023	0.031	Reject Ho

	Hypothesis/sub-hypothesis	Paired Mean Difference	p-value	Results of the test
3	Hypothesis 3: Null hypothesis states that the mean rand value of trade of IPOs less than or equal to mean rand value of trade of non-IPOs	1130328400	0.196	Do not reject Ho
4	Hypothesis 4: Null hypothesis states that the mean rand value of trade of IPOs less than or equal to mean turnover of non-IPOs	0.004	0.078	Do not reject Ho

The results from the extended Fama-French factors, with the two liquidity level factors and a Carhart momentum factor also show that the IPOs that listed between the years 1992 and 2010 do not underperform or over-perform over a five year period after listing. However the null hypothesis that that the average monthly abnormal returns equal zero can be rejected for the size and liquidity level based BHV, BMV, SMV, SLV, BHT, BMT, SMT and SLT portfolios which all outperformed the market with average annual abnormal performances of 0.300%, 0.396%, 0.432%, 0.288%, 0.444%, 0.336%, 0.492% and 0.276% respectively during this period.

Finally the comparison of the mean liquidity levels of IPOs with that of non-IPO firms matched in terms of size and book-to-market value indicate that IPOs do not have significantly higher liquidity levels in terms of the turnover (TO) measure or the rand value of trade (PVOL) measure. The fact that IPOs do not have higher liquidity levels compared to non-IPOs could help explain the fact that this study did not find evidence of IPO underperformance. This follows from the fact that if IPOs had significantly higher liquidity levels, it could have led to underperformance as Eckbo and Norli's (2001, 2005) studies show.

While the liquidity level factors of IPOs do appear to play a role in explaining the long-run performance of IPOs over a five year period, it is contrary to the traditional liquidity-return nexus literature. This follows from the fact that  $TO_t$  has a significant coefficient in the extended Fama-French equation which is positively related to the monthly excess portfolio return  $R_{pt}-R_{ft}$ .  $PVOL_t$  is weakly significant and also positively related to  $R_{pt}-R_{ft}$ . As a result of the positive relation and the fact that both factors have negative mean returns, the evidence indicates that as far as this sample is concerned, a risk premium does not exist.

## **6. CHAPTER 6-DISCUSSION OF RESULTS**

### **6.1. Introduction**

The following section discusses the results obtained in the Chapter 5. The discussion will be based in the same order as the results of the hypotheses test were reported in Chapter 5.

### **6.2. The long-run performance of IPO using the calendar time portfolio approach and the original Fama-French factors**

#### **6.2.1. Total IPO portfolios for the period 1992-2010**

Ritter's (1991) influential paper on IPO long-run performance was able to put forth convincing evidence of IPO underperformance over a three year period when compared to firms by size and industry. Similarly Loughran and Ritter (1995) found that IPOs underperformed over a period of five years after the issue when compared with mature non-issuers of the same size. Since then a number of studies have shown that IPOs underperform other benchmarks over a three-to-five year period in what has been termed as the long-run underperformance of IPOs.

The major objective of this study was to confirm if IPOs listed in South Africa over the period 1992-2010 underperformed in a similar manner

over a five year period. Since the method used to calculate the long-run performance of IPOs was found to influence the degree of underperformance found, the calendar time portfolio approach has been argued as one of the best possible available methods to calculate the long-run performance of events like IPOs (Mitchell & Stafford, 2000).

The results of this study show that when the excess monthly portfolio returns are regressed on the original Fama-French equations, using a calendar time portfolio approach, the intercept is insignificantly different from zero. This indicates that the IPOs that listed between 1992 and 2010 do not underperform or over-perform the market over the five year period after listing.

This finding is in accordance with many other studies that have been conducted globally since Ritter (1991) documented IPO underperformance. However since many of these studies were conducted using other methods of calculating long-run returns, only comparisons with a selected number of studies that utilised the calendar time portfolio approach is listed below in Table 31. It has to be indicated that the majority of these studies relied heavily on t-values rather than p-values to determine if their findings were significant or not. As a result much of the comparison is based on the t-values.

The findings of this study that IPOs do not underperform significantly is in line Brav *et al.* (2000) who document an insignificant intercept of

-0.37 with a t-value of -1.94 over the period 1975 to 1992. Similarly Ritter and Welch (2002) document an insignificant intercept of -0.21 with a t-value of -1.23 over the period January 1973 to September 2001.

Table 31: Comparison of selected results from studies that utilised the calendar time portfolio approach

Authors	Time Period	Country	$\alpha_p$	P/(t-value)	R <sup>sq</sup> / (Ad.R <sup>sq</sup> )
Eckbo & Norli (2001, 2005)	1973-1996	United States	-0.22	0.193	0.870
Gompers & Lerner (2003)	1935-1972	United States	0.082*	2.90 (t)	0.824
Zheng (2007)	Sep 1980- November 2002	United States	-0.07	-0.36 (t)	0.814 (Ad)
Loughran & Ritter (1995)	1973-1992	United States	-0.45*	-3.1 (t)	0.92 (Ad)
Brav & Gompers (1997)	1977-1994	United States	-0.52*	-2.80 (t)	0.825 (Ad)
Brav <i>et al.</i> (2000)	1975-1992	United States	-0.37	-1.94 (t)	0.95 (Ad)
Ritter & Welch (2002)	Jan 1973-Sep 2001	United States	-0.21	-1.23(t)	0.86 (Ad)
Purnanandam & Swaminathan (2004)	1980-1997	United States	-0.42*	-2.21 (t)	0.862 (A)
Lyandres, Sun & Zhang (2008)	1970-2005	United States	-0.43*	-3.76 (t)	N/A
Gregory <i>et al.</i> (2010)	January 1975- December 2004	United Kingdom	-0.0023 <sup>2</sup> 0.0023 <sup>3</sup>	0.119 (-1.556:t) 0.245(1.161:t)	N/A N/A
Mangozhe (2010)	1992-2007	South Africa	NA	NA	0.32 (Ad)
This study (2011)	1992-2010	South Africa	-0.002	0.739	0.936

\*Significant at 5% level of significance

<sup>2</sup>Equal Weighed returns

<sup>3</sup> Value Weighed returns

The results of this finding are also in line with Gregory *et al.* (2010) who document insignificant returns over a 60 month period, using both value weighed and equal weighed returns. The value weighed approach

yields an intercept of 0.0023 with a p-value of 0.245, while the equally weighed approach yields an intercept of -0.0023 with a p-value of 0.119. More recently Zheng (2007) also finds an insignificant intercept of -0.07 with a t-value of -0.36 over a period September 1980 to November 2002.

The findings of this study contradict Loughran and Ritter's (1995) finding of a significant intercept of -0.45 with a t-value of -3.1 over the period 1973-1992. Similarly Brav and Gompers (1997) find a significant intercept of -0.52 with a t-value of -2.80 over the period 1977-1994. More recently Lyandres, Sun, and Zhang's (2008) study covering the period 1970-2005 also yields a significant intercept of -0.43 with a t-value of -3.76.

It also differs from Purnanandam and Swaminathan (2004) who find that IPOs are overpriced at the time of listing. They find that overvalued IPOs are most likely to underperform in the long-run over a 60 month period after listing. They obtain a significant intercept of -0.42 with a t-value of -2.21 which indicates underperformance over a five year period.

These conflicting set of results mostly from studies conducted in the US, highlights the impact that different periods of study and different samples can have on the long-run performance measurement of IPOs. It is therefore important to view the results of this study within that

context, as it possible for studies focused on a different period with a different sample of IPOs to yield totally different results.

Closer to home Mangozhe (2010) also reports finding an insignificant intercept that leads him to conclude that IPOs do not underperform over a five year period, for IPOs that listed between 1992 and 2007. The results of this study are in conformance with his study. However Mangozhe's findings do not provide an estimate of the intercept,  $\alpha_p$ , for the whole portfolio to make a direct comparison.

A brief comparison with other studies that utilised other methods to calculate the long-run performance of IPOs is also presented in Table 32 below. The findings of this study differ from the findings of Page and Reyneke (1997) who document long-run underperformance over a four year period after listing. They find underperformance when utilising a HPR approach, even after matching for size, price to earnings ratio as well as the sector indices.

Similarly it differs from the findings of Alli *et al.* (2010) who document that IPOs have a positive long-run performance over a three year period when a HPR approach is also used. M'kombe and Ward (2002) use a BHAR approach to document underperformance of IPOs over a five year period using the CAPM and the book-to-market value as benchmarks.

Table 32: Comparison of selected results from studies that utilised other methods to calculate the long-run performance of IPOs

Authors	Time Period	Country	Methodology	Results	P/(t-value)
Page & Reyneke (1997)	January 1980-December 1992	South Africa	HPR	1.HPR differentials based on size (-63.45%*) 2.HPR differentials based on price to earnings ratio (106.91%*) 3.HPR differentials based on sector (-96.39%*)	N/A NA NA
Alli <i>et al.</i> (2010)	1995-2004	South Africa	HPR	HPR (1.08%)	1.45 (t)
M'kombe & Ward (2002)	1980-1998	South Africa	BHAR	1.BHAR based on CAPM (-35.67%*) 2.BHAR based on book-to-market portfolios (-61.56%*)	-2.169(t) -2.056(t)
Aggarwal <i>et al.</i> (1992)	Brazil (1980-1990) Chile (1982-1990) Mexico (1987-1990)	Brazil Chile Mexico	HPR?	Brazil (-47%*) Chile (-23.7%) Mexico(19.6% <sup>2</sup> )	-2.27(t) -1.41(t) -1.67(t)
Ahmad-Zaluki (2009)	1990-2000	Malaysia	T-test of difference of means of operating performance measures	1. Based on Operating Income/ Operating Asset (IPOs-1.47% compared to non-IPOs 6.88%) <sup>1</sup> 2. Based on Operating Income/Sales (IPOs-1.90% compared to non-IPOs 5.80%)	-2.71 (t) -0.81(t)
This study (2011)	1992-2010	South Africa	-0.002	0.739	0.936

\*Significant at 5% level of significance

<sup>1</sup>Significant at 1% level of significance

<sup>2</sup>Period of one year

In addition this study differs from the findings of Aggarwal *et al.* (1992) who document underperformance for Brazilian and Chilean IPOs over a three year period after listing. Probably using a HPR approach, they also document one year underperformance for Mexican IPOs. Ahmad-Zaluki's (2009) study on Malaysian IPOs also documents underperformance when measures of operating performance are used over a three year period. The operating measures include the Operating Income/Operating Assets measure as well as the Operating Income/Sales measures.

The difference between this study and the studies above could be due to the fact, that the use of the calendar time portfolio approach is able to provide a better estimate of the long-run performance of IPOs as documented by Gompers and Lerner (2003). Alternatively, they also indicate that different results could also be obtained when different time periods and IPO samples are used as in the above cases.

In terms of the model, although the intercept,  $\alpha_p$ , is insignificant, the coefficients on all three factors are significant and positive. The loading on the excess market portfolio,  $R_{mt} - R_{ft}$ , confirms the role of the broader market in explaining IPO returns despite the fact that it had a very low mean return value. The positive slope for the  $SMB_t$  portfolio is reflective of the fact that larger companies have larger average returns. This is contrary to expectation, based on the negative relation between size and returns (Fama & French, 1993). The continued domination of

conglomerates and institutional investors on the JSE could be one of the possible reasons for not observing the size effect on the IPO sample studied.

While  $HML_t$  retains a positive loading of 0.083, the small loading is also indicative of the smaller role played by  $HML_t$  in explaining the returns of IPOs in this sample. This follows from the fact that both the  $R_{mt}-R_{ft}$  and the  $SMB_t$  portfolios have much higher and significant coefficients of 0.811 and 0.631 respectively. Since the model has an R-Square of 0.936, this indicates that  $HML_t$  contributes the least towards the excess portfolio returns,  $R_{pt}-R_{ft}$ .

However this should not be surprising as  $HML_t$  actually has the lowest mean return value of all the portfolios. Moreover this mean value is negative indicative of the smaller risk capturing role played by the  $HML_t$  portfolio. Other than this, the results do not provide any other clues as to why this behaviour occurs.

The fact that all the three Fama-French factors are able to produce slopes that are at least five standard errors above zero indicate they are still capable of capturing common variations in stock returns. However when compared to Fama and French (1993), it appears that the significance of the  $R_{mt}-R_{ft}$  factor has reduced while the significance of the  $SMB_t$  portfolio has increased. This is based on a relative

comparison to the coefficients of 25 portfolios that were used by Fama and French (1993).

The direct implication of this finding is that it suggests the inclusion of the  $R_{mt}-R_{ft}$  factor, the  $SMB_t$  portfolio and the  $HML_t$  portfolio in the explanation of long-run stock performance on the JSE. It however raises questions about whether the size effect is applicable to the IPO stocks listed on the JSE. Since the book-to-market value plays a smaller role in the explanation of IPO stock returns, it also raises the question of whether other known or unknown factors unique to South African IPO stocks is causing this behaviour.

The fact that the average abnormal returns is insignificantly different from zero indicates that the markets are efficient and that investors should not be worried about losing the value of their investment over a five year period. However, the fact that IPOs do not over-perform the market could also discourage investors to other investment products that could yield significantly higher intercepts over a five year period.

As for companies seeking to raise capital through IPOs, this study provides some comfort and confidence that IPOs do not underperform over a five year period. Ironically it also indicates that the cost of raising equity through an IPO could be higher in contrast to the situation where IPO underperformance actually lowers the cost of equity for IPOs (M'kombe & Ward, 2002).

### 6.2.2. IPO portfolios in terms of size and book-to-market values

The discussion of the results of all the size and book-to-value based portfolios is presented together in this section due to the similar manner in which they are defined and constructed. One of the important differences between this study and many similar studies that look at the relationship between size and book-to-market based portfolios and portfolio returns is that they are usually based on the larger 25 (five size and five book-to-market) portfolio methodology.

One of the key reasons that the 25 portfolio methodology was not utilised for this study was due to the lack of a sufficient sample size to obtain 25 reasonably well populated portfolios every month for the period of the study. As a result the comparisons will be more descriptive as a tabular format that compares the various studies would prove to be more difficult to describe here.

One pattern that is noticeable is that it appears as if the model is not able to explain the returns of the larger portfolios when compared to the smaller portfolios. In particular the model seems unable to explain the returns of the BH and BL portfolios. The application of an independent sorting procedure could have resulted in this observation by allocating firms on the basis of their size in accordance with the 50:50 split, and book-to market values in accordance with the 30:40:30 split to the respective portfolios. As Michou *et al.* (2007) point out different methods

of constructing the Fama-French factors could result in different estimates of these factors as well as the abnormal returns.

The small sample size compared to other studies could itself be one of the reasons for this observation with far fewer firms being allocated to the BH and the BL portfolios compared to other portfolios. In addition the fact that the thinly-traded stocks were also included in this study could have resulted in a few outliers affecting the BH and BL portfolios only.

Fama and French (1992) demonstrated that there is a negative relationship between size and average returns as well as a positive relationship between average returns and book-to-market value. These findings are confirmed by Fama and French (1993) who find that average returns tend to decrease from the small to the bigger sized portfolios. Similarly they find that in every size quintile, average returns tend to increase with the book-to-market value.

The results of the regression of the returns of portfolios based on size and book-to-market value appear to provide mixed results in the context of the above studies. The significant positive intercepts of the bigger portfolios indicate that their returns are less than that of the significant positive intercepts of the smaller portfolios. However they are larger than the significant negative intercept of the SL portfolio.

Similarly within each size category (big or small), it was expected that the intercepts would increase when one moved from the lower book-to-market value to the higher book-to-market value portfolios. The intercepts appear to increase from the low to the medium book-to value portfolios, but decreases from the medium to the high book-to-market value portfolios contrary to expectations.

While the model's lack of explanatory power for the BH and BL portfolios might explain a part of this observation, it could also suggest that for this particular sample the book-to-market effect is less affective in explaining the returns of the IPO stocks particularly in the lower and higher book-to-value categories. This finds support from the fact that the BM and SM portfolios are the only portfolios in which a book-to-market effect is visible.

Despite the fact that the overall IPO portfolio does not show average abnormal performances different from zero, three of the size and book-to-market value based portfolios show positive and significant average monthly abnormal returns. The BM, BL and SM portfolios have average annual abnormal returns of 0.312%, 0.300% and 0.756% respectively indicating IPO over-performance.

This suggests that the continued dominance of conglomerates and institutional investors on the JSE might have played a role in explaining the higher returns of the bigger IPOs compared with the smaller IPOs.

However it has to be indicated that these returns are far too small to be considered economically significant.

The only portfolio showing an underperformance is the SL portfolio which has an average annual abnormal return of -0.240%. This finding of underperformance in the SL portfolio is consistent with Brav and Gompers (1997) finding that underperformance is characteristic of small and low book-to-market firms.

In terms of the factors, the  $R_{mt}-R_{ft}$  factor retains its ability to explain the cross-section of returns and is significant in all portfolios except the SL portfolio. Since this is the only portfolio that has underperformed the market, it suggests that the  $R_{mt}-R_{ft}$  factor might be playing a bigger role in explaining the returns of the size and book-to-market based portfolios.

Similarly the  $SMB_t$  portfolio seems to play a significant role explaining the returns of the smaller portfolios, but not that of the bigger portfolios where  $SMB_t$  seems to lose its strong ability to explain the returns of especially the BL portfolio. However, the only portfolio where the size effect is observed is for the BH portfolio where  $SMB_t$  is negatively and significantly related to the average returns.

The  $HML_t$  portfolio follows a similar pattern by being strongly significant in all three smaller portfolios but not in the bigger portfolios, where  $HML_t$

seems to lose its strong ability to explain the returns of especially the BH portfolio. Interestingly  $HML_t$  also takes on negative and significant values in the BL and SL portfolios reflective of the fact that book-to-market value is negatively related to the average returns in these portfolios.

A direct comparison with Mangozhe (2010) study was not possible due to the manner in which that study was structured. This is despite the fact that it was also based on six size and book-to-market portfolios. On the whole these findings although not entirely in line with Fama and French (1992, 1993) and Mitchell and Stafford (2000) findings, appear to confirm some of their fears.

More especially Fama and French (1993) show that their three factor model does not even provide a full explanation of the average returns of portfolios formed on size and book-to-market value, the very dimensions of average return that the model's risk factors are designed to capture. Their study utilised a 25 (5 X 5) size and book-to-value portfolios.

The implications of these findings are that the application of the Fama-French factors to determine long-run abnormal returns are sensitive to the manner in which the factors are constructed. In particular given the continued domination of conglomerates and institutional investors on the JSE, it might be appropriate to use a sorting mechanism that factors

in the number of trade-able firms on the JSE rather than all the firms on the JSE, for future studies. The trade-able firms constitute that set of firms which are which are more frequently traded compared to the set of firms which are not traded very frequently.

To conclude, for investors, the above findings indicate that they must desist from investing in small and low book-to-value IPO firms. The medium book-to-value IPO firms (both small and big) and, the big and low book-to-value IPO firms still provide opportunities for investment. For companies seeking to issue IPOs the opposite applies in terms of the cost of equity, and small and low book-to-value firms would benefit from a lower cost of equity if they issued an IPO. This could be particularly useful to small and upcoming entrepreneurial firms seeking to raise capital.

### **6.3. The long run performance of IPOs using the calendar time portfolio approach and the extended Fama-French factors**

#### **6.3.1. Total IPO portfolio for the period 1992-2010**

Early studies on IPO underperformance by Loughran and Ritter (1995) and Ritter (1991) were based on comparisons to similar size based non-IPO stocks. While this kind of matching and subsequent variations in terms of size and book-to-market value have been used widely, the assumption has been that this kind of matching would effectively control

for the systematic risk of IPO firms (Eckbo & Norli, 2001, 2005). However, researchers have begun to question if this process of matching firms has resulted in certain important yet plausible risk factors which lowers the risk of IPO stocks from being omitted.

One of these risk factors has been identified as the risk associated with the level of liquidity of stocks. This follows Amihud and Mendelson (1986) finding evidence that asset returns include a significant premium for the quoted [bid-ask] spread. Chordia *et al.* (2001) also find that variables related to trading activity play an important role in the cross-section of expected returns over and above well document effects such as size, book-to-market value and momentum.

The next step in this study was to understand directly the relationship between the excess monthly portfolio returns and the measures of liquidity levels. The ideal framework to test the effect of these liquidity risk factors was to incorporate them into the extended Fama-French three factor model and understand their impact on the long-run performance of IPOs as indicated by Eckbo and Norli (2001, 2005). This allows one to jointly estimate the factor coefficients and the coefficients of the liquidity variables (Brennan & Subrahmanyam, 1996).

It appears that the inclusion of the two liquidity factors and the Carhart momentum factor has resulted in the sign of the intercept becoming positive and the long-run performance of IPOs becoming positive.

However it has to be noted that this finding is insignificant at the 5% level of significance. This suggests that even after factoring the liquidity factors and the Carhart momentum factor, IPOs do not over-perform or underperform the market.

However a closer look suggests that it is not the inclusion of the liquidity factors that resulted in the changed sign of the intercept. In fact it is the inclusion of the Carhart momentum factor that was responsible for the change in signs. The possible reason for this is the large and positive mean returns displayed by the  $PRYR_t$  factor as described in Section 5.2. In accordance with Michou *et al.* (2007) this indicates that although the coefficient of  $PRYR_t$  factor is negative and weak in significance, it is still capable of capturing risk related to the returns.

It is important to note that both liquidity factors  $TO_t$  and  $PVOL_t$  are positively related to the excess portfolio returns contrary to expectations. The relationship between  $TO_t$  and the return is significant while the relationship between  $PVOL_t$  and the return is very weak. This finding in itself provides evidence against the possibility of finding a liquidity premium.

One of the possible reasons for this is that both the  $TO_t$  and  $PVOL_t$  portfolios display negative mean returns. As a result of this fact, the actual contribution of both these liquidity factors is to reduce the excess portfolio returns instead of contributing towards a risk premium. It is also

possible that the extreme values of turnover and rand value of trade exhibited by the sample of IPOs have resulted in this positive relationship. A comparison with a few of the known studies that link liquidity levels with IPO performance is indicated in Table 33 below.

The results of this study are consistent with Eckbo and Norli (2005) finding a statistically insignificant intercept on the basis of which they do not reject the hypothesis that the IPO portfolio receives an expected return commensurable with its risk. They however find that there is conclusive proof for a liquidity risk premium for the IPO sample studied which is in contrast with the findings of this study. Moreover their study provides strong evidence that turnover is negatively related to returns while this study indicates that turnover is positively related to returns.

Table 33: Comparison of selected results from studies that link liquidity levels with IPO performance

Authors	Time Period	Country	$\alpha_p$	P/(t-value)	$R^{sq}/Ad.R^{sq}$
Eckbo & Norli (2005)	1973-1996	United States	-0.21*	0.179	0.885
Narayan & Zheng (2011)	Jan 1994-Dec 2005	China	1. Based on Trading Volume (0.009 <sup>1</sup> )(0.012 <sup>2</sup> ) 2. Based on turnover rate (-0.486 <sup>1</sup> )(0.028 <sup>2</sup> ) 3. Based on trading probability (0.0347 <sup>1</sup> )(0.019 <sup>2</sup> )	1. Based on Trading Volume (2.30 <sup>1</sup> )(0.806 <sup>2</sup> ) 2. Based on turnover rate (-19.829 <sup>1</sup> )(2.413 <sup>2</sup> ) 3. Based on trading probability (5.552 <sup>1</sup> )(1.430 <sup>2</sup> )	1. Based on Trading Volume (0.031 <sup>1</sup> )(0.024 <sup>2</sup> ) 2. Based on turnover rate (0.066 <sup>1</sup> )(0.014 <sup>2</sup> ) 3. Based on trading probability (0.042 <sup>1</sup> )(0.002 <sup>2</sup> )
This study (2011)	1992-2010	South Africa	-0.002	0.739	0.936

\*Significant at 5% level of significance

<sup>1</sup>Shanghai Stock Exchange

<sup>2</sup>Shenzhen Stock Exchange

On the other hand this study seems to agree with Narayan and Zheng's (2011) study on the Chinese Stock Exchanges. Their study however includes a third liquidity measure called the trading probability measure besides the two liquidity measures used in this study. They find inconclusive evidence that the liquidity risk is priced on the Chinese stock exchanges. Overall they conclude that there is weak evidence of a negative relationship between liquidity and stock returns on the Chinese stock exchanges. A comparison with other relevant return-liquidity studies not related to IPOs is detailed in the Table 34 below.

Table 34: Comparison of selected results from studies that link liquidity levels with stock performance

Authors	$\alpha_p$	P/t-value	Turnover coefficient (t-value)	Trading Volume Coefficient (t-value)	$R^{sq}/Ad.R^{sq}$
Eleswarapu & Reinganum (1993)	N/A	N/A	Based on bid-ask spread	Based on bid-ask spread	N/A
Datar <i>et al.</i> (1998)	2.30*	9.70 (t)	-0.04 (-8.58)	-	N/A
Brennan <i>et al.</i> (1998)	0.071	1.02 (t)	-	-0.162 <sup>1</sup> (4.17) -0.086 <sup>2</sup> (1.87)	N/A
Chordia <i>et al.</i> (2001)	-0.002	0.05 (t)	-0.183 (-3.63)	-0.183(-3.63)	N/A
This study (2011)	-0.002	0.739	0.089 (2.262)	0.031(1.833)	0.936

\*Significant at 5% level of significance

<sup>1</sup>New York Stock Exchange

<sup>2</sup>NASDAQ

The results in this study contrasts with the study by Datar *et al.* (1998) who find a significant negative relationship between the excess returns and the turnover factor. They obtain a significant turnover coefficient of -0.04 with a significant t-value of -8.58. As a result they find strong evidence of a liquidity premium for the sample studied. However their

study did not utilise the Fama-French three factor model and a comparison with their intercept could be misleading.

The results of this study also contrasts with the study by Brennan *et al.* (1998) who find a significant negative relationship between the excess returns and the dollar trading volume factor. Their intercept (0.071) is also insignificantly different from zero with a t-value of 1.02. They obtain a dollar trading volume coefficient of -0.162 with a significant t-value of 4.17 for the New York Stock Exchange and a dollar trading volume coefficient of -0.086 with a less significant t-value of 1.87 for the NASDAQ. While their study also documents strong book-to-market and momentum effects it also provides evidence that the liquidity premium is priced.

The results of this study also contrasts with the study by Chordia *et al.* (2001) who find a significant negative relationship between the excess returns and the turnover factor as well as the dollar trading value. Their intercept (-0.002) is also insignificantly different from zero with a t-value of 0.05. They obtain a turnover coefficient of -0.183 with a significant t-value of -3.63. The coefficient for the dollar volume of trade is also -0.183 with a significant t-value of -3.63. While their study also documents strong book-to-market value and momentum effects it also provides evidence of a liquidity premium.

However, it is more-or-less in line with the finding of Eleswarapu and Reinganum (1993) who find that there is no association between the bid-ask spread and the stock returns except for the month of January. Their study makes use of 49 portfolios based on size and the bid-ask spread and the entire focus of the paper was to find if a liquidity premium existed. As a result no estimates are provided for the intercept,  $\alpha_p$ . However this study did not look into the January effect in terms of the return-liquidity nexus.

In terms of the model the extended Fama-French model also results in a better R-square value of 0.968 compared to the initial value of 0.936 indicating that the model has greater explanatory power for the excess monthly portfolio returns. The  $R_{mt}-R_{ft}$  factor remains positive and highly significant indicating that it plays a more significant role in explaining the returns even within the extended equation.

However while the coefficient of  $SMB_t$  remains positive and significant, it has decreased from 0.631 to 0.520 in the extended equation. A similar phenomenon occurs with the coefficient of  $HML_t$  which decreased from the original value of 0.083 to 0.011 in the extended equation and is not significant. This implies that the net impact of including the additional factors is to strengthen the role of the  $R_{mt}-R_{ft}$  factor while decreasing the strength of the  $SMB_t$  and  $HML_t$  portfolios. Unfortunately their pair-wise correlations do not provide much insight into this behaviour.

In conclusion, despite the inclusion of the liquidity factors and the momentum factor, the results of this study are still in line with Mangozhe's (2010) finding of an insignificant intercept that leads him to conclude that IPOs do not underperform or over-perform over a five year period. The results also show that turnover is significantly and positively related to returns, while the rand value of trade has a weak and positive relation with returns.

The extended Fama-French model would therefore be advocated as the better model in terms of explaining the IPO performance as it has a higher R-square value (0.968) compared to the original Fama-French model (0.936). In addition the Standard Error of the Estimate has decreased slightly from 0.060 for the original Fama-French model to 0.055 for the extended Fama-French model. Domestic and international investors looking towards emerging markets in the hope of obtaining higher liquidity risk premiums will be disappointed as there appears to be no conclusive evidence of the liquidity risk being priced for IPOs listed on the JSE.

### **6.3.2. IPO portfolios in terms of size and liquidity levels (turnover and rand value of trade)**

The discussion of the results of sub-hypotheses 2.1 and 2.2 are discussed together due to the similar manner in when they are defined as well as due to the similarity in their results. Comparisons with other

studies will be made where available, as most of the prior studies indicated have used different size and liquidity measures to construct their portfolios. As a result much of the discussion would be descriptive as tabular comparisons would be difficult to illustrate here.

There are a number of similarities between both sets of portfolios based on size and turnover, or the size and rand value of trade. One of the reasons for the similarity could be the similar manner in which these portfolios were constructed. The other reason is that it indicates that both sets of liquidity measures are indeed capturing the same set of underlying liquidity risk, especially given the high correlation between both of these liquidity factors.

For both sets of regressions, the results reflect the fact that the model had a reduced explanatory power for the bigger portfolios compared to the smaller portfolios. This finding is similar to the pattern discussed for the size and book-to-market based portfolios in Section 6.2.2. The application of an independent sorting procedure by allocating firms on the basis of their size in accordance with the 50:50 split and turnover (or rand value of trade) in accordance with the 30:40:30 split to the respective portfolios is suggested as one of the possible reason for this pattern. The fact that the size based categorisation is common to all three sets of regressions further strengthens the evidence for a size based sorting rationalisation for the occurrence of this behaviour.

In addition the inclusion of all IPO stocks regardless of thin-trading could also have allowed certain outliers to drive this particular behaviour. Alternatively the small sample size compared to other studies could itself be one of the reasons for this observation with few firms being allocated to either the big and high turnover (or rand value of trade) portfolios, or the big and low turnover (or rand value of trade) portfolios.

While the overall IPO portfolio does not show significant underperformance or over-performance, it is interesting to note that eight out of the twelve size and liquidity (turnover and rand value of trade) portfolios exhibit over-performance. Even more interesting is that the portfolios that deliver over performance are similar in both sets of regressions.

For example the BHV, BMV, SMV and SLV portfolios have average annual abnormal performances of 0.300%, 0.396%, 0.432% and 0.288% respectively. Their compatriot portfolios BHT, BMT, SMT and SLT portfolios also over-perform the market with average annual abnormal performances of 0.444%, 0.336%, 0.492% and 0.276% respectively. Interestingly both the highest and lowest average annual abnormal performances come from the smaller sized portfolios.

There is however no monotonous (linear increase) in average monthly returns as one moves from the bigger to smaller portfolios or from the

highly liquid portfolios to less liquid portfolios. This could be due to other factors at play that are unique to the IPO stocks listed on the JSE. Alternatively the effects of the continued domination of conglomerates and institutional investors on the JSE could also be driving some of these results. Finally in the construction of the  $PVOL_t$  factor, it was noticed that there were a number of missing values for the  $PVOL_t$  factor resulting from the small sample size. This could have biased the estimation of these results, especially as it relates to  $PVOL_t$ .

As for the factors, the  $R_{mt}-R_{ft}$  factor continues to play a key role with positive and significant coefficients in all twelve portfolios. Similarly,  $PRYR_t$  continues to remain negative and insignificant in all but one portfolio.  $TO_t$  remains significant and positive in most portfolios except for the SHT and SMV portfolios where it has significant negative coefficients as expected. It also appears that  $PVOL_t$  is insignificant in all bigger size portfolios while it becomes significant for the SMT and SLT portfolios. In general no conclusive trends become apparent when the excess returns of the twelve portfolios are regressed against the extended Fama-French factors.

The only portfolios which confirms to the findings of Datar *et al.* (1998) who observe that stock returns are a decreasing function of the turnover rate is the SHT and SMV portfolios. In the SHT portfolio  $TO_t$  has a negative coefficient of -1.025 with a significant t-value of -17.804 and p-value of 0.001. In the SMV portfolio  $TO_t$  has a negative coefficient of

-0.294 with a t-value of -4.766 and a p-value of 0.001. Similarly the only portfolio that confirms with Brennan *et al.* (1998) finding of a significant negative relationship between the excess returns and the trading volume factor is the SHV portfolio. Here  $PVOL_t$  has a negative coefficient of -1.885 with a t-value -59.932 and a p-value 0.001.

In conclusion, investors will benefit from knowing that the majority of IPOs categorised in terms of the size and liquidity levels (both turnover and rand value of trade) over-perform the market. However most of these returns are not economically significant and investors could be motivated in investing in other higher return investment products. The fact some of these portfolios over-perform the market should not be mistaken for market inefficiency though. This is because there will always be some portfolios that over-perform the market and some portfolios that underperform the market resulting in the market still being efficient on the whole.

#### **6.4. Rand value of trade of IPO stocks and Non-IPO stocks**

Eckbo and Norli (2001, 2005) find that one of the reasons that IPOs underperform is because of their increased liquidity levels after the offering. Their findings are based on the notion that measures of liquidity levels can influence asset returns (Amihud & Mendelson, 1986). In Sections 6.2.1 and 6.3.1, it has been discussed that overall,

the IPOs that listed between 1992 and 2010 did not underperform or over-perform the markets significantly.

In this context, a reasonable undertaking would be to compare the liquidity levels of IPOs with that of non-IPO firms (comparable matched firms) in order to determine if higher liquidity levels were in fact driving this behaviour. The first liquidity level tested is the rand value of trade.

The rand value of trade for IPOs ( $PVOL_{IPO}$ ) in this sample is greater than that of matched firms ( $PVOL_{MATCHED}$ ) reflective of the fact that it has higher liquidity levels. However this difference is not significant at the 5% level of significance despite the fact that the direction of the difference is as expected. A comparison of these results with the results of Eckbo and Norli (2005) is highlighted in Table 35 below.

Table 35: Comparison of the mean rand value of trade of IPO and Non-IPO firms with other studies

<b>Eckbo &amp; Norli (2005)</b> (In of millions of shares)			
$PVOL_{IPO}$	$PVOL_{MATCHED}$	Number of observations	P-value
14.224	14.421	2091	.012
<b>Current Study (2011)</b> (In of millions of shares)			
$PVOL_{IPO}$	$PVOL_{MATCHED}$	Number of observations	P-value
9.852	9.777	259	.196

A direct comparison may not be appropriate here as share prices for US shares are in US dollars while the South African calculations are based

in South African rands. However, the smaller rand value of trade could be reflective of the smaller size of the South African stock market compared to the US stock market where Eckbo and Norli (2001, 2005) conducted their studies.

The other possible reason for not finding evidence in favour of significantly higher rand value of trade for IPOs ( $PVOL_{IPO}$ ) could be due to the fact that the overall improvement in market liquidity has not been accompanied by similar improvements in rand value of trade ( $PVOL_{IPO}$ ) for IPO stock. Again the continued dominance of conglomerates and institutional investors on the JSE could also have contributed towards the lower  $PVOL_{IPO}$ .

In summary, based on the rand value of trade, IPOs do not appear to have significantly higher levels of liquidity. This could explain why Alli *et al.* (2010) and Mangozhe (2010) find no evidence of under-performance on the JSE. This is supported by the fact that this study also finds no underperformance for the overall portfolio. Moreover the  $PVOL_t$  portfolio has an insignificant and positive relationship with the excess returns of the portfolio.

## **6.5. Turnover of IPO stocks and Non-IPO stocks**

Eckbo and Norli (2001, 2005) find that one of the reasons that IPOs underperform is because of their increased liquidity levels after the

offering. Their findings are based on the notion that measures of liquidity levels can influence asset returns (Amihud & Mendelson, 1986). In Sections 6.2.1 and 6.3.1, it has been discussed that overall, the IPOs that listed between 1992 and 2010 did not underperform or over-perform the markets significantly.

In this context, a reasonable undertaking would be to compare the liquidity levels of IPOs with that of non-IPO firms (comparable matched firms) in order to determine if higher liquidity levels were in fact driving this behaviour. The results indicate that the mean liquidity levels of IPOs (in terms of turnover) differ from the mean liquidity level (in terms of turnover) of size matched companies by a very small margin. This difference is however not significant at the 5% level of significance. A comparison of the mean turnover of this study with the mean turnover of Eckbo and Norli (2005) is illustrated in Table 36 below.

Table 36: Comparison of the mean turnover of IPOs and Non-IPO firms with other studies

<b>Mean Turnover Eckbo &amp; Norli (2005)</b>				
TO <sub>IPO</sub>	TO <sub>MATCHED</sub>	(TO <sub>IPO</sub> - TO <sub>MATCHED</sub> )	P-value	Number of observations
0.094	0.062	0.032	0.000	2091
<b>Mean Turnover Current Study (2011)</b>				
TO <sub>IPO</sub>	TO <sub>MATCHED</sub>	(TO <sub>IPO</sub> - TO <sub>MATCHED</sub> )	P-value	Number of observations
0.029	0.025	0.004	0.780	259

The smaller sample size available in South Africa could possibly have limited the magnitude and significance of the mean turnover difference between the IPO stock and the matched firm stocks. It is also possible

that the inclusion of IPO stock returns in the years 2008, 2009 and 2010 to ensure a sufficiently large sample size could have resulted in the lower overall liquidity levels. This was due to the impact of the global financial crisis that significantly reduced liquidity on a macro level as well at the micro level.

One possible reason for not finding evidence in favour of significantly higher turnover values for IPOs ( $TO_{IPO}$ ) could be due to the fact that the overall improvement in market liquidity has not been accompanied by similar improvements in turnover ( $TO_{IPO}$ ) for IPO stock. Again the continued dominance of conglomerates and institutional investors on the JSE could have contributed towards the lower  $TO_{IPO}$ .

In summary, based on turnover, IPOs do not appear to have significantly higher turnover compared to non-IPOs. This could explain why Alli *et al.* (2010) and Mangozhe (2010) find no evidence of underperformance on the JSE. This is supported by the fact that this study also finds no underperformance for the overall portfolio. Moreover the  $TO_t$  portfolio has a significant and positive relationship with the excess returns of the portfolio.

## 6.6. Overall conclusion

In terms of the long-run performance of IPOs this study was able to establish that over a five year period, IPOs do not underperform or

over-perform the market. This result is in accordance with Mangozhe (2010) who also documents similar findings. The addition of the three additional factors also indicates that IPOs do not over-perform or underperform the market over a five year period in conformance with Eckbo and Norli (2001, 2005). The extended Fama-French model comes out as the stronger model in terms of explaining IPO performance, when compared to the original Fama-French model.

However, this study differs from Eckbo and Norli (2001, 2005) study in that, this study does not find any evidence of a liquidity premium for IPOs listed on the JSE. This is not surprising as the results of this study also show that IPOs do not have significantly higher liquidity levels in terms of turnover (TO) and rand value of trade (PVOL). However this could explain why the results of this study, Alli *et al.* (2010) and Mangozhe (2010) do not document underperformance of IPOs.

Although the markets appear to be efficient in explaining the total IPO portfolios, this study indicates that when portfolios are sorted on the basis of size and book-to-market value, size and turnover value, or size and rand value of trade, the majority of the portfolios over-perform the market.

## 6.7. Shortcomings of the study

One of the major shortcomings of this study was that it was difficult to obtain a coherent and integrated database of past and present IPOs from a single source. As a result even for the same time periods comparisons between two different studies proved problematic due to the different samples used. As an example, the IPO database used by Mangozhe (2010) is not similar to the IPO database used in this study.

By utilising the calendar time portfolio approach, this study was basically constructed to track the five year long-run performance of IPOs after listing. As a result long-run performance over the one and three year period after listing could not be calculated from the same portfolios for comparison purposes. Due to the time intensive nature of constructing calendar time portfolios, this study could not create the one year and three year portfolios for comparison purposes.

Many studies rely on the use of a thin-trading filter. This study did not utilise a thin trading filter fearing a possibility that the sample sizes required for the construction of the calendar time portfolios would be too small. This appears to have caused some outliers to influence the results of this study as depicted by the extreme value of the data items. Moreover financial and resource firms were also included in the study unlike in many other studies. All these factors could have impacted the final outcome of this study.

As many as 284 companies delisted over the period and these companies were excluded from the final study. Although the initial plan included attempts to estimate missing data items and re-run the study, the time duration of this study prevented any estimation of missing data items. Further to that no statistical approximations were made to control for the skewness and kurtosis of key factors and variables.

The inclusion of the IPOs that listed in the outer years of 2008, 2009 and 2010 could also have influenced the liquidity levels of IPOs in the wake of the global financial crisis. Although a three factor Fama-French regression indicated no substantial differences for the total IPO portfolio without these years, no further tests were conducted for the other portfolio categories given the time constraints.

The comparison of liquidity levels of IPOs to matched firms proved to be difficult due to the smaller sample of IPOs in the earlier years between 1992 and 1998. As a result liquidity levels were only calculated for IPO and non-IPOs for the period between 1998 and 2010. This could also have impacted on the comparison of liquidity levels of IPOs and non-IPOs.

The process of creating the calendar time portfolios was a manual process that involved copying and pasting data items from several Excel spreadsheets to a single Excel spreadsheet. In this process

certain unintended errors could have been made. All these factors could also have impacted the final outcome of this study.

## 7. CHAPTER 7-CONCLUSION

This study was a descriptive study on the long-run performance of IPOs listed on the JSE between 1992 and 2010. In particular this study sought to determine if IPO firms over-performed or underperformed the market over a five year period after listing on the JSE. In addition the study sought to determine the impact of the liquidity levels of IPO stock on the long-run performance of IPOs. This was done by first of all factoring these liquidity levels into the methodological framework that was used to determine the long-run performance of the IPOs. In addition a comparison was made between the liquidity levels of the IPOs and non-IPOs to determine if IPOs had a significantly higher liquidity levels.

The rationale for conducting this research was based on the widely documented and debated anomaly of IPOs underperforming over a three-to-five year period after listing. Ritter (1991) was able to show that firms significantly underperformed over a three year period after going public when compared to a set of comparable firms matched by size, in what has been characterised as the long-run underperformance of IPOs.

Long-run performance, which deals with the stock price performance of IPOs in a period lasting from three-to-five years after the offering was based on raw (absolute) performance, or performance relative to a

benchmark (abnormal return) (Ritter & Welch, 2002). In accordance with Bodie *et al.* (2010) suggestion, this study utilised a five year period as it provided a reasonable number of observations without being contaminated by old and possibly no-longer relevant returns.

While the initial studies of Loughran and Ritter (1995) and Ritter (1991) were based on IPO stocks in the USA, several studies over the years have managed to document long-run underperformance of IPOs in other countries (Aggarwal *et al.*, 1992; Ahmad-Zaluki, 2009; Gregory *et al.*, 2010; M'kombe & Ward, 2002; Page & Reyneke, 1997; Purnanandam & Swaminathan, 2004).

While different reasons and sources have been put forward to explain the long-run underperformance of IPOs, there is clearly no agreement between researchers as to the exact cause or solution to the anomaly. In fact, the acceptance of the IPO under-performance effect is far from universal (Ang *et al.*, 2007). This follows the growing realisation that the methodological approach and econometric method used to calculate IPO performance in terms of an appropriate investment strategy can have a direct impact on the studies of long-run IPO performance (Gregory *et al.*, 2010; Ritter & Welch, 2002).

This is supported by other findings that show that the time period being studied and the sample size being studied also have a direct bearing on the findings of IPO long-run performance studies (Ang *et al.*, 2007;

Gompers & Lerner, 2003). As a result, different researchers have continued to find other methods and ways of analysing the long-run performance of IPOs in the hope of finding a solution to a potential market anomaly.

It was against this context that Eckbo and Norli (2001, 2005) correctly pointed out that, the matched-firm procedure used in earlier studies might have inadvertently resulted in the omission of important and intuitively possible risk factors which effectively lowers the risk of IPO stocks. Based on this assumption, Eckbo and Norli (2001, 2005) found that IPO stocks are less risky than size matched firms.

They use this fact to explain their lower than expected returns when compared to equivalent non-IPOs. In particular they show that in the years immediately following the issue, IPO stock have lower leverage ratios and higher liquidity (turnover and dollar volume of trade) than matched firms.

It was this specific relationship between the levels of liquidity and its impact on the long-run performance of IPOs that is of interest to this study. In particular this follows from the fact that a recent study in South Africa by Alli *et al.* (2010) found positive abnormal performance when analysing South African IPOs. Almost at the same time, Mangozhe (2010) also found no evidence of underperformance for South African IPOs.

Interestingly Alli *et al.* (2010) indicates “that the liquidity of the JSE as a whole (measured in volume of shares traded) increased from 7.5% in 1994, to 27% in 1998, to 35% in 2000 and finally 41.6% in 2006” (p.7). Extending Acharya and Pedersen (2005) concept of commonality in liquidity, whereby the liquidity of stocks co-vary with the overall market liquidity, one would expect IPO stocks to become more liquid over this period and show a decline in returns. However the fact that Alli *et al.* (2010) and Mangozhe (2010) find no underperformance for IPOs seems to indicate their levels of liquidity have dropped rather than increase.

It was this dichotomy that served as a key motivation to conduct a study into the long run performance of IPOs listed on the JSE and analyse the impact of the liquidity levels on the long run performance of IPOs. Since the debate on the long-run underperformance of IPOs was far from over there was also a continued need to investigate this phenomenon as IPOs are increasingly being viewed as a popular mechanism of raising capital and funding growth for South African firms (Brau *et al.*, 2006).

## 7.1. Findings

This study utilised a calendar time portfolio approach based on the original three factor Fama-French model to calculate the long-run performance of IPOs. The initial set of regressions of the monthly excess portfolios returns of IPOs on the excess market return factor,

$R_{mt}-R_{ft}$ , the  $SMB_t$  portfolio and the  $HML_t$  portfolio yielded an insignificant intercept ( $\alpha_p$ ). This indicated that the average monthly abnormal returns were not significantly different from zero and reflected the fact that the IPOs that listed on the JSE between 1992 and 2010 did not underperform or over-perform the market over a five year period after listing.

When the two liquidity factors and the Carhart momentum factor were added, the extended Fama-French equation also yielded an insignificant intercept ( $\alpha_p$ ). This indicated that despite the inclusion of the liquidity factors, the average monthly abnormal returns were still not significantly different from zero and reflected the fact that the IPOs that listed on the JSE between 1992 and 2010 did not underperform or over-perform the market over a five year period after listing.

While the turnover factor ( $TO_t$ ) was significant and positively related to the excess monthly portfolio returns, the rand value of trade ( $PVOL_t$ ) factor displayed a positive and weak relationship with the excess monthly portfolio returns. This together with the fact that the mean returns on both these factors were negative meant that a liquidity risk premium did not exist for the IPOs listed on the JSE.

A paired sample t-test comparing the mean values of both the turnover and rand value of trade values of IPOs and non-IPOs yielded an

insignificant finding. This indicated that IPO stock did not have higher levels of liquidity compared to non-IPO stock.

The finding that the liquidity levels of IPOs are not significantly higher than non-IPOs is also useful in understanding Alli *et al.* (2010) and Mangozhe (2010) findings. The fact that both the above studies did not document any underperformance of IPOs could be attributed to the lower levels of liquidity as evidenced in this paper. This is also supported by the finding of this study, which did not document any underperformance either.

When the IPO stock is broken down in terms of size and book-to-market values, the BM, BL and SM portfolios significantly over-perform the market with average annual abnormal returns of 0.312%, 0.300% and 0.756% respectively. The SL portfolio on the other hand underperforms the market with an average annual abnormal return of -0.240%.

When the IPO stock is broken down in terms of size and rand value of trade, the BHV, BMV, SMV and SLV portfolios significantly over-performing the market with average annual abnormal returns of 0.300%, 0.396%, 0.432% and 0.288% respectively. In terms of the size and turnover, a similar pattern is observed with the BHT, BMT, SMT and SLT portfolios significantly over-performing the market with average annual abnormal returns of 0.444%, 0.336%, 0.492% and 0.276% respectively.

The study also showed that the extended Fama-French model was a better model in terms of explaining the IPO returns compared to the original three factor model. The above findings provide further proof that for the overall portfolios, IPOs do not underperform or over-perform the market. As a result investors and companies desiring to raise capital via IPOs should not be deterred for fear of losing shareholder value over a long term (five year period) after listing.

Additionally investors and firms in specific size and book-to-market value, size and turnover, and size and rand value of trade based portfolios stand to gain from the over-performance of these portfolios compared to the market. For investors looking for a liquidity premium, the results indicate that liquidity risk premium is not priced for IPOs listed on the JSE as there is a positive relation between the liquidity factors and excess monthly portfolio returns.

## **7.2. Suggestions for future research**

The present study utilised a calendar time portfolio approach that tracked the performance of IPOs over a five year period after listing. A study that could compare the one year, three year and five year performance of IPOs using the calendar time portfolio approach would be useful to compare how the returns change over time.

Delisted firms and missing data on various firms have created gaps in data items that could have compromised the quality of this study. A comprehensive study on the long-run performance of all IPO (listed and delisted) over a longer period could provide evidence against IPO underperformance in South Africa.

In addition commonality in liquidity in the South African context needs further investigation particularly in light of the fact that IPO stocks did not exhibit higher liquidity levels despite increasing liquidity levels of the broader South African financial markets.

The impact of the dominance of conglomerates and institutional investors on the performance of stock on the JSE in general is another possible area for further research. This is particularly to determine if they have had an impact on the size and book-to-market effects that have been documented in other parts of the globe.

## 8. REFERENCES

Acharya, V. V., & Pedersen, L. H. (2005). Asset pricing with liquidity risk. *Journal of Financial Economics*, 77(2), 375-410.

Aggarwal, R., Leal, R., & Hernandez, F. (1992). The aftermarket performance of initial public offerings in Latin America. *Financial Management*, 20, 43-53.

Ahmad-Zaluki, N. A. (2009). Post-IPO operating performance and earnings management. *International Business Research*, 1(2), 39-48.

Albright, S. C., Winston, W. L., Winston, W., Zappe, C. (2009). *Data analysis and decision making* (6<sup>th</sup> Ed.). International Edition: South-Western Publishing Co.

Alli, K. L., Subrahmanyam, V., & Gleason, K. C. (2010). Short-and long-run performance of initial public offerings in postapartheid South Africa. *Journal of African Business*, 11(1), 1-25.

Amihud, Y. (2002). Illiquidity and stock returns: Cross-section and time-series effects. *Journal of Financial Markets*, 5(1), 31-56.

Amihud, Y., & Mendelson, H. (1986). Asset pricing and the bid-ask spread. *Journal of Financial Economics*, 17(2), 223-249.

Ang, A., Gu, L., & Hochberg, Y. V. (2007). Is IPO underperformance a peso problem? *Journal of Financial and Quantitative Analysis*, 42(03), 565-594.

Berk, J. B. (1995). A critique of size-related anomalies. *Review of Financial Studies*, 8(2), 275-286.

Blumberg, B., Cooper, D. R., & Schindler, P. S. (2008). *Business research methods*. International Edition: McGraw-Hill Higher Education.

Bodie, Z., Kane, A., & Marcus, A. J. (2010). *Essentials of investments with S&P card* (8<sup>th</sup> Ed.). International Edition: McGraw-Hill.

Brau, J. C., & Fawcett, S. E. (2006). Initial public offerings: An analysis of theory and practice. *The Journal of Finance*, 61(1), 399-436.

Brau, J. C., Ryan, P. A., & DeGraw, I. (2006). Initial public offerings: CFO perceptions. *Financial Review*, 41(4), 483-511.

Brav, A., & Gompers, P. A. (1997). Myth or reality? The long-run underperformance of initial public offerings: Evidence from venture and nonventure capital-backed companies. *The Journal of Finance*, 52(5), 1791-1821.

Brav, A., Geczy, C., & Gompers, P. A. (2000). Is the abnormal return following equity issuances anomalous? *Journal of Financial Economics*, 56(2), 209-249.

Brennan, M. J., & Subrahmanyam, A. (1996). Market microstructure and asset pricing: On the compensation for illiquidity in stock returns. *Journal of Financial Economics*, 41(3), 441-464.

Brennan, M. J., Chordia, T., & Subrahmanyam, A. (1998). Alternative factor specifications, security characteristics, and the cross-section of expected stock returns. *Journal of Financial Economics*, 49(3), 345-373.

Carhart, M. M. (1997). On the persistence in mutual fund performance. *Journal of Finance*, 52, 57-82.

Chan, K., Cooney, J. W., Kim, J., & Singh, A. K. (2008). The IPO derby: Are there consistent losers and winners on this track? *Financial Management*, 37(1), 45-79.

Chan, K., Wang, J., & Wei, K. C. (2004). Underpricing and long-term performance of IPOs in China. *Journal of Corporate Finance*, 10(3), 409-430.

Chang, X., Lin, S. H., Tam, L. H. K., & Wong, G. (2010). Cross - sectional determinants of post - IPO stock performance: Evidence from China. *Accounting & Finance*, 50(3), 581-603.

Chien-Ting Lin, & Shou-Ming Hsu. (2008). Determinants of the initial IPO performance: Evidence from Hong Kong and Taiwan. *Applied Financial Economics*, 18(12), 955-963.

Chordia, T., Subrahmanyam, A., & Anshuman, V. R. (2001). Trading activity and expected stock returns. *Journal of Financial Economics*, 59(1), 3-32.

Competition Commission (2008, March). *Review of changes in industrial structure and competition*. Input paper for 15 year review of policy and research division of the Competition Commission, South Africa

Datar, V. T., Y. Naik, N., & Radcliffe, R. (1998). Liquidity and stock returns: An alternative test. *Journal of Financial Markets*, 1(2), 203-219.

de Jong, F. (2007). Event studies methodology. *Lecture Notes*,

DeAngelo, H., DeAngelo, L., & Stulz, R. M. (2010). Seasoned equity offerings, market timing, and the corporate lifecycle. *Journal of Financial Economics*, 95(3), 275-295.

Derrien, F. (2005). IPO pricing in "hot" market conditions: Who leaves money on the table? *The Journal of Finance*, 60(1), 487-521.

Dichev, I. D., & Piotroski, J. D. (2001). The long-run stock returns following bond ratings changes. *Journal of Finance*, 56(1), 173-203.

Eckbo, B. E. (2007). *Handbook of corporate finance: Empirical corporate finance*. Amsterdam: North Holland.

Eckbo, B. E., & Norli, Ø. (2001). Leverage, liquidity, and long-run IPO returns. *Amos Tuck School of Business Administration, Dartmouth College,*

Eckbo, B. E., & Norli, Ø. (2005). Liquidity risk, leverage and long-run IPO returns. *Journal of Corporate Finance, 11(1-2), 1-35.*

Eleswarapu, V. R., & Reinganum, M. R. (1993). The seasonal behavior of the liquidity premium in asset pricing. *Journal of Financial Economics, 34(3), 373-386.*

Espenlaub, S., Gregory, A., & Tonks, I. (2000). Re - assessing the long - term underperformance of UK initial public offerings. *European Financial Management, 6(3), 319-342.*

Fama, E. F. (1998). Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics, 49(3), 283-306.*

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *Journal of Finance, 47(2), 427-465.*

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics, 33(1), 3-56.*

Fama, E. F., & French, K. R. (1998). Value versus growth: The international evidence. *The Journal of Finance, 53(6), 1975-1999.*

Fama, E. F., & French, K. R. (2002). Testing Trade - off and pecking order predictions about dividends and debt. *Review of Financial Studies*, 15(1), 637-659.

Firer, C., Ross, S., Westerfield, R., & Jordan, B. (2008). *Fundamentals of corporate finance* (4<sup>th</sup> ed.). London: McGraw-Hill.

Gompers, P. A., & Lerner, J. (2003). The really Long - run performance of initial public offerings: The pre - Nasdaq evidence. *The Journal of Finance*, 58(4), 1355-1392.

Gregory, A., Guermat, C., & Al - Shawawreh, F. (2010). UK IPOs: Long run returns, behavioural timing and pseudo timing. *Journal of Business Finance & Accounting*, 37(5 - 6), 612-647.

Hoechle, D., Schmid, M., & Zimmermann, H. (2009). A generalization of the calendar time portfolio approach and the performance of private investors. *EFA 2007 Ljubljana Meetings Paper*.

Ibbotson, R. G. (1975). Price performance of common stock new issues. *Journal of Financial Economics*, 2(3), 235-272.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance*, 48, 65-91.

Kao, J. L., Wu, D., & Yang, Z. (2009). Regulations, earnings management, and post-IPO performance: The Chinese evidence. *Journal of Banking & Finance*, 33(1), 63-76.

Khurshed, A., Mudambi, R., & Goergen, M. (2007). The long-run performance of UK IPOs: Can it be predicted. *Managerial Finance*, 33(6), 401-419.

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarian investment, extrapolation, and risk. *Journal of Finance*, 49(5), 1541-1578.

Lee, C. M. C., & Swaminthan, B. (2000). Price momentum and trading volume. *Journal of Finance*, 55(5), 2017-2069.

Li, J., Zhang, L., & Zhou, J. (2006). *Earnings management and delisting risk of IPO firms*. Unpublished manuscript.

Logue, D. E. (1973). On the pricing of unseasoned equity issues: 1965–1969. *Journal of Financial and Quantitative Analysis*, 8(01), 91-103.

Loughran, T., & Ritter, J. R. (2000). Uniformly least powerful tests of market efficiency. *Journal of Financial Economics*, 55(3), 361-390.

Loughran, T., Ritter, J. R., & Rydqvist, K. (1994). Initial public offerings: International insights. *Pacific-Basin Finance Journal*, 2(2-3), 165-199.

Loughran, T., & Ritter, J. R. (1995). The new issues puzzle. *Journal of Finance*, 50(1), 23-51.

Lowry, M., & Schwert, G. W. (2002). IPO market cycles: Bubbles or sequential learning? *The Journal of Finance*, 57(3), 1171-1200.

Lyandres, E., Sun, L., & Zhang, L. (2008). The new issues puzzle: Testing the investment-based explanation. *Review of Financial Studies*, 21(6), 2825-2855.

Lyon, J. D., Barber, B. M., & Tsai, C. L. (1999). Improved methods for tests of long - run abnormal stock returns. *The Journal of Finance*, 54(1), 165-201.

Mangozhe, G. T. (2010). *The long-run investment performance of initial public offerings (IPOs) in South Africa*. (Unpublished Master of Business Administration). University of Pretoria, Johannesburg.

Marshall, B. R., & Young, M. (2003). Liquidity and stock returns in pure order-driven markets: Evidence from the Australian stock market. *International Review of Financial Analysis*, 12(2), 173-188.

Martínez, M. A., Nieto, B., Rubio, G., & Tapia, M. (2005). Asset pricing and systematic liquidity risk: An empirical investigation of the Spanish stock market. *International Review of Economics & Finance*, 14(1), 81-103.

Michou, M., Mouselli, S., & Stark, A. (2007). Estimating the Fama and French factors in the UK-an empirical review. *Working Paper-Manchester Business School*, 505

Mitchell, M. L., & Stafford, E. (2000). Managerial decisions and long-term stock price performance. *Journal of Business*, 73(3), 287-329.

M'kombe, C., & Ward, M. (2002). Aftermarket price performance of initial public offerings on the JSE. *Investment Analysts Journal*, (55), 7-20.

Mtshiya, Z. (2010, June 7). Life healthcare cuts IPO size by 35% as it raises R5.26bn. [ZolaMtshiya's blog](#). Retrieved from: //www.bhfglobal.com

Myers, S. C. (1984). The capital structure puzzle. *Journal of Finance*, 39(3), 575-592.

Narayan, P. K., & Zheng, X. (2011).The relationship between liquidity and returns on the Chinese stock market. *Journal of Asian Economics*, 22(3), 259-266.

Page, M.J., & Reyneke, I. (1997).The timing and subsequent performance of initial public offerings (IPOs) on the Johannesburg stock exchange. *Journal of Business Finance & Accounting*, 24(9 - 10), 1401-1420.

Pástor, L., & Stambaugh, R. F. (2003). Liquidity risk and expected stock returns. *Journal of Political Economy*, 111(3), 642-685.

Pencek, T., Hikmet, N., & Lin, J. B. (2009). Stock market performance of healthcare initial public offerings. *Journal of Business & Economic Studies*, 15(2), 26-31.

Purnanandam, A. K., & Swaminathan, B. (2004). Are IPOs really underpriced? *Review of Financial Studies*, 17(3), 811-848.

Reilly, F. K. (1973). Further evidence on short-run results for new issue investors. *Journal of Financial & Quantitative Analysis*, 8(1), 83-90.

Ritter, J. R. (1991). The long-run performance of initial public offerings. *The Journal of Finance*, 46(1), 3-27.

Ritter, J. R., & Welch, I. (2002). A review of IPO activity, pricing, and allocations. *The Journal of Finance*, 57(4), 1795-1828.

Schultz, P. (2003). Pseudo market timing and the long - run underperformance of IPOs. *The Journal of Finance*, 58(2), 483-518.

Stoll, H. R. (1978). The supply of dealer services in securities markets. *Journal of Finance*, 33(4), 1133-1151.

Van Rensburg, P. (2002). Market segmentation on the Johannesburg stock exchange II. *Journal for Studies in Economic and Econometrics*, 21, 1-23.

Xiong, Y., Zhou, H., & Varshney, S. (2010). The economic profitability of pre-IPO earnings management and IPO underperformance. *Journal of Economics and Finance*, 34(3), 229-256.

Yang, S., Wang, T., & Jiang, S. (2007). What explains the high returns to the IPOs of China's A-shares? *Journal of Economic Policy Reform*, 10(4), 297-308.

Zheng, S. X. (2007). Are IPOs really overpriced? *Journal of Empirical Finance*, 14(3), 287-309.