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IPO Long-Run Returns: A New Approach+

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Abstract

The long-run underperformance of initial public offerings (IPOs) is heavily documented; however, researchers have been unable to consistently determine which IPO characteristics affect the level of underperformance. Our main contribution is to examine this relation using a unique, alternative approach that concentrates on pairs of IPOs issued on the same day, thereby avoiding many of the biases (e.g., overlapping time periods) embedded in previous studies. Over the period 1986 to 2000 we find that issues with lower initial returns, higher quality underwriters, and/or high technology status tend to have higher long-run returns.

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I. Introduction

Numerous studies attempt to identify determinants of long-run returns in a variety of contexts (e.g., mergers, capital structure changes). However, there is often a significant degree of uncertainly surrounding the conclusions drawn, which is most likely a function of the difficulties (and associated biases) related to measuring long-run performance. When examining long-run returns, it is the researcher's duty to identify a control sample against which to measure abnormal returns. It is the ambiguity surrounding the selection of this control sample (particularly overlapping time periods and problematic matching criteria) that generally provides the greatest source of criticism.

We choose to examine a particularly interesting area in which to implement a new approach to measuring long-run returns: initial public offerings (IPOs). Ritter (1991) was among the first to document the long-run underperformance of IPOs relative to seasoned issues. Although many subsequent studies have attempted to determine which characteristics contribute most heavily to the level of IPO long-run return, considerable

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uncertainty remains. To avoid many of the documented problems associated with existing long-run analyses, we implement our unique approach that utilizes a matching scheme designed to create zero-cost portfolios of IPOs issued on the same day.

Our matching approach employs only observations from days with multiple IPOs. While this requires discarding some data (i.e., days with only a single IPO), it eliminates a primary concern of most long-run studies since we need not select a control group. More specifically, we eliminate all but two IPOs for each day on which there are multiple issues, using a wide variety of criteria (such as three-year returns, offer prices, and underwriter rank) to determine the surviving sample issues. We create a zero-cost portfolio on each trading day by going long one IPO (the higher "valued" issue) and short the other. We then look at IPOs in a portfolio sense.

This approach allows us to identify IPO selection strategies with the greatest potential for the highest long-run return, which we define as the percentage return calculated from 31 days after the offering to three years after the offering. We do not contend that our approach should completely replace other methods currently used (as it has its own bias) to measure long-run performance. Rather, we suggest that our unique matching scheme is simply an alternative approach to existing methods.

We study IPOs issued between January 1, 1986, and December 31, 2000, which implies our long-run returns range to December 31, 2003. Our primary analysis is based on sorting by three-year returns, going long in the IPO with the highest long-run return and short in the IPO with the lowest long-run return for the given issue date; however, we conduct robustness checks using multiple matching criteria (such as those identified above). In general, we find, as would be expected, that the predictability of long-run returns is low, thus any single characteristic, even if significant in our analysis, is unlikely to provide a valid criteria by which to consistently pick long-run winners. Nonetheless, we find that some characteristics may be helpful in identifying potentially profitable issues.

Consistent with previous studies, we find IPO returns in the 30-day post-offer period (both the initial return and the return in the subsequent 29 calendar days) are negatively related to long-run returns, and underwriter reputation is positively related. It also appears that high-tech firms perform better than non-high-tech firms, on average; however, this may be an artifact of a few high profile firms and/or the period we study. Contrary to our expectations, we find that overhang, a measure of share retention by preexisting owners, is generally unrelated to long-run performance.

We also examine the effect of venture-capital (VC) backing. Brav and Gompers (1997) find that non-VC-backed firms tend to underperform VC-backed firms in the long run. This result is surprising, however, considering that Black and Gilson (1999) find that venture capitalists exit investments relatively quickly after the IPO, and their impact may thus be only temporary. In contrast to Brav and Gompers, we find that VC backing is unrelated to long-run return, particularly after controlling for endogeneity.

We also find that offer prices are negatively related to long-run returns; however, any significance appears to be dependent on the matching criteria we employ. This finding is in contrast to the results of Fernando, Krishnamurthy, and Spindt (2002), who find a positive relation between offer prices and long-run returns. Thus, we conclude that the greatest underperformance is associated with issues that are non-high-technology firms, are backed by low quality underwriters, and/or experience high initial returns.

Although we apply our approach in the context of initial public offerings, we believe its use spans multiple areas. As such, our primary contribution is not necessarily a resolution of long-run IPO performance. Rather, it is the new approach we develop for examining long-run returns.

The rest of the paper proceeds as follows: Section I provides background information; Section II explains the matching approach we employ; Section III discusses our data; Section IV presents descriptive statistics; Section V presents our results; Section VI provides a series of robustness checks; and Section VII concludes.

II. Background

Previous studies that address the long-run underperformance of IPOs do so in one of two contexts: relative to seasoned issues or relative to other IPOs. For example, Ritter (1991) and Loughran and Ritter (1995) find IPO firms significantly underperform comparable seasoned firms by over 7 percent in the three years after going public. They argue that many first time issuers fall victim to societal “fads,” in that they enter the market towards the end of the fad period. Issuers attempt to “time the market” and maximize profits from the excitement associated with these fads. This causes excessive optimism in the initial stage of the offering. Once the excitement wears off, returns decline to a sustainable equilibrium, and IPO stocks consequently underperform.

Those studies that examine the performance of IPOs relative to each other, which is the primary application here, have suggested many possible explanations for the level of underperformance, finding generally contradictory results. To illustrate these contrasting findings, we consider one specific hypothesis as an example: third party certification (underwriters and/or venture capitalists).

Carter, Dark, and Singh (1998) find that, on average, long-run returns are higher for IPOs brought to market by more reputable underwriters.[1] Chemmanur and Fulghieri (1994) argue that market investors use the underwriters’ past performance, as measured by the quality of firms they have underwritten, to assess their credibility. The underwriter thus has an incentive to market IPOs that have higher long-run returns in order to protect their reputation and to capture future business. In contrast, however, Logue, Rogalski, Seward, and Foster-Johnson (2002) use path analysis and find the impact of underwriter reputation on long-run returns does not reflect a direct relationship. Thus, similar to many

[1] Michaely and Shaw (1994) use the investment bank’s capital as a proxy for prestige and find similar results.

other characteristics, existing studies present unclear results regarding the relation between underwriter reputation and long-run post-IPO performance.

Another possible explanation related to the "certification" hypothesis contends that IPOs backed by venture capitalists have lower information asymmetry than those that are not, possibly as a result of the active management approach VCs employ. As a result, VC-backed IPOs should outperform non-VC-backed issues. Consistent with this hypothesis, Brav and Gompers (1997) find that, using equal-weighted returns, IPOs not backed by venture capitalists underperform those that are in the long run. Using value-weighted returns, they find that only small, non-VC-backed IPOs underperform; however, Teoh, Welch, and Wong (1998) find that non-venture capital backed IPOs, regardless of size, underperform in the long run. In contrast, Campbell and Frye (2004) find no difference between long-run returns for VC-backed versus non-VC-backed issues.

As the above discussion suggests, studies examining IPO long-run returns are extensive but, to some extent, contradictory. The problem lies in the fact that studies examine differing time periods, use distinct matching approaches, and cover overlapping time periods. Thus, any study attempting to clarify the potential relations to long-run performance must do so in a framework that avoids many of these issues. It is with this goal that we develop and implement the unique approach we discuss in the subsequent section.

III. Portfolio Approach

IIA. Measuring long-run returns

To examine long-run performance, Barber and Lyon (1997) propose calculating buy-and-hold abnormal returns (BHARs). A BHAR is simply a holding period return on the sample firm less the holding period return on a comparable asset or portfolio. This technique is viable in the sense that it represents a strategy an actual investor might employ. However, Fama (1998) and Mitchell and Stafford (2000) illustrate that a skewness bias can cause BHARs to overstate long-run performance, even when there is no abnormal return after the first month. This makes it harder to detect positive abnormal returns when they are present and makes rejection of the null in favor of a negative alternative more likely.

Cumulative abnormal returns (CARs) are also used frequently (e.g., Fama, 1998) in long-run performance studies. As an actual investment strategy, this approach implies frequent rebalancing, which may not be economically viable in light of transaction costs. Frequent rebalancing may also lead to upward bias due to a bid-ask bounce, as discussed by Blume and Stambaugh (1983), Roll (1983), and Canina, Michaely, Thaler, and Womack (1998).

While statistical inference suffers from fewer problems using the CAR method than the BHAR method, worrisome effects remain in either case. We avoid many of these pitfalls, however, by creating portfolios comprised of IPOs that occur on the same day. For example, the cross-sectional correlation among securities that arises when using BHARs is irrelevant since each portfolio is comprised of securities that span an identical time period. In addition, time-series regressions suggested by Fama (1998) and Brav, Geczy, and Gompers (2000), which are designed to capture the effects of correlation of returns across event stocks missed by the model for expected returns, are unnecessary.

IIB. Portfolio formation

There are multiple days in our sample when more than two IPOs are offered. For each zero-investment portfolio, however, we need only two IPOs. To address this issue, we use a variety of sorting procedures to choose which IPOs will be included in our portfolios. We initially sort by the three-year calendar day return, "buying" those IPOs with the highest three-year return and "selling" those with the lowest three-year return, where three-year returns are calculated as the percent change in the dividend-adjusted price from the end of the thirty-first trading day after the offering date to three years after the offering date.

This approach is equivalent to creating a long-short, zero-cost portfolio on each given day. More specifically, we are essentially creating an equally weighted portfolio, using the exact dollar amount shorted to invest in the long position. Given that shares have different offer prices, this implies that portfolios will likely consist of more of some shares and fewer of others.

We then measure the three-year return on this "portfolio" and subsequently apply standard OLS procedures by regressing the difference of our independent variables on the difference of the long-run returns. To illustrate our approach, consider three IPOs issued on the same day. IPO A has a three-year return of 10% and an offer price of $12.00. IPO B has a three-year return of 8% and an offer price of $10.00. Finally, IPO C has a three-year return of 6% and an offer price of $8.00. Sorting by three-year returns would eliminate IPO B, as the other two issues represent those with the highest and lowest long-run returns.

We would then go long (buy) IPO A and go short (sell) IPO C by subtracting the two. Our dependent observation thus becomes the difference in long-run returns, or 4%. Likewise, our independent variable would be the difference between the respective offer prices of IPO A and C, or $4.00. For our model, which has multiple independent variables, we calculate the difference in each. We repeat this process for each day in the sample period on which multiple IPOs are issued. It is this novel approach to measuring IPO long-run returns that is the primary contribution of our analysis.

Of course, no method is without potential flaws, and ours is no exception. As discussed, our matching scheme requires we discard a significant number of observations, specifically those that are the only issue on a given day. This selection criterion creates a potential bias due to influences associated with "hot" or "cold" market conditions. For example, during cold periods it is more likely to have single issue days; whereas, in hot markets it is more likely to have multiple issue days. Thus, our approach may overweight hot periods and underweight cold periods.

To more closely examine this potential bias, we analyze the extent to which issues are excluded each year in our sample. We find that approximately 55% of our working sample occurs on days during the 1995-2000 period, a six-year span of relatively hot markets, while only 45% occur on days from 1986-1994, a nine year span of relatively cold markets. A quick comparison of issues that are included in the sample versus those that are excluded indicates that we are indeed overweighting hot time periods, particularly during the bubble period of 1999-2000. Specifically, issues included in the sample have higher initial returns, are more likely to be venture-capital backed, and are more likely to be high-tech firms, all characteristics associated with the hot market of the 1995-2000 time period.

Given our understanding of the potential bias of our approach, we certainly do not propose that it should be used in all situations. While it avoids many of the biases associated with other measures of long-run return, our unique scheme has its own potential problem. Thus, it then becomes the burden of the researcher to determine which bias is the most problematic and use the method that avoids this problem. For example, if a researcher is evaluating a question revolving around only the bubble period, then our approach should be used since the hot market bias would not be relevant. Our goal is simply to provide an alternative to the existing approaches for measuring long-run return.

IV. Data

Using Thompson Financial’s Securities Data Company (SDC) database, we collect offering data on all IPOs issued in the United States during the January 1, 1986 to December 31, 2000 time period. We exclude closed-end investment funds, real estate investment trusts, American Depositary Receipts, unit offerings, issues with offer prices below $5, and mutual-to-stock conversions.

We collect pricing data from the Center for Research in Security Prices (CRSP) database. Since we measure three-year returns, we collect data from CRSP for the period January 1, 1986, to December 31, 2003. Unfortunately, approximately 24 percent of the firms in our sample are delisted prior to three years after the IPO. Eliminating these from our sample would introduce survivorship bias, so we retain these issues.[2] We cannot, however, simply use the price at the close of the delisting date as a final price, as Shumway (1997) finds that about two-thirds of delistings are surprises and are not incorporated into the reported closing price. So, for companies delisted prior to three years after the IPO, delisting returns are retrieved from CRSP daily tapes and used, along with the closing price on the day of the delisting, to determine an extrapolated three-year price (e.g., Shumway, 1997). Since our matched portfolios involve zero investment, matching a delisted security with one that does not delist is of little consequence.

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[2] As a robustness test, we exclude these firms and repeat our analyses. The results are qualitatively similar, although uniformly less significant. Also, we separately apply the recommended adjustments from Shumway (1997) and Shumway and Warther (1999) of -.3 for NYSE listed stocks and -.55 for NASDAQ listed stock. Again, the results are similar to those reported.

Our approach employs only IPOs that occur on days with multiple offerings. IPOs that are the only issue on a particular day are excluded. There are a total of approximately 4,600 issues during this time period. After excluding single day issues, our base sample consists of 3,190 IPOs that take place across 1,039 days.

V. Descriptive Statistics

Table 1 provides descriptive statistics (i.e., means and standard deviations) for the entire sample period, as well as for four sub-sample periods (i.e., 1986-1989, 1990-1994, 1995-1998 and 1999-2000).[3] *ShareOver* is a measure of the extent to which preexisting owners retain control of the firm after an IPO. We follow Bradley and Jordan (2002) by defining overhang as shares retained (i.e., shares outstanding prior to the IPO less secondary shares offered) relative to total shares offered. Standard principal-agent theory predicts that the retention of more shares should increase the economic incentive to improve long-run performance.

Proceeds is gross issue proceeds of the issue in millions of dollars, unadjusted for inflation.[4] *Offer* is the offer price of the issue in dollars. *Secondary* is the percentage of total shares offered that are secondary shares. *Integer* is a dummy variable equal to one if the issue has an integer offer price, zero otherwise.

Initial is underpricing and is calculated as the percentage change from the offer price to the end of the first trading day. Rather than just looking at underpricing, we extend our analysis to examine the percentage change in share price from the end of the first trading day to 29-days later, which we term *Return2-30*. Aggarwal (2000) documents that underwriters, as permitted by the SEC, actively support prices post-IPO through their overallotment option. Although legal, it is still price manipulation, so we do not begin our measure of long-run performance until 30 days post-IPO. In addition, analysts are barred from making recommendations for the first 25 calendar days after an issue goes public.[5] In order to distinguish between underpricing (i.e., first day returns) and short-run returns (i.e., from day 2 to 30) we include both variables in the model specification.

Rank is the underwriter prestige ranking as measured by the Carter and Manaster (1990) ranking system and, as updated by Loughran and Ritter (2004). *HT* is a dummy variable equal to one for high-tech firms, zero otherwise. *VC* is a dummy variable equal to one if the issue is backed by a venture capitalist, zero otherwise.

Panel A of Table 1 reports the statistics for all IPOs that occur on a day with multiple issues, and these represent all issues from which portfolios can be formed. As would be expected, long-run return exhibits a significant time period dependency, and the results,

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[3] In recent work, many studies (e.g., Loughran and Ritter, 2004) have used three time periods (i.e. 1986-1989, 1990-1998, and 1999-2000). Our results suggest that combining issues from the early 1990s with those from the mid-1990s could bias the results; therefore, we use four periods.

[4] In unreported results, we repeat all analysis using inflation adjusted proceeds. The results are qualitatively unchanged.

[5] This period was changed to 40 days after our sample period.

consistent with previous studies, suggest poor long-run performance. The average level of overhang appears to be relatively stable across the first three periods, but increases significantly in 1999-2000. We find an increase in both underpricing and the return in the subsequent 29-day period, both reaching unusually high levels during the “bubble period” of 1999-2000.

The offer price, total offer proceeds, and the percentage of IPO offer prices that are integers have increased over time, while the percentage of secondary shares offered has decreased. Underwriter rank is relatively constant from 1986-1998, but increases in 1999-2000. The increase in the percentage of high-tech firms is also consistent with the increase in venture capital backing, as venture capitalists tend to concentrate their investments in these industries.

Panel B displays descriptive statistics for IPOs that remain after we match by three-year returns. We have a total of 1,039 days with multiple IPOs, which leads to 2,078 IPOs, i.e., two observations per day, where the retained observations are those issues with the highest and lowest three-year return for the given trading day. The statistics are qualitatively similar to those reported in Panel A.[6]

VI. Results

Our matching approach allows us to apply traditional OLS to our sample without concern for the biases typically associated with long-run performance analyses. We begin by examining the sample created by “buying” those IPOs with the highest three-year return and “selling” those with the lowest, thereby creating a zero-cost portfolio on each of the 1,039 days with multiple IPOs, giving us 1,039 possible observations (i.e., one zero cost portfolio per issue day with multiple IPOs). We then estimate the following regression:

$$\begin{aligned} Return31Three = \alpha + \beta_1 ShareOver + \beta_2 Ln\,Proceeds + \beta_3 Secondary + \beta_4 Offer + \\ \beta_5 Initial + \beta_6 Return2-30 + \beta_7 Integer + \beta_8 Rank + \beta_9 HT + \beta_{10} VC + \varepsilon \end{aligned} \tag{1}$$

where each explanatory variable represents the difference between the value for the IPO with the highest three-year return and the value for the IPO with the lowest three-year return (as explained earlier).

Return31Three is the difference in long-run return between the two IPO issues, each calculated from day 31 after offer to three years after offer. One key aspect of our approach is that *Return31Three* does not need to be market-adjusted. Since each matched pair spans the same investment horizon, and performance is measured only relative to the same-day IPO, market performance is wholly irrelevant in our comparison of long-run performance.

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[6] In unreported results, we also evaluate descriptive statistics on samples matched by overhang, initial and short-run returns, Carter-Manaster rank, size, and offer price. The results are similar to those reported.

We hypothesize that higher overhang (increased retention of pre-IPO shares) will increase the owners' incentive to stay actively involved in the operations of the company. Consequently, *ShareOver* should have a positive relation to long-run return differences, i.e., issues with greater overhang should have greater long-run return. Brav and Gompers (1997) find that smaller firms exhibit greater underperformance. Consistent with this, we hypothesize that larger companies, as proxied by issue proceeds, will have higher long-run returns.

Ritter (1991) documents a negative relation between initial returns and long-run returns, as initial overreaction necessitates a reversion to a sustainable pricing level. We also use the return from the second trading day to the thirtieth trading day to control for both the legal "management" of IPO prices by investment banks and the ban on analyst recommendations post-IPO. However, we believe *Return2-30* will pick up much of the same effect as documented by Ritter (1991). Thus, we expect the coefficient on *Return2-30* to be negative, indicating that higher short-run returns lead to lower long-run performance.

Bradley, Cooney, Jordan, and Singh (2003) find that initial returns are significantly higher for issues that have integer offer prices, a phenomenon they attribute to uncertainty surrounding the issue, as well as lack of time available to negotiate an offer price. Therefore, we expect a negative relation between *Integer* and the three-year return. We also expect evidence of a certification effect, so we hypothesize that *VC* and *Rank* will be positively related to long-run returns.

Column (1) of Table 2 reports the results (coefficients and *t*-statistics) from the above regression over the entire period (i.e., 1986-2000). As might be expected, the predictive significance of the regression is extremely low (adjusted R^2 of .0413). This suggests that even if a variable is highly significant, its economic importance in predicting long-run performance may be small. However, investors need a starting point, and the significant variables may serve this purpose.

The percentage of secondary shares offered is positively related to long-run returns, suggesting that firms that issue fewer primary shares experience larger returns. This is consistent with a dilution effect, as more primary shares offered would dilute the value of existing shares. Thus, a greater percentage of secondary shares means less dilution (and greater per share value), but it also may be indicative of more informed management, as they would be aware of the dilution effect and attempt to avoid it.[7]

The coefficient on *Offer* is negative and significant. This finding is in contrast to Fernanda, Krishnamurthy, and Spindt (2002), who find that offer price has a positive relationship with long-run performance. They attribute their result to the notion that higher offer prices are generally associated with better underwriters.[8] We find that higher

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[7] It is possible that *ShareOver* and *Secondary* are related; thus, we separately repeat the analysis using only one of the two variables. We find our general results are unchanged.

[8] Fernanda, Krishnamurthy, and Spindt also find a U-shaped relation between offer price and underpricing, which could explain our findings since we include only a single variable for Offer. Thus, as a robustness

initial and short-run returns lead to lower long-run returns. Thus, all else equal, firms with higher initial and short-run returns underperform their matched IPO over the following three year period. This is consistent with Ritter (1991), who documents the underperformance of firms with high initial returns.

Over the entire period, underwriter rank is positive and significant, indicating that higher ranked underwriters are associated with larger long-run returns. This result is consistent with an underwriter certification effect and the findings of Carter, Dark, and Singh (1998). *HT* is also positively related to underpricing; however, this result may be driven by a few highly successful firms and/or the period we study, as the bubble represented a time when high technology firms rose significantly in value.

One variable that renders an interesting result is VC-backing. We find a negative and moderately significant relation between the presence of VC-backing and long-run returns. This is in contrast to the findings of Brav and Gompers (1997) and Teoh, Welch, and Wong (1998). Our results suggest that firms that are venture capital backed experience lower long-run returns. However, VC-backing may be related to underpricing, so the results may reflect this underlying relation. To address this endogeneity, we conduct a two-stage regression, finding that VC-backing is not significantly related to long-run performance. (We discuss this test in more detail in the section on robustness checks.)

Columns 2 through 5 of Table 2, which contain results from analyses of data across various time periods, illustrates some variation in both sign and significance. The general predictive significance of the overall regressions remains low. We also lose significance in many of the individual variables, although this could be attributable to the reduction in the number of observations.

Overhang, which was expected to be a significant factor overall, has opposite effects in the last 2 time periods. For 1995-1998, we indeed find a positive relationship, but the relation is negative during the "bubble" period of 1999-2000. If we run the regression including only the first three time periods, we find a significantly positive coefficient for overhang. This is consistent with increased share retention creating an incentive to run the firm better.

The relation of both the percentage of secondary shares offered and underwriter quality to long-run returns generally remains positive. The negative relation of short-run returns to long-run returns is generally consistent, but is much stronger in more recent periods. This is expected given the high levels of underpricing during these years.

We also find that the overall results for the offer price are driven primarily by the 1986-1989 and 1995-1998 time periods. Further, the high-tech variable is significant in the 1995-1998 period, but not elsewhere, which is indicative of the effect of subsequent returns from the bubble period. Overall, we conclude that many of the variables may have

check, we also include the square of the offer price in our analysis. However, we find that there is not a significant nonlinear relation. The impact of offer price remains negative and significant.

a somewhat stronger time-specific component, with the bubble period creating some striking differences. Thus, it appears, as would be expected, that predicting long-run returns is a daunting task. Further, it is possible that our model, and its associated bias, is somewhat to blame for the peculiar results as well. There are, however, some characteristics that do appear to be relatively consistent.

VII. Robustness

The majority of the independent variables we employ have previously been found to be related to the level of underpricing. Therefore, we repeat the regression after including interaction terms between *Initial* and each of the independent variables. We find, however, that this has no significant influence on our results. We also implement a two-stage approach by first predicting *Initial* via an ordinary least squares regression involving the typical variables. We then use the predicted values in our regressions. The results are qualitatively unchanged. Specifically, the *t*-statistic on the predicted value of *Initial* is -2.45, which is very similar to the original results. All other variables retain their signs and approximate significance levels.

Although we form our primary portfolios based on three-year returns, investors using our results to implement a trading strategy might look at any number of firm characteristics. So, to check that our results are not an anomaly found only when sorting by three-year returns, we also sort our data based upon several other variables. These include the offer price, the 30-day return, issue proceeds, and the Carter-Manaster underwriter rank. So, for example, we form a sample by going long in the IPO with the highest offer price and short in the IPO with the lowest. Similarly, we form a sample by going long in the IPO with the highest underwriter rank and short in the IPO with the lowest. We repeat this sample creation for each variable mentioned, thereby creating multiple, distinct samples with which to gauge the robustness of our findings.

Table 3 presents our results (i.e., coefficients and *t*-statistics) for the entire time period for the robustness samples mentioned above. In Column 1 we report results from matching the issues by the offer price. Column 2 reports results from matching the issues by 30-day return. Column 3 reports results matched by proceeds, and column 4 reports the results for portfolios matched by underwriter rank.[9]

Across all the matching criteria employed, some of our results are generally consistent. For example, we find that the coefficients on both initial and short-run returns generally remain negative and significant, indicating issues with higher initial and 30-day returns underperform those with lower initial and 30-day return in the long run. We also find that underwriter rank and high-tech designation have a consistently positive relation to long-run returns.

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[9] The matching schemes involving offer price and underwriter rank produce several matches with the same value. Since it doesn't make sense to subtract those two, we exclude those matched pairs.

We do, however, find some inconsistencies in the significance of additional variables. The coefficient on the offer price is insignificant when it is the sorting criteria, and the level of secondary shares is significant in only two of the regressions. The level of overhang has a positive and significant relation when sorting by 30-day returns, proceeds, and underwriter rank, but not when sorting by offer price.

Except for the specification where we sort by the 30-day return, we find the same negative and significant relation between venture-capital backing and long-run returns as with our primary results. This is in contrast to previous studies, so what causes the difference? It is possible that studies finding positive relations between VC involvement and long-run returns are biased by difficulties in calculating long-run returns as discussed earlier. Our matching scheme could possibly overcome these difficulties and provide a clearer picture of the actual influence. A crude check is to calculate a simple univariate test of the hypothesis of identical returns for VC-backed firms versus non-VC-backed firms. Applying this test, we find the difference is not significant.

Another prospect, as previously mentioned, is that the results could be a product of endogeniety. Dolvin (2005), among others, finds that VCs tend to be associated with higher overhang, so the presence of venture capital may not be exogenous. To determine if this is indeed the case, we implement a 2-stage least squares approach by first predicting VC backing via a probit model. After obtaining predicted probabilities, we assign a value of 1 to issues with probabilities in excess of .5 and zero otherwise. We then re-estimate our OLS analyses using the predicted VC variable. The coefficient on VC is not significant, regardless of the matching scheme implemented. We conclude that there is no significant relation between VC involvement and long-run returns, and any apparent relation is likely due to endogeneity.

While there are many possible criteria for forming portfolios, there are consistencies in our results that suggest which criteria may be the best for earning the highest long-run returns. Specifically, the consistently high, positive significance of underwriter rank suggests that buying IPOs with the highest ranked underwriter and shorting those with the lowest may yield the best results.[10] However, our results also suggest that buying issues with the lowest initial and short-run returns may also be profitable. An investor may also profit from buying high-tech issues.

As a crude test of these conclusions, we calculate median values in each year for offer price and underwriter rank. We also examine initial and short-run returns. For brevity and since the results are similar, we combine them to create *Return30*, calculated as the percentage return from offer to 30 days later. We then compare subsequent long-run returns for those issues with above median values and those issues with below median values. Issues at the respective median values are excluded. In addition, we also compare high-tech issues to non-high-tech issues. If our methodology accurately reflects reality,

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[10] The methodology we employ requires the ability to short newly issued IPOs; however, this strategy may be limited by the availability of shares and the actions of underwriters. Thus, buying just those shares with the highest underwriter rank (or lowest 30-day return or lowest offer price) may be the most likely strategy.

this test should be consistent with the results in Table 2. The results are reported in Table 4.

We find no significant differences in the performance of issues with below the median offer prices versus those with above the median offer prices. This finding reflects the disparity concerning the *Offer* variable in our previous analysis. It appears that the significance is contingent upon the matching scheme implemented. The results for the 30-day return support our earlier results in that issues that have low 30-day returns outperform those with high 30-day returns by over 16%. This difference is highly significant.

The univariate tests for the underwriter rank indicates issues underwritten by high quality underwriters outperform those underwritten by low quality underwriters by a very large margin. This difference is highly significant, but these results may be a bit misleading due to the high occurrence of issues that have underwriters ranked at the median. This median is a rank of 8 for almost every year in the sample. Therefore, the issues that have underwriters ranked above the median are essentially only those that have underwriters with a rank of 9. Also, we find, as expected, that high-tech firms experience lower underperformance than do non high-tech firms.

Overall, the univariate results suggest that many of the significant variables we identify are useful in selecting long-term investments. Specifically, the “best” strategy appears to be buying issues that are high tech, have lower 30-day returns, and/or have higher quality underwriters. But, again, these results are relative to other IPO firms and are not necessarily indicative of performance relative to seasoned issues.

VIII. Conclusions

The study of long-run security returns is challenging given the need for a reliable control sample, which leads to concerns such as overlapping time periods and problematic matching criteria. As such, existing methods, such as buy-and-hold returns and cumulative abnormal returns, as well as the application of Fama-French time series regressions, are associated with biases that make it difficult to reach definitive conclusions.

One arena that has seen broad application of these approaches is initial public offerings. Identifying the determinants of long-run IPO performance has been notoriously difficult due to the number of biases that are present in existing approaches. We avoid many of these, however, by choosing only IPOs that occur on the same day. By forming a zero-cost portfolio of two IPOs, we eliminate any cross-correlation effects from our sample. We also need not address any macroeconomic concerns that, when the IPOs do not encompass the same time period, we would be compelled to consider.

For the sample period 1986-2000 we find that long-run performance is influenced positively by underwriter reputation. Also, initial and 30-day returns have a negative impact on long-run performance. It also appears that high-tech firms typically earn higher long-run returns relative to non-tech issuances. After sorting by a variety of IPO characteristics, our results remain qualitatively unchanged.

Our unique method for measuring long-run IPO performance yields some interesting results relative to the existing literature. We conclude that the best strategies for long-run investment are buying issues with low initial and 30-day returns, more reputable underwriters, and those that are high-tech. However, successfully predicting winners and losers will never be an easy task due, in part, to inconsistency over time.

Overall, it is not our findings related to IPO performance that are the primary contribution of our study. Rather, it is the unique approach that we develop for measuring long-run returns. With that said, we do not intend for our approach to become the sole method used in this type of analysis. We do feel, however, that it provides a unique way to approach a subject that has yet to find any real consensus. Our approach corrects for some well-known biases, but unfortunately introduces a potential bias (hot market) of its own. It then becomes the researcher's burden to determine which biases he/she is most concerned with and use the method most capable of controlling them.

REFERENCES

Aggarwal, Rajesh K., 2000, Stabilization activities by underwriters after initial public offerings, Journal of Finance 55, 1075-1102.

Barber, Brad M. and Richard Lyon, 1997, Detecting long-run abnormal stock returns: the empirical power and specification of test statistics, Journal of Financial Economics 43, 341-372.

Black, Bernard S. and Ronald J. Gilson, 1999, Does venture capital require an active stock market?, Journal of Applied Corporate Finance 37, 36-48.

Blume, Marshell E. and Robert F. Stambaugh, 1983, Biases in computed returns: An application to the size effect, Journal of Financial Economics 12, 387-404.

Bradley, Daniel J., John W. Cooney, Bradford D. Jordan, and Ajai K. Singh, 2004, Negotiation and the IPO offer price: A comparison of integer versus non-integer IPOs, Journal of Financial and Quantitative Analysis 39, 517-540.

Bradley, Daniel J. and Bradford D. Jordan, 2002, Partial adjustment to public information and IPO underpricing, Journal of Financial and Quantitative Analysis 37, 595-616.

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

Brav, Alon, Christopher C. Geczy, and Paul A. Gompers, 2000, Is the Abnormal Return Following Equity Issuances Anomalous?, Journal of Financial Economics 56, 209-249.

Campbell, Terry L. and Mellisa B. Frye, 2004, Venture capitalists involvement in the long-run performance of IPOs. Working Paper.

Canina, Linda, Roni Michael, Richard Thaler, and Kent L. Womack, 1998, Caveat compounder: A warning about using the daily CRSP equal-weighted index to compute long-run excess returns, Journal of Finance 53, 403-416.

Carter, Richard B., Frederick H. Dark, and Ajai K. Singh, 1998, Underwriter reputation, initial returns, and the long-run performance of IPO stocks, Journal of Finance 53, 285-311.

Carter, R.B. and Steven Manaster, 1990, Initial public offerings and underwriter reputation, Journal of Finance 45, 1045-1068.

Chemmanur, Thomas J. and Paolo Fulghieri, 1994, Investment bank reputation, information production, and financial intermediation, Journal of Finance 49, 57-79.

Dolvin, Steven D., 2005, Venture capitalist certification of IPOs, Venture Capital 7, 131-148.

Fama, Eugene F., 1998, Market efficiency, long-run returns, and behavioral finance, Journal of Financial Economics 49, 283-306.

Fernando, Chitru S., Srinivasan Krishnamurthy, and Paul A. Spindt, 2004, Are share price levels informative? Evidence from the ownership, pricing, turnover, and performance of IPO firms, Journal of Financial Markets 7, 377-403.

Loughran, Tim and Jay R. Ritter, 2004, Why has underpricing changed over time?, Financial Management 33, 5-38.

Loughran, Tim and Jay R. Ritter, 1995, The new issue puzzle, Journal of Finance 50, 23-51.

Logue, Dennis E., Richard J. Rogalski, James K. Seward, and Lynn Foster-Johnson, 2002, What is special about the roles of underwriter reputation and market activities in initial public offerings?, Journal of Business 75, 213-243.

Michaely, Roni and Wayne H. Shaw, 1994, The pricing of initial public offerings: Tests of adverse selection and signaling theories, Review of Financial Studies 7, 279–319.

Mitchell, Mark L. and Eric Stafford, 2000, Managerial performance and long-term stock price performance, The Journal of Business 73, 287-329.

Ritter, Jay R., 1991, The long-run performance of initial public offerings, Journal of Finance 46, 1-27.

Roll, Richard, 1983, On computing mean returns and the small firm premium, Journal of Financial Economics 12, 371-386.

Shumway, Tyler, 1997, The delisting bias in CRSP data, Journal of Finance 52, 327-340.

Shumway, Tyler and Vincent A.Warther ,1999, The delisting bias in CRSP's Nasdaq data and its implications for the size effect, Journal of Finance 54, 2361-2379.

Teoh, Siew H., Ivo Welch, and T.J. Wong, 1998, Earnings management and the long-run market performance of initial public offerings, Journal of Finance 53, 1935-1974.

Table I: Descriptive Statistics

This table provides means and standard deviations for the entire sample (1986-2000), as well as for the four sub-sample periods. Panel A reports statistics for the entire sample, while Panel B reports statistics for the sample after matching by the three-year return. *Return31Three* is the three-year return, measured as the percentage change in stock prices from the end of day 31 to end of three years after offer. *ShareOver* is a measure of shares retained by the preexisting owners. *Proceeds* is the gross proceeds of the issue in millions of dollars. *Offer* is the offer price of the issue in dollars. *Secondary* is the percentage of total shares offered that are secondary. *Integer* is a dummy variable equal to one if the issue has an integer offer price, zero otherwise. *Initial* is the percentage return from offer price to the end of the first trading day. *Return2-30* is the percentage change in share price from the end of the first trading day to 29 days later. *Rank* is the underwriter prestige ranking as measured by the Carter and Manaster (1990) ranking system. *HT* is a dummy variable that equals one if the issue is high-tech in nature, zero otherwise. *VC* is a dummy variable that equals one if the issue is backed by a venture capitalist, zero otherwise. Data are from Thompson Financial's Securities Data Company database and the Center for Research in Securities Prices database.

PANEL A: ALL POSSIBLE MATCHES

	1986-2000 (N = 3,190)	**1986-1989** (N = 448)	**1990-1994** (N = 938)	**1995-1998** (N = 1,223)	**1999-2000** (N = 581)
Return31Three	-9.83	-4.22	11.74	-1.82	-68.77
	{105.23}	{85.02}	{92.30}	{125.45}	{61.69}
ShareOver	2.87	2.69	2.33	2.62	4.36
	{1.95}	{1.59}	{1.24}	{1.70}	{2.74}
Proceeds	44.71	26.62	32.87	42.85	81.67
	{64.52}	{91.49}	{41.24}	{43.38}	{88.68}
Offer	12.09	11.03	11.18	11.98	14.64
	{4.66}	{4.56}	{4.02}	{4.39}	{5.30}
Secondary	10.80	17.15	12.20	11.02	3.38
	{18.06}	{20.42}	{18.20}	{18.69}	{10.76}
Integer	.79	.66	.74	.81	.95
	{.40}	{.48}	{.44}	{.39}	{.22}
Initial	23.77	7.54	11.45	17.38	68.57
	{51.64}	{17.84}	{17.37}	{26.88}	{98.23}
Return2-30	6.63	-1.25	3.18	4.33	22.74
	{40.04}	{16.44}	{17.84}	{24.36}	{79.90}
Rank	7.07	7.16	6.80	6.93	7.72
	{2.20}	{2.01}	{2.24}	{2.24}	{2.03}
HT	.48	.33	.41	.52	.64
	{.50}	{.47}	{.49}	{.50}	{.48}
VC	.46	.35	.48	.37	.68
	{.50}	{.48}	{.50}	{.48}	{.47}

PANEL B: MATCHED BY RETURN31THREE

	1986-2000 (N = 2,078)	**1986-1989** (N = 324)	**1990-1994** (N = 618)	**1995-1998** (N = 762)	**1999-2000** (N = 374)
Return31Three	-1.43	.01	18.03	9.94	-63.85
	{120.77}	{94.67}	{104.58}	{148.42}	{72.00}
ShareOver	2.89	2.64	2.34	2.70	4.36
	{2.01}	{1.45}	{1.27}	{1.79}	{2.94}
Proceeds	44.57	29.44	31.93	42.51	83.81
	{67.43}	{105.35}	{37.01}	{40.73}	{90.09}
Offer	12.03	10.93	11.04	11.99	14.77
	{4.67}	{4.54}	{4.14}	{4.33}	{5.20}
Secondary	11.03	16.42	12.47	11.31	3.36
	{18.47}	{20.76}	{18.60}	{19.27}	{10.47}
Integer	.78	.64	.72	.82	.95
	{.41}	{.48}	{.45}	{.39}	{.23}
Initial	24.59	8.23	11.03	18.22	74.22
	{53.23}	{18.74}	{16.64}	{28.15}	{101.58}
Return2-30	5.57	-1.31	2.64	4.55	18.48
	{40.93}	{17.20}	{16.95}	{25.60}	{83.93}
Rank	7.09	7.17	6.78	6.99	7.78
	{2.18}	{1.96}	{2.26}	{2.23}	{2.01}
HT	.48	.35	.42	.51	.63
	{.50}	{.48}	{.49}	{.50}	{.48}
VC	.46	.37	.48	.337	.67
	{.50}	{.48}	{.50}	{.48}	{.47}

Table II: Long-Run Return Regression Results

This table presents coefficients and *t*-statistics from the OLS regression as follows:

$$Return31Three = \alpha + \beta_1 ShareOver + \beta_2 Ln\,Proceeds + \beta_3 Secondary + \beta_4 Offer + \beta_5 Initial + \beta_6 Return2-30 + \beta_7 Integer + \beta_8 Rank + \beta_9 HT + \beta_{10} VC + \varepsilon$$

Return31Three is long-run return calculated from day 31 after offer to three years after offer. *ShareOver* is share overhang, defined as shares retained relative to total shares offered. *LnProceeds* is the natural log of gross proceeds of the issue in millions of dollars. *Secondary* is the percentage of the total shares offered that are secondary. *Offer* is the offer price of the issue in dollars. *Integer* is a dummy variable equal to one if the issue has an offer price that is an integer, zero otherwise. *Initial* is the first day percentage return of the issuance. *Return2-30* is defined as the percentage change in share price from the end of the second trading day to 30-days later. *Rank* is the underwriter prestige ranking as measured by the Carter and Manaster (1990) ranking system, updated by Loughran and Ritter (2004). *VC* is a dummy variable equal to one if the issue is backed by a venture capitalist, zero otherwise. All variables in the regression represent the difference between the value for the IPO with the highest three-year return and the value for the IPO with the lowest three-year return. Data are from Thomson Financial's Securities Data Company database and the Center for Research in Securities Prices database. Results are provided for the entire sample period (1986-2000), as well as for four subperiods (1986-1989, 1990-1994, 1995-1998, and 1999-2000).

	1986-2000 (1)		1986-1989 (2)		1990-1994 (3)		1995-1998 (4)		1999-2000 (5)	
	Coef.	*t*-stat	Coef	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat
Intercept	105.97	22.65	101.89	12.69	128.92	20.44	143.45	15.28	-15.62	-1.86
ShareOver	1.19	.61	-1.70	-.42	3.29	.84	7.92	2.02	-4.34	-1.94
LnProceeds	3.98	.57	6.43	.66	1.01	.09	21.30	1.43	-13.20	-1.21
Secondary	.48	2.49	.64	2.22	.30	1.14	.46	1.27	.80	1.42
Offer	-2.59	-2.12	-3.24	-1.79	-1.74	-.86	-9.36	-3.53	1.81	1.07
Initial	-.24	-2.80	.17	.48	-.21	-.71	-.12	-.50	-.11	-1.36
Return2-30	-.25	-2.75	-.02	-.03	-.00	-.01	-.42	-1.53	-.08	-1.03
Integer	-3.29	-.40	-3.37	-.29	-10.92	-1.10	20.13	1.21	-58.50	-2.14
Rank	5.81	2.84	1.70	.45	.11	.04	7.18	1.72	6.31	2.00
HT	27.16	3.53	14.85	1.06	8.46	.81	39.94	2.74	-14.57	-1.01
VC	-14.40	-1.86	6.02	.44	8.19	.75	-24.06	-1.63	-9.16	-.68
N	992		158		300		369		162	
Adj. R-Sq.	.0413		-.0042		-.0112		.0621		.1253	

Table III: Robustness Tests

This table presents coefficients and *t*-statistics from the OLS regression as follows:

$$Return31Three = \alpha + \beta_1 ShareOver + \beta_2 Ln\,\mathrm{Pr}\,oceeds + \beta_3 Secondary + \beta_4 Offer + \beta_5 Initial + \beta_6\,\mathrm{Re}\,turn2 - 30 + \beta_7 Integer + \beta_8 Rank + \beta_9 HT + \beta_{10} VC + \varepsilon$$

Return31Three is long-run return calculated from day 31 after offer to three years after offer. *ShareOver* is share overhang, defined as shares retained relative to total shares offered. *LnProceeds* is the natural log of gross proceeds of the issue in millions of dollars. *Secondary* is the percentage of the total shares offered that are secondary. *Offer* is the offer price of the issue in dollars. *Integer* is a dummy variable equal to one if the issue has an offer price that is an integer, zero otherwise. *Initial* is the first day percentage return of the issuance. *Return2-30* is defined as the percentage change in share price from the end of the second trading day to 30-days later. *Rank* is the underwriter prestige ranking as measured by the Carter and Manaster (1990) ranking system, updated by Loughran and Ritter (2004). *VC* is a dummy variable equal to one if the issue is backed by a venture capitalist, zero otherwise. All variables in the regression represent the difference between the value for the IPO with the highest three-year return and the value for the IPO with the lowest three-year return. Data are from Thomson Financial's Securities Data Company database and the Center for Research in Securities Prices database. Results are provided for the entire sample period (1986-2000).

MATCHED BY:	Offer		Return30		Proceeds		Rank	
	(1)		(2)		(3)		(4)	
	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat
Intercept	-14.88	-1.90	-5.98	-1.05	-9.36	-1.13	-7.96	-.82
ShareOver	.55	.32	3.02	1.67	3.86	2.09	4.16	1.95
LnProceeds	5.77	.92	8.58	1.27	12.81	1.65	11.56	1.51
Secondary	.21	1.14	.71	3.69	.43	2.22	.29	1.35
Offer	-.92	-.72	-2.95	-2.50	-3.05	-2.63	-2.78	-2.06
Initial	-.12	-1.67	-.06	-.86	-.18	-2.18	-.21	-2.34
Return2-30	-.21	-2.37	-.24	-2.63	-.28	-2.81	-.34	-2.72
Integer	-6.04	-.79	-7.10	-.89	-.13	-.02	3.80	.43
Rank	8.97	4.79	5.94	2.90	8.13	3.97	8.07	2.94
HT	20.29	2.94	11.83	1.58	20.85	2.84	22.83	2.82
VC	-11.51	-1.61	-.71	-.09	-17.90	-2.35	-23.23	-2.67
N	968		992		992		856	
Adj. R-Sq.	.0504		.0382		.0535		.0404	

Table IV: Median Robustness Tests

This table presents mean long-run returns and standard deviations for the entire sample based upon median measures of (1) *Offer,* (2) *Return30*, and (3) *Rank*. In addition, we also examine the mean long-run return for those issues designated high tech verses non high-tech firms, as well as those issues with secondary shares offered verses those with none. We first divide the sample into years and find the median value for each year. We then evaluate the three-year average returns from those issues above and below the median in each year for each respective criterion. Issues at the respective median values are excluded. Also presented are t-tests for difference in the average returns. *Offer* is the offer price of the issue in dollars. *Return30* is defined as the percentage change in share price from the end of the first trading day to 30-days later. *Rank* is the underwriter prestige ranking as measured by the Carter and Manaster (1990) ranking system. *HT* designates high-tech firms.

	Below Median		Above Median		*t-statistic*
	Mean	Std. Deviation	Mean	Std. Deviation	
Offer	-10.0507	109.2240	-9.7877	100.3797	.07
Return30	-2.0329	115.2770	-18.1458	93.1710	-4.31
Rank	-20.8154	95.9391	16.8327	105.7445	7.96
HT	-12.9072	85.3516	-6.5273	122.9302	1.68