An Empirical Analysis of Initial Public Offering (IPO) Performance

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Abstract: For decades, researchers have disagreed about the magnitude and predictability of abnormal securities' price performance generated by initial public offerings (IPOs). The purpose of this study was to identify the best specified and most powerful method of abnormal performance detection and to apply this method to examine the price performance of IPOs. Matched by size, industry, and book-to-market ratios this study explored which of the resulting seven portfolios and matched-firm methods of abnormal performance detection produced the best specified and most powerful test statistics. Additionally, this study analyzes IPO price performance to determine if IPOs generate abnormal performance. This analysis was conducted using the event study approach for the research design along with the buy and hold abnormal return (BHAR) method of calculating abnormal returns. The findings were that (a) all of the matched-firm methods of abnormal performance detection were well specified and powerful (matching by industry affiliation generated the best power and specification results) and (b) that the IPOs generated statistically significant abnormal price performances occurring in: (a) short-term analyses, (b) longer-term analyses, and (c) analyses of the lockup and quiet periods.

Key words: Event study, IPO performance, Quiet period, Lockup period, Specification and power analysis, Short- and long-term abnormal performance, Initial public offering, Price performance

An Empirical Analysis of Initial Public Offering (IPO) Performance

This research project will provide the reader with thorough understanding of the anomalies related to IPO price performance, by canvassing the population of IPOs that went public on U.S. financial exchanges from 1985-2002. There were four test of abnormal IPO performance carried out in this research project, test for: (a) abnormally positive pre-market and initial day of trade performance, (b) abnormally negative longer-term performance, (c) abnormally negative performance occurring around the expiration of the lockup period, and (d) abnormally positive performance occurring during the expiration of the quiet period. In addition to the preceding tests, this study seeks to determine which of seven portfolio-matching (PM) and matched firm (MF) strategies are the best-specified and most powerful estimators of normal performance. The matching strategies evaluated in this analysis were PM techniques by market capitalization, industry affiliation, and market capitalization and book-to-market ratios and MF techniques by market capitalization, industry affiliation, industry affiliation and market capitalization, and market capitalization and book-to-market ratios. This study relied on the use of the event study methodology throughout the analysis and the calculation of abnormal returns by the buy and hold abnormal return (BHAR) method.

The main results and conclusions reached in this analysis were as follows. First, this paper illustrates how poor, in regards to specification and power, PM techniques performed; on a positive note, all of the MF strategies used to estimate abnormal performance performed remarkably well—interestingly enough, the MF approach by industry affiliation outperformed the more popular approach—matching by market capitalization and book-to-market ratios. Second, it is apparent that initial abnormal performance, between the offer and initial trading of shares, is substantial—the current study estimates this abnormal performance at 11.74%—however, abnormal performance is not constrained to pre-market inefficiencies. During the initial trading day, IPOs in this sample generated abnormally positive performance of 3.44%. Third, this analysis illustrates that IPOs experience substantial long-term underperformance three years after their initial unseasoned equity offering, when compared against firms matched based upon industry affiliation. Finally, IPOs experience significant abnormally positive performance in the five-day period surrounding the expiration of the quiet period of 1.64% and a significantly negative abnormal performance of 1.00% around the expiration of the lockup period.

This paper continues as follows. Section I introduces the theory, empirical work, and conceptual framework of the hypotheses related to IPO performance. Section II presents the proposed methodology. Section III presents the results of the current analysis. Section IV provides a summary of the work and concludes.

Literary Review

Studies of IPO performance have concentrated in two general veins of inquiry: (a) why do IPOs generate abnormal performance and (b) to what extent is this performance abnormal. This project focus on addressing the second of the two preceding questions, namely how significant this abnormal IPO performance. Many researchers have attempted to answer this question (e.g. Affleck-Graves, Hedge, & Miller, 1996; Ibbotson, 1975; Loughran & Ritter, 2004; Reilly & Hatfield, 1969), but questions regarding their methods used to identify abnormal performance have arisen (e.g. Brav, Geczy, & Gompers, 2000; Brown & Weinstein, 1985; Cheng, Chueng, & Po, 2004; Schultz, 2003). This list of relevant research is only an introduction to a vibrant debate that has been brewing, and is as complicated as it is interesting and

invigorating. The question that this project seeks to illuminate is as follows: If IPOs generate abnormal performance, when is this abnormal IPO performance significant and how should academics measure this performance?

Method

Traditionally, researchers attempt to measure abnormal performance in research conducted on financial data sets using the event study methodology. This method seems to have been pioneered by Ball and Brown (1968) and Fama, Fisher, Jensen, and Roll (1969), in which the researchers analyze the impact of information on the performance of a publicly traded security; however, according to Campbell, Lo, and MacKinlay (1997) the first published event study was conducted 1933. When we refer to traditional event study designs, like those mentioned in Campbell et al. (1997), normally the researcher has the luxury of (a) an estimation window, (b) event window, and (c) post-event. However, when dealing with IPOs, we lack this estimation period, which is suppose to provide the researcher with normalized expectations of return behavior. Therefore, researchers have to find other means of estimating normal return behavior.

Researchers have used various methods to accomplish this task. In current and recent research, these methods normally fall into one of two categories: matched firm (MF) approaches or portfolio matching strategies (PM). PM matching strategies have been carried out by Brav and Gompers (1997), Carter, Dark, and Singh (1998), Gompers and Lerner (2005); contrarily, Bhabra and Pettway (2003) and Perfect and Peterson (1997) focused solely on the MF approach; Finally, Ritter, J. (1991) used both MF and PM strategies. Attempts have been made by Barber and Lyon (1997), Mitchell and Stafford (2000), and others to generate tests of different methods analyzing the ability of different methods to detect abnormal performance—the two general approaches are categorized as event and calendar time analyses.

There are good arguments for and against using various methods; researchers typically prefer one method to the other. This project is interested in evaluating the investor's buy and hold investment experience; therefore, because the buy-and-hold investor's returns are most appropriately modeled in event time the method used to analyze the investment performance in the current analysis was the buy and hold abnormal return (BHAR) method. The question that is inherently difficult to answer is that if we were interested in analyzing the buy and hold investor's experience, in terms of abnormal performance, what would the best-suited method look like? Mitchell and Stafford (2000) picked apart the BHAR method in their analysis, but they focus their critiques on portfolio-matching techniques and using bootstrapping procedures or bootstrapped *t*-statistics and stated that "BHARS have poor statistical properties, producing biased test statistics in random samples" (p.302). Portfolio-matching techniques produce misspecified test statistics in random samples; however, the method ignored in the Mitchell and Stafford (2000) analysis is the matched-firm approach to benchmarking, which will produce well-specified test statistics in the present analysis. Barber and Lyon (1997) concluded that the matched firm approach, relying on a firm's market capitalization and book-to-market ratios to evaluate firm performance, generated well-specified test statistics throughout their analysis. This project focuses on measuring the buy-and-hold investor's investment experience; therefore, the researcher applied the BHAR method throughout this analysis.

Research Questions

This analysis focuses on four different research sections; this section develops these questions and this paragraph identifies them. The first question that this research project endeavors to answer is which general method, matched-firm or portfolio-matching technique, paired with firm-specific information (i.e. market capitalization, industry affiliation, and book-to-market ratios) provides the best proxy for expected return. The next topic that this project seeks to address is when short-term abnormal performance occurs, in the process of issuing unseasoned equity shares; the researcher analyzes the specific time horizons in segments, studied by pre-trade and initial trading day results. Lengthening this analysis the project will then seek to determine whether IPOs underperform the market in longer-term analyses. Finally, the analysis will evaluate whether IPOs generate significant abnormal performance in the five-day period surrounding the expiration of the quiet and lockup periods.

Specification and Power Analyses

The first portion of the hypothesis testing section will evaluate the performance of potential methods used to identify abnormal performance in similar studies. There has been significant debate regarding whether researchers should use the CAR or BHAR method of calculating abnormal returns when conducting event studies, in the previous subsection, this debate was already articulate. In this section, the discussion centers around which method of estimating expected return should be use to conduct event studies, given that the BHAR method is the appropriate method used to estimate the extent of abnormal performance.

In the majority of research projects attempting to determine which method of abnormal performance detection, portfolio matching or matched-firm, to use when conducting event studies conclude that the matched firm approach works quite well (Ang and Zhang, 2004; Barber and Lyon, 1997). However, researchers continuously revert to their quest to identify a method of abnormal performance detection that relies on the construction of portfolio benchmarks. In Lyon, Barber, and Tsai (1999) the researchers used skewness adjusted *t* statistics and empirically generated distributions of mean long-term stock returns generated from pseudo portfolios, to compensate for the following biases: (a) the new listing bias, (b) the rebalancing bias, (c) skewness bias, (d) cross-sectional dependence, and/or (e) a bad model problem (p. 197). However, after these efforts are undertaken, the control-firm approach used to detect abnormal performance, using market capitalization and book-to-market ratio data to match, generated better-specified test statistic than either adjusted portfolio technique.

This analysis will illustrate that the entire set of matched firm approaches used to detect abnormal performance generated well-specified and relatively powerful test statistics, prior to making additional changes to the models of abnormal performance detection. We can easily avoid exposing the matched firm approach to the new listing, rebalancing, and skewness biases. Cross-sectional dependence may pose some threat to the conclusions and results reached in this analysis; however, it is apparent that markets run in cycles—whether we are discussing industry correlations, correlations of market returns by size and/ or market-to-book ratios—this problem is evident in the majority of analyses conducted on event studies. This study assumes that the sample sizes used to implement the analyses and the 18-year period that the study was ran will minimize the impact of this bias on the results obtain. Finally, this research project provides evidence that when researchers use the match firm approach to detect abnormal performance,

combined with an independent sampling technique, the model performs very well regardless of the techniques researchers use to match the event firms. In summary, first, there are many biases that researchers can fall prey to when attempting to conduct event studies, second, when researchers use portfolio-matching techniques instead of matched firm approaches these biases are accentuated, and , third, the biases affect the results of the portfolio-matching techniques more than the matched-firm approaches used to detect abnormal performance.

Short-Term Abnormally Positive Performance

The most visible abnormality that currently exists in studies of IPO performance is that IPOs tend to produce extremely abnormally positive performance results a short duration after going public. This excess abnormal return occurs either in the preissuance period or in the one-day performance of the post-offering period (see Krigman, Shaw, & Womack, 1999; Loughran & Ritter, 2004; McDonald & Fisher, 1972; Reily & Hatfield, 1969). Miller and Reilly (1987) found that the extent of this underperformance was approximately 9.87% (p. 34) and Ibbotson, Sindelar, and Ritter (1994) reiterated this sentiment by concluding that "first–day returns average 10-15%" (p. 66). Cheng, Cheung, and Po (2004) found, while studying IPO price performance on the Hong Kong financial market, that no trading profits were obtainable once IPOs began trading publicly (p. 853), this finding contrasts those reached in Miller and Reilly (1987), an analysis of IPOs listed in the U.S. markets. Historically, researchers seem to have assumed that IPOs obtained profits in the first trading day. Perhaps, they have ignored the negative social and process implications attached to an empirical finding that the positive IPO performance is constrained to the pretrading period. If the abnormal performance is constrained between the offer and issuance, then the distributions of shares, and whom the shares are distributed, become a more fundamental question, in regards to affording investors with equal opportunities to profit. This question is relevant because the underwriting syndicate holds an unfair informational advantage over the majority of the investing public.

The pertinent questions are does the underwriting syndicate exploit the informational advantage, and is the initial abnormally positive performance a result of an under pricing / rebating scheme (see Ritter & Welch, 2002)? There are alternative arguments for what occurs here, for example, the investing public may create abnormal performance because they are acting irrationally when attempting to value these IPOs. This irrational analysis may occur because the investors know about the historical pricing anomaly (short-term abnormally positive performance), and in turn demand for new issues are exacerbated and unwarranted optimism, in the post-issuance performance capability of these securities, increases, thus pushes the share price away from its fundamental value in the aftermarket (see Garfinkle, Malkiel, & Bontas, 2002). Case in point, Purnanandam and Swaminathan (2004) found in a study of 2,000 IPOs that went public from 1980 to 1997 that investors overvalued the median IPO, when compared against firms matched by operating characteristics—they approximate the overvaluation at approximately 14% to 50% (p. 812). Since the investment bankers, who are underwriting these offerings, are considered market experts, it seems that the market would consider a systematic underpricing a disadvantageous finding for the EMH. If investors are responsible for this abnormal performance, then researchers should seriously question market efficiency because the markets are irrationally pricing individual securities in a reaction to systematic events related to the process of issuing unseasoned equity shares.

Long-term Underperformance

Researchers have also provided evidence in support of the theory that IPOs suffer from long-term price underperformance when measured against standard benchmarks (see Affleck-Graves, Hedge, & Miller, 1996; Ibbotson, 1975; Loughran, & Ritter, 1995; Ritter, 1991). Ritter (1989) found that, in his sample of IPOs issued from 1975-84, IPO's 3-year holding period returns (HPR) underperformed portfolios matched based upon market capitalization and industry characteristics by 27.39% (p. 4); Ibbotson, Sindelar, and Ritter (1994) found similar results analyzing IPO data from 1970-1990. Ritter (1989) and Ibbotson (1994) suggested that on average IPOs underperform standard benchmarks from the end of the initial trading day to at least the firm's five-year publicly traded anniversary.

Event-specific Abnormal Performance

Two events in occur systematically after a company issues unseasoned equity to the public are the expiration of the quiet period and the lockup period. Researchers have illustrated that these two events produce abnormal performances in empirical analyses of event studies. However, the directions of the abnormal performances that the two events generate are divergent, and researchers have questioned the magnitude and causes of these abnormal performances. The following two sections will define and review the literature related to the abnormal performance, which that purportedly occurs during the expiration of the quiet and lockup periods.

The Quiet Period. The quiet period is the market's terminology for SEC regulation #5180, enacted in 1971; it states that companies are not to issue forecasts or predictions related to revenues, income, and earnings per share, or publish "opinions concerning values" (see Bradley, Jordan, & Ritter, 2003, p. 5). The rationale behind the enactment of the quiet period is that, according to Bradley, Jordan, Ritter, and Wolf (2004), it provides investors with the necessary time to value the company without insider interference or influence. The quiet period provides a time period that allows investors to search for a fair value of the underlying assets owned by the company without external, expert, influence on their opinions.

At the conclusion of the quiet period, the SEC allows investment firms to initiate coverage of a security. The reason why this period is so interesting is that Bradley, Jordan, and Ritter (2003) have found that from 1996-2000, for all IPOs issued, analysts initiated coverage on 76% of the newly issued IPOs, and of these 76%, analysts initiated coverage on 96% of these issues as a strong buy or a buy (p. 33). This is not what the researcher expected; structurally, I would prefer to see a distribution that, from a probabilistic standpoint, firms rated would just as likely receive a positive rating as a negative rating. According to Bradley et al. (2003), when analysts initiate coverage immediately after the quiet period, the IPOs affected by this event experienced a significantly positive abnormal return of 4.1% in a five-day window surrounding the quiet period (p. 33). If analysts left the newly issued IPOs uncovered at the conclusion of their quiet period, firms experienced an insignificant abnormal return of 0.1% (see Bradley et al., 2003, p. 33). In 2004, Bradley, Jordan, Ritter, and Wolf (2004) attempted to expand this study to include IPOs that went public from January 2001 through July 2002; the impact of the expiration of the quiet period during this time horizon was insignificant (p. 11). In this study, the researcher

endeavored to answer why the two research projects differed in regards to their results and analyze whether abnormal performance is significant during the expiration of the quiet period.

Lockup Expiration. Researchers, in the past, have not built a solid case to declare that abnormal performance occurs as the lockup period expires. However, Field, and Hanka (2001) found that from 1988 to 1997, during the expiration of the lockup period, investors experienced a three-day abnormally negative performance of 1.5% (p. 471). The results from Garfinkle, Malkiel, and Bontas (2002) were in agreement with Field et al. (2001), although the Garfinkle et al. (2002) found that negative performance experienced during the expiration of the lockup period was to 4.47%. The two different percentages vary remarkably and the methods that the researchers used to calculate abnormal returns are quite different. It is my goal to add clarity and specificity to this potential anomaly.

Summary

From a methodological perspective, according to Lyon, Barber, and Tsai (1999), "the analysis of long-run abnormal performance is treacherous" (p. 198); therefore, it is beneficial for any analysis attempting to identify long-term abnormal performance to be paired with a specification and power analysis of the metric used to identify this abnormal performance. This empirical study will combine the majority of the different tests of abnormal performance that occur because of unseasoned equity issuance with a test of the metric used to identify abnormal performance. Many researchers have conducted analyses on IPO performance, both short- and long-term, and, in general, what prompts researchers to doubt the outcome of an analysis is the metrics they use to calculate expected returns and aggregate abnormal returns. Thus, researchers should include a specification and power analysis of the metric used to estimate expected return within their analyses of abnormal performance, to avoid undue criticism and dissention in regards to the interpretation of the conclusions generated in the analysis.

This analysis tests the models of expected return to find the best-specified and most powerful method to use to detect abnormal performance so that we use the best the metric to detect abnormal IPO performance. This study tested five conjectures related to IPO performance—they were as follows: (a) abnormally positive performance occurring in pre-issuance trading, on the initial day of trade, around the expiration of the quiet period, and (a) abnormally negative performance occurring at the conclusion of the lockup period and in long-term analyses. Researchers have run analyses related to these aforementioned abnormalities in preceding studies, however, for whatever reason, as outlined in this section other scholars have questioned the results of these analyses. This analysis aims to reconcile tests of abnormal IPO performance using large sample sizes and well-specified and powerful method used to estimate expected return as well as detect abnormal performance.

Methodology

A discussion of the rationale behind the decisions to use the BHAR method to calculate abnormal returns over the choice of the CAR method was address earlier in this document; this section will describe how the researcher will implement the method and run the power and specification analyses. Furthermore, the sample sizes are different in many of the analyses, even though the study canvassed the entire time horizon, from January 1985 to December 2002;

because of incomplete records, the researcher conducted some of the analyses with much smaller sample sizes than originally anticipated. This section will review the methodological procedures applied to conduct the power and specification analyses as well as the test of abnormal performance and the samples sizes of each test.

Power and Specification Analyses

In this analysis, the researcher conducted the power and specification analyses based partially on the methodology described in Ang and Zhang (2004). The following paragraphs describe the adjustments made to the Ang et al. (2004) methodology. It is appropriate to note here that two different power and specification analyses were run to determine how increases in sample sizes would influence the metrics ability two identify abnormal performance. In the first analysis, we took 10 non-repeating samples of 50 companies taken from the list of Russell 3000 constituents each year of our analysis. Next, the researcher combined these 10 yearly samples of 50 companies were combined to produce larger samples (n – 500).

Specification Analysis

To evaluate which of the seven different benchmarking techniques generated the best specified test statistics, the project needs a pool of random companies to evaluate, the metric used as a proxy for normal performance, a method used to calculate abnormal performance, and a method to aggregate abnormal performances a cross the sample. This analysis uses the BHAR methodology to calculate abnormal performance and seven different methods based upon either portfolio matching or matched-firm methods used to proxy for expected returns; however, now the project's pool and the method used to aggregate returns a cross samples will be specified.

This project used two different procedures to obtain proxies for expected returns: (a) portfolio-matching and (b) matched-firm. For the match-firm approach, the researcher extracted the sample firms used in this analysis from a list of the components of the Russell 3000 Index each year. If a company was included in the Russell 3000 list of companies, the company was eligible to be a matched firm in this analysis—each year, the list was updated, from 1985-2002, due to the addition and deletion of firms from the list of constituents each year. If a firm is matched based upon any singular firm characteristic (i.e. market capitalization or industry affiliation), the pool of potential matched firms are sorted and the closet match is selected; furthermore, if there are multiple firms that meet the matching requirements, a number is assigned to each potential match and a firm is randomly selected from the potential matches. If two factors are included in the matching procedure (i.e. industry and market capitalization and market capitalization and book-to-market ratios), the firms are sorted by the most appropriate factor (i.e. industry affiliation for the industry/market capitalization sort and market capitalization for the market capitalization and book-to-market sort) first, and then the second factor.

When this research project used the portfolio-matching technique, it relied on external portfolios to match the firm to a similar portfolio with a similar likeness. The procedure for matching was simple: the researcher paired the event firm with a portfolio grouping compiled and maintained on Dr. Kenneth French's website (URL: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). The researcher then

carried out this matching procedure for portfolio-matching approaches based upon industry affiliation, market capitalization, and market capitalization and book-to-market ratios.

After the pairings were made, the performance of the simulated event firm (randomly drawn from the Russell 3000 list each year) and the matched firm or portfolio match were compared, in terms of specification, for 1, 2, 3, and 4-year time horizons. The researcher then ran the specification analysis to determine if a metric would conclude that abnormal performance had occurred when in actuality it had not—throughout this analysis the level of significance was set at 5%. Therefore, on for each pairing the following Buy and Hold Abnormal Return (BHAR) was calculated:

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

The researcher then pooled the result of this formula for each sample taken for this analysis and then compiled the following summary statistics: (a) sample size, (b) sample average, (c) sample standard deviation.

After the researcher compiled these statistics for each sample taken, he calculated the following statistic, Barber and Lyon (1997):

$$t_{BHAR} \equiv \overline{BHAR_{i,t}} \,/(\sigma(BHAR_{i,t}) / \sqrt{n}) \quad (2)$$

The researcher then took the *t* statistics and grouped them based upon their respective sample to generate the empirical size (ES) statistic. The following calculation will provide us with the ES statistic; again, we are comparing this statistic against our theoretical 5% level of significance to determine if our metric can perform properly if abnormal performance does not exist. The researcher calculated this statistic by taking each sample of 50 or 500 observations contained in the yearly cohorts, summing the number of times that the given metric identified abnormal performance, and dividing this sum by total number of observations contained in the cohort.

Power Analysis

The power analysis uses the results of the specification analysis as a base to continue the evaluation of the given method of abnormal performance detection. All models that the researcher has properly constructed should identify no abnormal performance. From this base of zero abnormal performance, abnormal performance is simulated across the entire sample by taking the average performance add adding either positive or negative percentage movements of 1, 5, 10, 15, 20, 30, 50, and 75%.

Using the outcome from these simulations, this project then calculates the t_{BHAR} for each level of simulated abnormal performance. We expect abnormal performance to be negligible where we simulate zero abnormal performance and increase as both positive and negative abnormal performances are simulated; therefore, when charting the results of this analysis we are looking to obtain a v or u-shaped power curve, centered on zero abnormal performance and increasing substantially as we simulate abnormal performance. After simulating abnormal performance, for each simulation and each metric, the Empirical Power (EP) statistic was calculated. The EP statistic is similar to the ES statistic, but when we calculate the EP statistic

we are analyzing how well a metric identifies the researcher's simulation of abnormal performance and when it does not. Thinking back to our u or v-shaped curve, at zero percent simulated abnormal performance we want to see that the metric does not identify abnormal performance, therefore, our ES statistic would be zero, but at each increment (positive and negative) from 1% to ∞, we want to see that the metric's ability to detect abnormal performance increases.

Short-term Abnormal Performance

The time horizon used to evaluate short-term abnormal performance shrank significantly when compared to the other studies in this analysis. Using the sources that were available (Hoovers IPO Central, Edgar IPO), this study was able to obtain premarket offering prices for the IPOs included in this analysis. The researcher used the following time horizon, January 1, 1997 to December 22, 2005, for tests conducted on the performance of the initial day of public trading and April 12, 1996 to January 28, 2008 for tests conducted on pre-trade performance. Although, this is a substantial reduction in the intended sample, there were still a significant number of observations in each sample—the researcher identified 1,876 observations for premarket performance and 2,143 observations for the initial day of trading. Even if it was possible to obtain performance data prior to January 1, 1997 for the initial day of trading in IPOs, the CRSP database, which was used to obtain daily pricing data in this analysis, did not have initial day trading data for IPOs listed prior to January 1997.

It is important to note, when we analyze pre-trade performance, the public does not openly share their return expectations and we lack a specific time horizons (e.g. does the offering to issue period last 12 hours, 24 hours, 36 hours, or more) to match the return of the event firm against. Therefore, the researcher compared the aggregate returns obtained in the pre-public trading period with the returns obtained by investor's investing in a market proxy—the researcher uses standard market indices to obtain this performance (e.g. Russell 3000, S & P 500, NASDAQ Index, etc.). Therefore, when the researcher evaluated abnormal performances occurring in pre-public trading he started with the assumption that the aggregate IPO will produce a return of 0%, and compared this return against the return of the DJIA, Russell 3000, and NASDAQ indices, to gain some insight on how substantial premarket IPO performance is. The researcher will revert to using the best-specified and most powerful method used to detect abnormal performance in the remainder of the analyses, because he has public trading data that can be compared our event firm's performance. Therefore, in our initial day of trading, the researcher will take the returns obtained in from the sample of IPOs and, using the BHAR method to detect abnormal performance, and match these firm's to the best-specified and most powerful metric identified in the preceding power and simulation analysis explained in the preceding section.

Long-term Abnormal Performance

To obtain a general sample to run tests for longer-term abnormal IPO performance, the researcher used the Field-Ritter dataset of founding dates, identified in Loughran and Ritter (2004; as noted in http://bear.cba.ufl.edu/ritter/foundingdates.htm) for companies that went public from 1985 to 1996. Additionally, the researcher obtained information pertaining to IPO issuance from 1996 to 2002 from on-line IPO databases (e.g. Hoovers IPO Central, Edgar IPO).

The total sample of IPOs used in this analysis was 5,883. Any company that had an offer price of less than $5 or were foreign offerings were removed from this list—this is the base IPO list used for both the analysis of longer-term abnormal IPO performance and event specific abnormal IPO performance. Using the best-specified and most power method of abnormal performance detection, the researcher paired the IPOs in this sample with the benchmark to determine whether abnormal performance is evident using time horizons ranging from day 2 to trading day 750.

Event-Specific Abnormal IPO Performance

For tests of abnormal performance occurring during the expiration of the quiet and lockup periods, the sample size shrunk to 5,529 due to firm attrition. In this analysis, the event horizon was the five-day period surrounding the day of the specific event—either the expiration of the lockup period or the conclusion of the quiet period. The researcher compared the BHAR obtained from the IPO experiencing the event against the benchmark and the results of these individual analyses were aggregate to give an average BHAR for the entire sample of IPOs issuing shares over this period.

Results

This section provides the results of test that the researcher conducted to indentify abnormal price performance related to the issuance of unseasoned IPO issuance. The first section provides the results of the specification and power tests the researcher conducted on seven metrics used to identify abnormal performance. Sections 2 through 4 will display the results of tests that the researcher conducted to identify abnormal performance, using the best-specified and most power testing procedure.

Specification and Power

The purpose of this section was to determine, which method of benchmarking was more effective testing for abnormal performance of the IPOs. Based upon the review of literature, the researcher employed two broad methodological strategies to conduct the specification and power analyses--the portfolio matching and the matched-firm approaches. The first subsection will present the specification results and the second subsection will present the results of the power analysis.

Tests for Specification

The first question that this analysis answered is as follows: in samples of 50 and 500 companies, how often did the randomly drawn event firm (i.e. drawn from the list of Russell 3000 constituents each year) generate statistically significant abnormal performance. The hypothesis test run on each of the 180 samples of 50 and 18 samples of 500 companies was as follows:

Hypothesis 1:

$$H_o : \overline{BHAR} = 0$$
$$H_1 : \overline{BHAR} \neq 0$$

After the researcher conducted the hypothesis test for each sample, he added the number of rejections together and divided by the number of observations, thus resulting in the *ES* statistics. The researcher displayed the results of the specification analysis Table 1.

Insert Table 1 Here

The researcher found that all of the approaches using the matched-firm technique (i.e. matching based upon market capitalization, industry affiliation, industry affiliation and market capitalization, market capitalization and book-to-market ratios) were generally well specified, using a level of significance of 5%. The matched-firm approach by market capitalization, alone, did identify abnormal performance in 5.56% of its samples, using sample sizes of 50 and 11.11% with sample size of 500. However, the researcher conducted an additional test to determine whether the *ES* was significantly different from the theoretical 5% level of significance—where α was the level of significance and n was the sample size.

$$\alpha \pm 1.96\sqrt{\frac{\alpha(1-\alpha)}{n}}$$

The *ES* interval ranges from 1.82% to 8.18% for the 180 samples of 50 companies and from negative 5.07% to 15.069% to the 18 samples of 500 companies. Matched firm approaches, matched based upon Market Capitalization, Industry Affiliation and Market Capitalization, and Market Capitalization and Book-to-Market Ratios Companies, generated spurious rejections; however, these rejections where not statistically different than our theoretical level of significance. Even though they were not statistically different from the theoretical level of significance used in this analysis, they were different. The best-specified matched-firm approach used in this analysis and the approach that did not identify abnormal performance greater than the theoretical level of significance in any of the analysis, which the researcher used in this analysis, was the matched firm technique based solely upon industry affiliation.

Each of the portfolio-matching strategies (i.e. matched by market capitalization, industry affiliation, and market capitalization and book-to-market ratios) rejected the null hypothesis; this indicates an identification of abnormal performance even though, the researcher had not simulated abnormal performance. Every specification test, using the portfolio-matching techniques, regardless of how it was matched to the event firm, generated misspecified test statistics in all cases that were significantly different from our theoretical level of significance.

As illustrated in Tale 1, as the sample size increases from 50 to 500, the observed percentage of spurious rejections decreased using the matched firm approach. This occurs because, without simulating abnormal performance, researchers would expect to detect no abnormal performance. Given the preceding results, I found I believe it is evident that the matched-firm approach is a better-specified method of abnormal performance detection than the methods using portfolio-matching strategies. The researcher concluded that the best-specified

matched firm approach is implemented using matched-firm strategy, matching by industry affiliation.

Tests of Power

The purpose of power analysis was to determine what test method had the least type II error, and which methodology had the highest power. This research project relied on running the power analysis by simulating abnormal performance in +/- .01, .05, .10, .15, .20, .30, .50, and .75 intervals to the individual BHARs derived from the results of the specification analysis. In essence, to calculate the *EP* statistic this analysis forced the average abnormal performance away from zero and imposed abnormal performance on the BHAR. The researcher calculated the *EP* statistic by adding each of the sample average BHARs, for each level of simulated abnormal performance, and dividing this sample average by the size of each sample. Again, the researcher abstracted 180 samples of 50 observations in the first round of the analysis and 18 samples of 500 companies in the second round of the analysis. The specific hypothesis tested in this analysis is the same as that tested in Hypothesis 1; however, the researcher conducted this hypothesis test for each level of simulated abnormal performance.

Insert Figure 1 Here

In Figure 1, all of the matched-firm approaches have defined power curves—the traditional U or V shaped—the power curve are centered approximately centered on zero, the point where no abnormal performance is simulated. In comparison, the portfolio-matched benchmarks had no defined structure or at least not the structure needed to make credible inferences pertaining to the power of the benchmark. Again, the portfolio benchmarks failed to approach acceptable standards that are necessary to judge the benchmarks ability to detect abnormal performance; in the remaining analyses, the portfolio techniques were not included in the analyses because the researcher did not considered them to be meaningful alternatives to the matched-firm approach.

Figure 1, illustrates that if the event firm generates abnormal returns of 15%, the competing matched-firm approaches only rejected the null hypothesis (identifying abnormal performance) in approximately 30% of samples. This seems rather low; researchers would identify simulated abnormal performances of greater than 30% in 70% of the analyses. After comparing these numbers with the results found in Figure 2 where the researcher expanded the number of firms per sample to 500 from 50, the matched-firm approach rejected 80% of the samples, if the simulated level of abnormal performance is 10% points of abnormal performance, compared with approximately a 17% identification using the smaller sample sizes. Therefore, as the sample size increases, the power curve narrows making the employed methodology appropriate.

Insert Figure 2 Here

There is still no statistically significant difference between the different matched firm approaches to benchmarking. When conducting the remainder of the tests the research project was concerned with the speed at which the metric deteriorates. As the event horizon increased the method's ability to detect abnormal performance decreases. Comparing the event horizons of

one-, two-, three-, and four-years using sample sizes of 50, this study found that a simulated abnormal performance of +/- 10% will be detected in 17%, 10%, 6%, and 6% of the samples; in samples of 500 observations the percentage of detection are 80%, 55%, and 25%, and 11%, respectively. To analyze the general ability of each of the matched-firm approaches to detect abnormal performance, this project now will identify when the metrics identify abnormal performance in 95% of the analyses. The *EP* reached 95% at 15%, 15%, 30%, and ~40% simulated abnormal performance using an event horizon of one-, two-, three-, and four-years, respectively, and sample sizes of 500 observations. Therefore, if researchers intend on using the matched firm approaches identified in this analysis their sample sizes and predicted level of abnormal performance should be significantly large.

The purpose of the power and specification analysis was to determine which of the seven benchmarking methods selected in the literature review would provide the best balance between specification and power or which method most appropriately balanced Type I and II errors. As in most analyses this project was more concerned with type I errors than type II--more succinctly it is better to err on the side of caution, not to conclude that abnormal performance occurs when in actuality it had occurred, than to conclude that abnormal performance occurred when in reality it did not. In the specification analysis, the only benchmarking method that generated well specified test statistics, over all time horizons and using sample sizes of both 50 and 500 observations, was the matched-firm approach based upon industry affiliation. There were substantial differences between the results of the power analysis run on the portfolio-matching and matched-firm approaches; the match-firm approaches performed significantly better in the power and specification analyses and there was no significant difference between the power results of the matched-firm approaches.

Section 2: Initial Performance

The following section focuses on the detection of abnormal performance during the initial trading period. The main questions posited in the following section were whether unseasoned IPOs produced abnormal performances in the time proceeding public trading and if this abnormal performance continued into the first day of public trading. The results of the analysis conducted prior to public trading are reported first and then and an analysis of whether IPOs produce abnormal performance on their first day of trade is reported.

IPO Performance (Pre-issuance)

Using standard indexed benchmarks to gauge normal performance—the company issues its shares on the night preceding its initial day of trade, the following hypothesis is tested:

Hypothesis 3:

$$H_0 : \overline{R} \leq 0$$
$$H_1 : \overline{R} > 0$$

This project uses the average returns in this round of the analysis; there is no way to pair event firms with another firm base upon firm specific criteria, because this performance occurs prior to public trading. The average return that IPOs generated prior to public trading or from their

offering to their issuance to the public was 11.74%, with a sample standard deviation of 31.16%, and 1876 observations taken from April 12, 1996 to January 29, 2008. The researcher applied the following formula to determine if the 11.74% performance was statistically different from zero.

$$t = \frac{\overline{X} - 0}{S/\sqrt{n}}$$

The resulting *t* statistic was 16.32, which was outside the critical value of 1.645 for a one-tailed statistical test, given a 5% level of significance.

The preceding analysis illustrated the difference between the performance obtained by IPOs pre-public trading and an expectation of zero abnormal performance, because this is the pre-public trading period, there is no specific way to pair the individual IPO performance with a benchmark. Therefore, the researcher aggregated the returns into monthly IPO cohorts, these performances assume the investor obtains shares of the IPO in the offering and sells them at the initial trade on the first day of public trading. In Table 2, I have illustrated how abnormal IPOs perform in pre-public trading.

Insert Table 2 Here

To make this analysis comparable to the results obtained in the remainder of these analyses contained in this project, the researcher paired these returns with the performances of standard benchmarks over this time horizon. The researcher displayed the results of these comparisons in Table 3. Table 3 shows the average monthly performance of IPO cohort versus those of DJIA, Russell 3000, and the NASDAQ Composite Indices over the period analyzed.

Insert Table 3 Here

As the numbers in Table 3 indicate, at 5% level of significance for a one-tail t test (t critical of 1.66), the researcher rejected the null hypothesis for only the IPO sample, implying that the IPO group experienced significant abnormally positive returns. None of the benchmark indices produced abnormal returns.

The DJIA was the best performing benchmark out of the three potential benchmarks chosen for this analysis; the project continues to analyze whether the IPO cohort significantly outperformed the best performing index, which was the DJIA in this period.

Hypothesis 2:

$$H_0 : \overline{R}_{IPO} \leq \overline{R}_{DJIA}$$
$$H_1 : \overline{R}_{IPO} > \overline{R}_{DJIA}$$

The average difference between the IPO cohort and the DJIA's yearly average return was 8.41%, with a sample standard deviation of 13.86%, and observations' occurring over 139 months--the computed *t* statistics was 7.15. Again, with a 95% level of significance for a one-tailed test the critical value of *t* is 1.66; therefore, this research project rejects the null hypothesis

and determines that significant abnormal performance occurred during the pre-public trading period when compared against standard indices.

Initial Day of Public Trading

This round of the analysis attempts to determine whether IPOs generate abnormal performance on the first day of public trading. To answer the question, the analysis evaluates the returns of IPOs issued to the public from January 1, 1997 to December 22, 2005, the sample contains 2,143 observations, and the researcher evaluated the following hypothesis test.

Hypothesis 3:

$$H_0 : \overline{R}_{IPO} \leq \overline{R}_{MF-IND}$$
$$H_1 : \overline{R}_{IPO} > \overline{R}_{MF-IND}$$

Using a standard *t* test, this analysis uncovered the following: the average return across the IPOs was 3.44%, and the average performance of the matched-firm benchmark was 0.13%. The sample standard deviation was 16.27%; resulting in a *t* value of 9.423, which when compared to a critical value of 1.645, at a 95% level of significance, indicated that the IPOs abnormal returns on the first day of trade are statistically significant. The returns of IPOs on the first day of trade are significantly different from the returns obtained for the matched-firm benchmark.

Section 3: Long-term Abnormal Performance

This round of the analysis turns to evaluating whether significant abnormal performances occur after the short-term abnormal performances. This project accomplished its longer-term analysis by canvassing the population of IPOs issued in the U.S. from January 1, 1985 to December 31, 2002. The study identified 5,583 IPOs to use in this analysis; the researcher matched these IPO upon industry affiliation to a benchmark firm. The BHAR was calculated and the research identified the sample average and standard deviation given the individual BHARs. The output, which encompasses trading day 2 through 750, is the averaged BHAR across the entire sample over the specified time horizon. The researcher evaluated the data and generated a two-tailed *t* test for all 749 time-horizons.

Hypothesis 4:

$$H_0 : BHAR_{IPO} = R_{MF-IND}$$
$$H_1 : BHAR_{IPO} \neq R_{MF-IND}$$

Insert Figure 3 Here

Analysis of the data provided in Figure 3 shows that, during trading days 5 through 12 IPOs significantly underperformed the matched-firm benchmark, at day 17 the trend changed positive, and it was significantly positive until trading day number 120 (with one insignificant reading on day 33)--at day 120 the BHAR is 1.934%. The averaged BHAR continued along

insignificantly, but positive, until reaching trading day 161. However, the BHAR did not generate a significantly negative BHAR until it reached 201 trading day. The BHAR remained significantly negative through the remainder of the analysis. In Figure 4, this project provides the *t* values calculated in comparing IPO performance to the matched-firm returns. Figure 4 shows that the trend of the BHAR was unmistakably negative. Overall, there is an abnormally positive performance of approximately 3 % occurring within the first year and at the end of year three, the highest abnormally negative performance occurred, which was -22.41%.

Insert Figure 4 Here

Section 4: Quiet and Lockup Expiration

To construct a test for abnormal performance at the expiration of the lockup and quiet periods this project canvasses the same population of IPOs used in the longer-term analysis. The number of observations for the quiet and lockup period analyses was 5529. To carry out these analyses this section calculates the 5-day BHAR surrounding the date in which the quiet period ended and the lockup period expired.

Hypothesis 5:

$$H_0 : BHAR_{IPO} \leq R_{MF-IND}$$
$$H_1 : BHAR_{IPO} > R_{MF-IND}$$

For the analysis of performance surrounding the expiration of the quiet period, the sample average BHAR was 1.64%, for the five-day period surrounding the event and the sample standard deviation was 13.9%. The resulting *t* statistic was 8.75, using a 95% level of significance the critical value was 1.645; the null hypothesis is rejected—at the conclusion of the quiet period IPOs produce a significantly positive abnormal performance.

Hypothesis 6:

$$H_0 : BHAR_{IPO} \geq R_{MF-IND}$$
$$H_1 : BHAR_{IPO} < R_{MF-IND}$$

In the analysis of the performance resulting from the expiration of the lockup period, the researcher found significantly negative performance of 1.00%. In addition, the sample standard deviation was 13.74%, therefore, the resulting *t* test produced a test statistic of –5.41, and with a 5% level of significance the critical *t* value is, again, -1.645. Therefore, again, the researcher rejected the null hypothesis and concluded that significant negative abnormal performance of 1.00% occurred at the expiration of the lockup period.

Conclusions

In the preceding section, the researchers has (a) presented a well specified and powerful method used to identify abnormal performance when conducting event studies, (b) shown that short-term abnormal IPO performance is positive, (c) illustrated that events occurring throughout the IPO process instigate abnormal performances, and (d) provided a description of IPO performance over the initial three years of seasoning. The results of the analyses related to event specific performances--abnormal performances occurring at the expiration of the quiet and lockup periods--generated significant, but not substantial abnormal performance. However, the pre-public trade abnormal performance of 11% and 3% abnormal performance in the initial trading day, together with long-term underperformance of IPOs in excess of 30%, seem to suggest that substantial performance abnormalities occur when companies issue unseasoned equity shares to the public.

Researchers focus the majority of their explanations that attempt to explain why short-term abnormal performance occurs on the asymmetric information hypothesis. To summarize, according to Ritter and Welch (2002), either investors are more informed than the issuer about the market demand for the company's shares or the investor believes that the issuer knows more about the firm's prospects and need protection against potential market lemons (IPOs that underperform). Recently, Purnanandam and Swaminathan (2004) questioned the conventional wisdom that companies initially discount their shares when they offer them to the public, for whatever reason. Purnanandam et al. (2004) found that, in a sample of over 2,000 IPOs issued from 1980 to 1997, companies typically overpriced IPOs, when the researchers compared these IPOs to their non-IPO counterparts the over pricing ranged from 15% to 50%, depending on the matching criteria. Puranandam et al. provide the first real critique of what has become general knowledge in the academic community: Companies typically under price their shares when they issue unseasoned equity. If IPOs are initially overpriced and this overpricing increases—not only in the period prior to public trading, but IPOs continue to generate significantly positive abnormal performance in their first day of trading—does this signal market inefficiency?

It would be a mistake to conclude that empirical evidence supports the conjecture that markets are inefficient. However, this initial over-pricing, followed by substantial short-term abnormally positive performance, which is followed by—over a period of three years—a reversal to longer-term underperformance could at least hint at market inefficiency. Efficient market theory concedes that short-term departures from fundamental or intrinsic will exist in the marketplace; however, prices will rapidly adjust and the market will eliminate pricing discrepancies. In Figure 4, this research project illustrates that when the IPOs are trading under their lockup provision, the returns are generally positive—of course discounting the significantly negative movement lasting through trading day two through seven, presumably a reaction to the initial positive movement prior to issuance and on the initial day of public trading. However, as the IPOs approach the expiration of the lockup period the performances generated by the IPOs evaluated in this analysis is resoundingly negative.

The expiration of the lockup period occurs at approximately trading day number 128 (i.e. 180 calendar day lockup period is equivalent to ~26 weeks, subtracting the weekends equals 128 trading days). In this research project's ex post analysis, after testing all ex ante hypotheses, it became apparent that the downward trend in IPO prices, following the expiration of the lockup period, was remarkable. In figure 5, the chart focuses in on what occurs from trading day 128 to

350, which the researcher has approximated at 241 calendar days—one-year, is a decline of .05% every trading day when compared against a firm matched based upon industry affiliation.

Insert Figure 5 Here

The regression summary is appealing, the R-Squared and Adjusted R-Squared values are in excess of 98%, and a relationship that is very significant (p - .001). The trend is undeniable and significant, after IPOs reach their lockup expiration, they are likley to experience negative performance of approximately .05% points in value each day for approximately one-year.

The general conclusion that the researcher has reached in this analysis is as follows, when it comes to participating in the IPO market, buyer beware. First, and foresmost, the process of issuance is not fair, there are not fair opportunities for economic profit. A class of sophisticated investors reap the benefits of the 11.74% of performance occuring prior to public trading and in the initial trading day investors may be able to obtain approximately 3 percentage points of positive performance, however, the investors have to buy at the market open and sell at the closing price on the security's initial trading day. If the average investor does not sell at the market close, holding onto the newly issued security will generate a negative 3% price movement from trading day 2 through trading day 7. This is then followed by a substantial upswing in performance and, ofcourse, eventually if held long enough investors will feel the sting of longer-term negative abnormal performance of 22.41% after approximately three years. The researcher has provided investors an overview of the patterns that IPOs seem to have exhibit from 1985 to 2002; hopefully, the average investor finds a meaningful way to put this infomration to use.

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Tables & Figures

Specification Analysis

180 Samples of 50 Simulated Event Firms

	Matched Firm				Matched Portfolio		
Time Horizon (Yrs)	MCap	Ind (Rand)	Ind -> MCap	MCap -> BE/MC	MCap	MCap -> BE/MC	Ind (47 Groupings)
1	5.00%	3.89%	4.44%	3.33%	43.89%	44.44%	46.67%
2	2.78%	1.67%	3.33%	2.78%	31.67%	25.56%	56.67%
3	2.22%	1.67%	2.22%	1.11%	33.33%	28.89%	65.56%
4	5.56%	3.89%	3.89%	2.78%	47.22%	36.67%	79.44%

18 Samples of 500 Simulated Event Firms

	Matched Firm				Matched Portfolio		
Time Horizon (Yrs)	MCap	Ind (Rand)	Ind -> MCap	MCap -> BE/MC	MCap	MCap -> BE/MC	Ind (47 Groupings)
1	0.00%	0.00%	0.00%	0.00%	83.33%	83.33%	66.67%
2	0.00%	0.00%	0.00%	5.56%	66.67%	66.67%	83.33%
3	11.11%	0.00%	0.00%	5.56%	66.67%	77.78%	94.44%
4	0.00%	0.00%	5.56%	0.00%	66.67%	61.11%	94.44%

Table 1. The results of the specification analysis conducted on 180 samples of 50 companies and 18 samples of 500 companies.

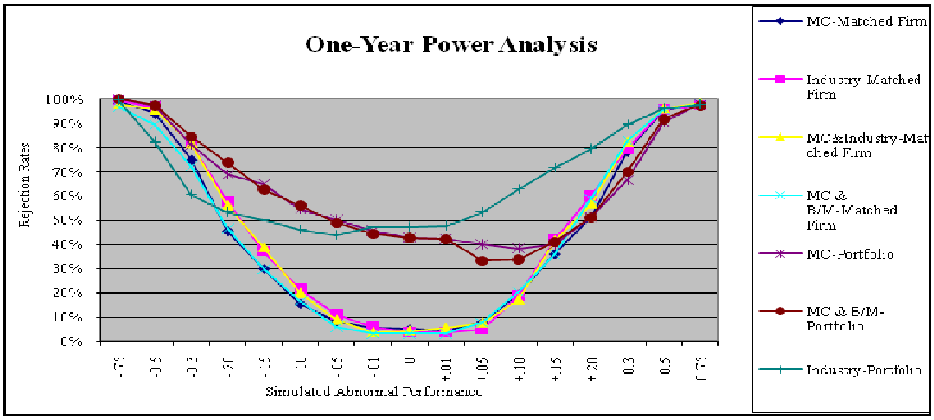

Figure 1. One-year power curve (n = 50).

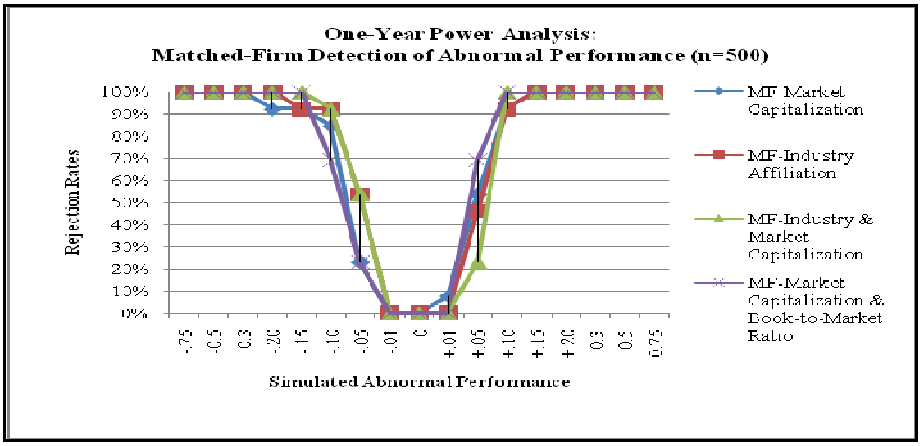

Figure 2. One-year power curve (n = 500).

Pre-Public Trade - Averaged Monthly IPO Performance from 1997-2007
Yearly Cohorts
Test Ho <= 0, H1 > 0

Year	Average Return	Stand Deviation	Observations	T-value	$t_{critical}$=1.796 (df=11)
2007	0.12	0.06	12.00	6.52	Reject
2006	0.10	0.05	12.00	6.73	Reject
2005	0.10	0.05	12.00	6.73	Reject
2004	0.09	0.04	12.00	7.77	Reject
2003	0.07	0.07	12.00	3.70	Reject
2002	0.06	0.04	12.00	4.68	Reject
2001	0.08	0.06	12.00	4.29	Reject
2000	0.35	0.33	12.00	3.68	Reject
1999	0.05	0.07	12.00	2.47	Reject
1998	0.00	0.04	12.00	-0.06	Accept
1997	0.02	0.02	12.00	2.49	Reject

Table 2. Pre-public trading IPO returns.

Sample Average Return Comparison from July 1996 to January 2008
Test Ho <= 0, H1 > 0, $t_{Critical}$=~2.61 ($t \rightarrow .005$)

	IPO	DJIA	Russell 3000	Nasdaq
Sample Average Return	8.96%	0.55%	0.46%	0.23%
Standard Deviation	13.52%	4.04%	4.42%	8.19%
Count	139.00	139.00	139.00	139.00
T-Value	7.81	1.60	1.22	0.33
Accept/Reject Decision	Reject	Accept	Accept	Accept

Table 3, Sample Return, Yearly Cohorts-Pre-Public Trading

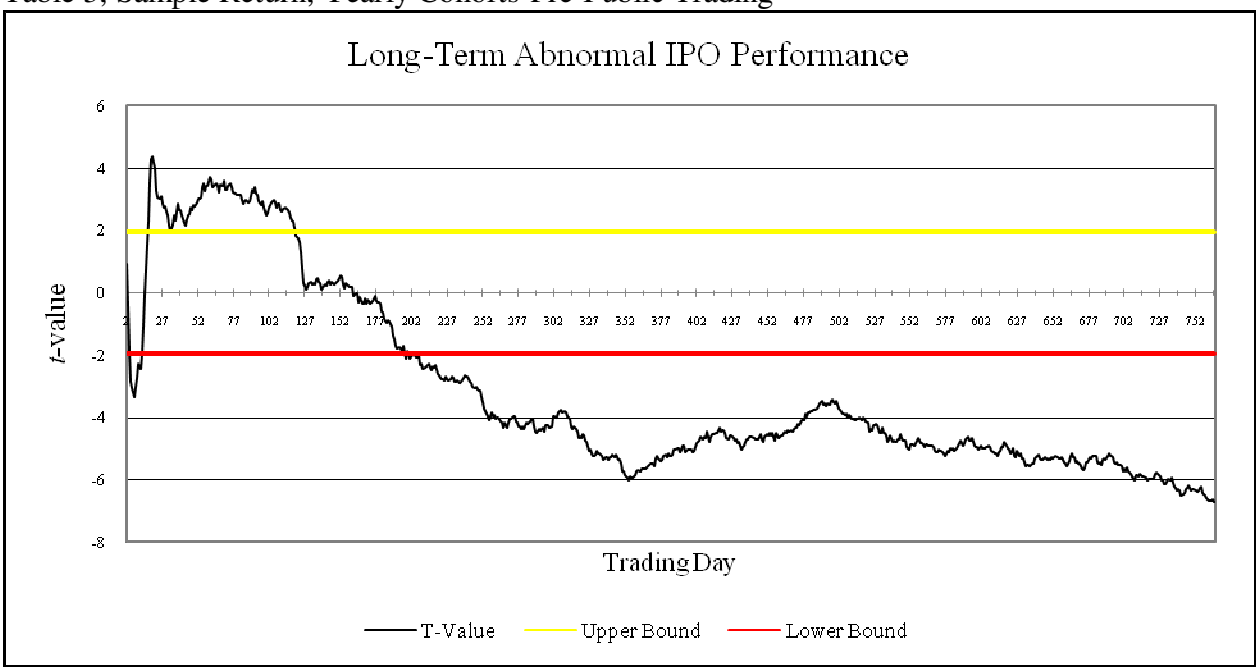

Figure 3. Long-term abnormal IPO performance

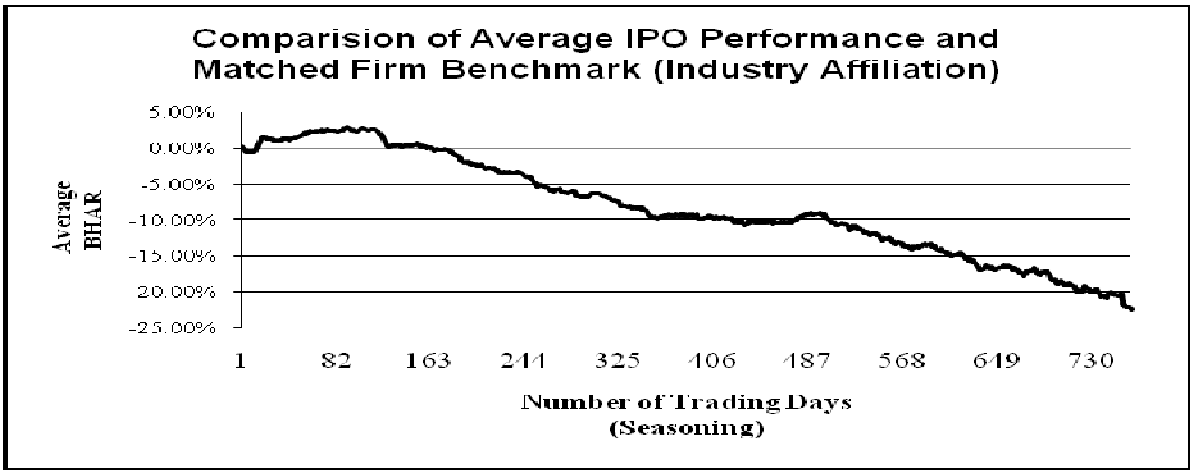

Figure 4. BHAR for IPOs from the initial trading day to trading day 755

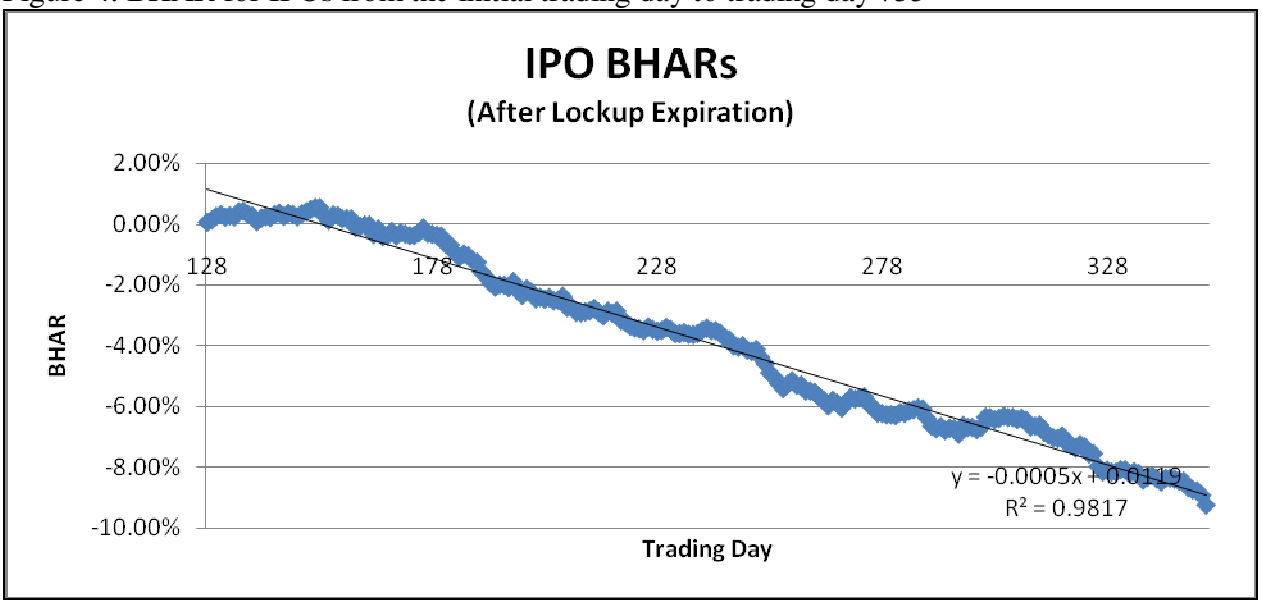

Figure 5. Illustration of the BHAR after IPOs reach their lockup period.