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# Is the abnormal return following equity issuances anomalous?

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**Abstract**

We examine whether a distinct equity issuer underperformance anomaly exists. In a sample of initial public offering (IPO) and seasoned equity offering (SEO) firms from 1975 to 1992, we find that underperformance is concentrated primarily in small issuing firms with low book-to-market ratios. SEO firms, that underperform these standard benchmarks have time series returns that covary with factor returns constructed from nonissuing firms. We conclude that the stock returns following equity issues reflect a more pervasive return pattern in the broader set of publicly traded companies. © 2000 Elsevier Science S.A. All rights reserved.

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## 1. Introduction

Tests of long-run stock returns have become increasingly common within the academic finance literature. Papers purporting to demonstrate long-run anomalous returns include Asquith (1983), Agarawal et al. (1992), and Loughran and

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Vijh (1997), who examine underperformance in stock returns following mergers; Michaely et al. (1995), who document poor returns following dividend omissions; and Dharan and Ikenberry (1995), who explore underperformance following exchange listing changes. Ikenberry et al. (1995), on the other hand, find overperformance following share repurchases. In addition, Ritter (1991), Loughran and Ritter (1995), and Spiess and Affleck-Graves (1995) show that stock market performance subsequent to initial public offerings (IPOs) and seasoned equity offerings (SEOs) is poor. Both sets of authors attribute underperformance to the effects of investor sentiment on returns: investors who purchase shares in IPO and SEO firms systematically over-value the shares at the time of an equity issue.[1]

We show that the poor long-run stock returns following equity issues are not unique. In event time performance tests we show that IPO issuer returns are similar to benchmarks matched on firm size and book-to-market ratios, although SEO returns still show some underperformance relative to various benchmarks. We calculate abnormal performance using both buy and hold returns and cumulative abnormal returns, and show that using buy and hold returns tends to magnify the underperformance of IPOs and SEOs.

We also utilize time-series factor models to test underperformance, finding that Fama and French's (1993) three-factor model can capture joint covariation of IPO returns, while the addition of Carhart's (1997) momentum factor is needed to capture the covariation of SEO returns. The covariation of equity issuer returns with a wider class of stock returns is potentially consistent with either a risk-based or a behavioral model. Fama and French (1993) interpret covariation of portfolio returns with their three factors as measures of a firm's riskiness. Our results are also consistent with behavioral models as presented in Black (1986); De Long et al. (1990); Lee et al. (1991); and Shleifer and Vishny (1997), in which noise traders drive stock prices away from fundamental values. Since these misvaluations tend to cluster in specific time periods, the joint covariation that we document may be driven by such market-wide misvaluations rather than by risk. We demonstrate that the low average return on equity issuer stocks is not a distinct anomaly; rather it is a manifestation of a broader pattern in returns.

In addition, evidence is provided showing that tests of long-run abnormal returns suffer from model misspecification, a concern raised by Fama (1998a). We show that reasonable changes to Fama and French's (1993) three-factor model significantly improve its explanatory power. Much like Fama and French's original model specification, our modifications are based on empirical return patterns and are designed to uncover underlying common effects.

[1] Other papers that examine long-run stock returns subsequent to issuances of corporate securities include Jegadeesh (1998), Brous et al. (1998), Mitchell and Stafford (1998), and Eckbo et al. (2000) for equity and Spiess and Affleck-Graves (1999) for debt.

Recently, Loughran and Ritter (1999) have criticized the ability of certain methodologies to detect long-run abnormal price reactions. They argue that using benchmark and factor returns that themselves contain a large number of issuing firms reduces the power of performance tests. Furthermore, they contend that time-series regressions, which are commonly used to detect departures from market efficiency, tend to have low power. They attribute this problem to specific weighting schemes used in the implementation of these regressions. Providing direct evidence to refute these claims, we show that purging benchmarks and factor returns of issuing firms does not substantially change the time-series regression results or the characteristics-matched performance mentioned above.

The rest of the paper is organized as follows. In Section 2 we begin with a discussion regarding the implementation of performance tests. Section 3 presents the sample selection and the data. Next, we critically examine the long-run performance of equity issuers and provide new evidence regarding the uniqueness of equity issuer long-run performance. Section 6 contrasts our results with recent research on the returns of equity issuers. Section 7 concludes.

## 2. Performance tests, time horizons, trading strategies, and methodology

This section presents the economic framework for our analysis. We do not develop new methodologies for evaluating long-run abnormal performance. Instead, we identify the explicit and implicit assumptions made in long-horizon stock return tests.

One component underpinning long-run performance tests is the choice of trading strategy implicit in the performance measurement methodology. Any study examining relative performance of specific classes of securities must also assume portfolio formation rules used to generate those returns. Similarly Fama (1970) points out that, any performance test must have some notion of what 'normal' returns are. Financial theory typically suggests that if there are pervasive and measurable sources of economic risk, or if firm characteristics help determine expected returns, then the researcher must match the sample returns to those on benchmarks composed of firms whose fundamental riskiness or return-determining characteristics are similar to the target group.

Thus, performance tests are joint tests of the null hypothesis of no abnormal performance, the formal model, *and* the trading rules or portfolio formation strategies invoked. While most authors recognize that abnormal performance measurement is always conditional on an asset-pricing model, few authors recognize that the method of measurement of abnormal performance also affects inferences. Recently, Barber and Lyon (1997), Kothari and Warner (1997), Lyon et al. (2000), Fama (1998a), Mitchell and Stafford (1998), Brav (1999), and Loughran and Ritter (1999) have addressed this issue. These authors argue that the method of performance measurement influences both the magnitude of the measured abnormal performance as well as the size and power of the statistical test. By varying models, trading rules, and benchmarks, we show here that these choices can lead to different conclusions and we demonstrate how fragile certain results in the literature actually are.

For example, conditional on a method of measuring abnormal performance and an asset-pricing model, should sample firm returns be equal or value weighted? Loughran and Ritter (1999) point out that the choice of weighting scheme is important for power considerations. To illustrate this point, consider a simple scenario in which a sample contains 1000 firms, 999 of which have a $1 million market capitalization (the 'small' firms) and one firm that has a $1,001 million market capitalization (the 'large' firm). Assume that the small firms have all underperformed by an equal percentage rate equal to 50% while the large firm has overperformed by 50%. It is easy to see that an equal weighted measure of abnormal performance will indicate severe mispricing ($-50\%$), while value weighting will lead the researcher to conclude that the sample abnormal performance is virtually zero. The first method provides strong evidence against market efficiency whereas the second does not.

We argue that if an alternative hypothesis suggests that small stocks are likely to be mispriced more than large stocks, then the power consideration alone implies the use of equal weighting. Similarly, if we are interested in the managerial implications of potential stock market mispricing, equal weighting returns might be more appropriate. If the researcher's goal, however, is to quantify investors' average wealth change subsequent to an event, then it follows that value weighting is the correct method. Therefore, we present results using both value and equal weighting to highlight cross-sectional differences in abnormal performance wherever they are present.

Several recent papers are related to our choice of tests of long horizon abnormal performance. Barber and Lyon (1997), Lyon et al. (2000), and Kothari and Warner (1997) provide thorough evidence on various methods of measuring abnormal performance. These papers do not find that one method is always preferred. Fama (1998b) and Mitchell and Stafford (1998), however, provide additional considerations regarding the merits of such methodologies. They argue that abnormal performance measures, such as cumulative abnormal returns (CARs) and time-series regressions, are less likely to yield spurious rejections of market efficiency relative to methodologies that calculate buy-and-hold returns by compounding single period returns at the monthly frequency. First, the buy-and-hold method can magnify underperformance – even if it occurs in only a single period – due to the nature of compounding single-period returns. Second, distributional properties and test statistics for cumulative abnormal returns are better understood.

Finally, and perhaps central to any test of long-run stock return performance, is the model misspecification problem as discussed by Fama (1998b). Fama points out that all models of expected returns are incomplete descriptions of the systematic variation of expected returns across firms. As we extend the measured horizon in an event study, it becomes more likely that the inadequacy of the maintained asset-pricing model is detected due to our compounding of the pricing errors induced by model misspecification. The approach we take in this paper is to examine the robustness of SEO and IPO underperformance with respect to various model specifications. As a result, we provide direct evidence of the importance of the model misspecification problem for equity issuers.

A troubling aspect of the model misspecification problem is that in absence of a clear alternative hypothesis, this misspecification cannot be rejected. In other words, supporters of market efficiency can always claim that the abnormal performance of a given sample is due to incorrect measurement of 'normal' returns rather than systematic security mispricing. Thus, our ability to identify the true underlying sources of pricing errors is in this sense limited.

Moreover, normative models of expected returns, such as the Capital Asset Pricing Model (CAPM) developed by Sharpe (1964) and Lintner (1965), have shown little ability to explain the cross-section of stock returns. In general, asset-pricing theory has had limited success in determining the exact sources of risk that investors care about when purchasing investments (Fama, 1998a). Consequently, empirical asset pricing has relied on empirically motivated factor models. Since the researcher has no guidance in the construction of these factors, the model misspecification problem and its critique are exacerbated. Our contribution to this debate is in showing that tests of long-run performance of equity issuers are severely affected by this problem. Alternative specifications of Fama and French's (1993) three-factor model have greatly improved pricing ability and eliminate issuer underperformance on the whole. These alternative model specifications, which exclude issuers in their factor formation, show that the returns of equity issuers strongly covary with those of non-issuing firms.

## 3. Data

Our sample of SEOs was identified in the *Investment Dealers' Digest of Corporate Financing* for the period 1975–1992. For inclusion in our sample, a firm performing a seasoned equity offering must have returns included in the files of the Center for Research on Security Prices (CRSP) sometime within five years of the offering date. Our sample includes 4526 offerings made by 2772 firms. These include all seasoned primary equity offerings, both pure primary share offerings and combination primary and secondary share offerings. Figs. 1 and 2 shows the clustering of SEOs in our sample. Unlike an IPO, in which a firm by definition can only go public once, many firms in our sample are multiple issuers of seasoned equity. 1783 (64.3%) firms perform only one seasoned equity issue; 614 (22.2%) issue twice; 211 (7.6%) issue three times; 81

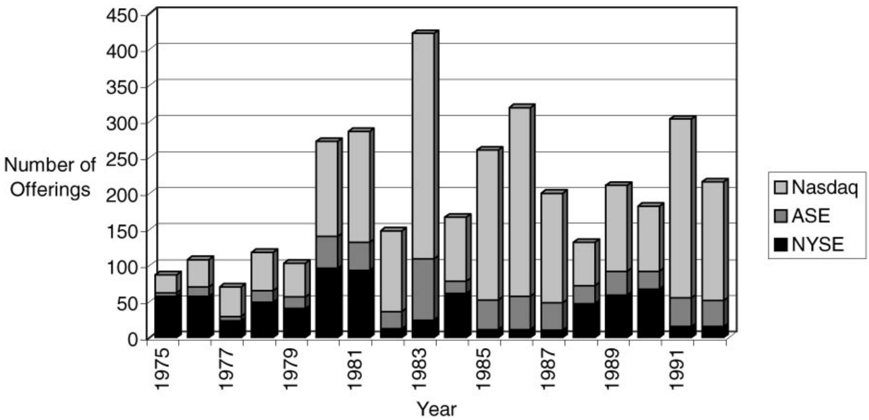


Fig. 1. Time series of seasoned equity offerings listed by exchange at time of offering. The sample of seasoned equity offerings was identified in the *Investment Dealers' Digest of Corporate Financing* for the period 1975–1992. For inclusion in our sample, a firm performing a seasoned equity offering must be followed by CRSP sometime after the offering date. The sample includes 4526 offerings made by 2772 firms. Offerings are listed by the exchange on which the firm was trading at the time of the offering.

(2.9%) issue four times; 35 (1.3%) issue five times; 17 (0.6%) issue six times; and 31 (1.1%) issue seven times or more. Fig. 1 also shows the distribution of issues by exchange. In the 1970s, most SEOs were NYSE firms. In later years, Nasdaq firms account for a larger fraction of issuances.

Our sample of IPOs is collected from various issues of the *Investment Dealers' Digest of Corporate Financing* for the period 1975–1992 as well as from the Securities Data Corporation database. Jay Ritter also provided data on initial public offerings for the period 1975–1984. For inclusion in our sample, a firm performing an IPO must have stock returns in the CRSP database within five years of the offering date. Our final sample includes 4622 IPOs for the period 1975–1992.

Our data set is different from those of Loughran and Ritter (1995) and Spiess and Affleck-Graves (1995) in several ways. First, unlike Loughran and Ritter, we exclude all unit offerings from our sample because separating the value of the offerings' components (usually common stock with warrants) is difficult. Utilities are also included in our sample even though Loughran and Ritter exclude them. The impact of including utilities is small: they comprise only 5.5% of either sample. We reestimated our results excluding utilities and, although not report here, these results were similar to those which we have reported. In addition, unlike Spiess and Affleck-Graves, who look only at offerings that are entirely primary shares, we include offerings that also have a secondary

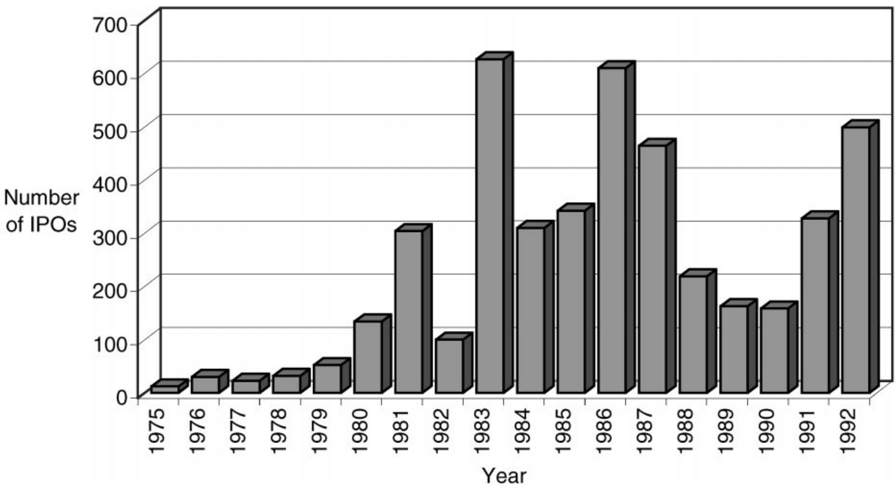


Fig. 2. Time series of initial public offerings. The sample of initial public offerings is collected from various issues of the *Investment Dealers' Digest of Corporate Financing* for the period 1975–1995 as well as from the Securities Data Corporation database. For inclusion in the sample, a firm performing an IPO must be followed by the Center for Research in Securities Prices (CRSP) at some point after the offering date. The final sample includes 4622 IPOs for the period 1975–1992 of which 539 list on NYSE, 215 list on ASE, and 3869 list on Nasdaq.

component in which insiders sells some of their shares in the offering. If, as Myers and Majluf (1984) suggest, insiders attempt to sell their shares when they perceive them to be overvalued, inclusion of these issues may reinforce the long-run underperformance effect we find in the data as the market revises its assessment of these firms' prospects. Including secondary issues along with primary issues is conservative in this sense. Because we can replicate the magnitude of underperformance documented in Loughran and Ritter (1995) and Spiess and Affleck-Graves (1995) using our sample, we do not feel our sample selection imparts any biases in our conclusions.

We examine the size and book-to-market characteristics of our sample. Starting in January of 1964, we use all New York Stock Exchange (NYSE) stocks to create size quintile breakpoints. This approach is based on Fama and French (1992), who use only NYSE stocks to create the breakpoints to ensure dispersion in the characteristics across portfolios. Size is measured as the number of shares outstanding times the stock price at the end of the preceding month. We obtain our accounting measures from the COMPUSTAT quarterly and annual files and define book value as book common equity plus balance sheet deferred taxes and investment tax credits for the fiscal quarter ending two quarters before the sorting date. If the book value is missing from the quarterly

Table 1
The distribution of IPOs by book-to-market and size.

The sample is all IPOs from 1975 through 1992. Size breakpoints are formed quarterly by dividing all NYSE stocks into size quintiles. Book-to-market breakpoints are formed quarterly with equal numbers of NYSE firms allocated to each of five book-to-market portfolios. The intersection of these quintile breakpoints results in 25 possible allocations.

| Book-to-market quintiles | Size quintile | | | | | |
|---|---|---|---|---|---|---|
| | Smallest (%) | Quintile 2 (%) | Quintile 3 (%) | Quintile 4 (%) | Largest (%) | Total (%) |
| Low | 51.80 | 18.20 | 5.50 | 1.70 | 0.40 | 77.60 |
| 2 | 8.20 | 1.90 | 0.90 | 0.20 | 0.10 | 11.50 |
| 3 | 3.00 | 1.20 | 0.60 | 0.10 | 0.10 | 4.90 |
| 4 | 1.60 | 0.60 | 0.30 | 0.10 | 0.00 | 2.60 |
| High | 2.00 | 0.80 | 0.40 | 0.20 | 0.00 | 3.40 |
| Total | 66.60 | 22.70 | 7.70 | 2.30 | 0.60 | 100.00 |

statements or if firms are missing altogether from the quarterly files, we search for the book value in the annual files. We create book-to-market quintile breakpoints using only NYSE firms and then form 25 ($5 \times 5$) size and book-to-market portfolios by intersecting the portfolio breakpoints and allocating all NYSE, Amex, and Nasdaq firms into these portfolios. Our benchmark portfolios are reformed each quarter.

These breakpoints also create 25 portfolios to which each SEO or IPO stock can be assigned. For the sample of SEO firms, we calculate the market value of the firm one month prior to the issuance. For the IPOs, the market value of equity is calculated at the end of the first month after the offering. We calculate book values using COMPUSTAT data. Book values for SEO firms are taken six months prior to the offering to allow for reporting lags. For the book value of equity of IPO firms, we use COMPUSTAT and record the first book value after the IPO as long as it is within eighteen months of the offering month. Shortening this interval does not affect any of the results that we report herein, although it does lead to a smaller sample size. The bias in book value should not be too large because the increment in book value due to retained earnings in the first year is likely to be very small for newly public companies; it is only the small recently incorporated firms that are missing data.

Table 1 presents the size and book-to-market portfolio distribution for the IPO sample by quintiles. IPOs are heavily weighted in the small, low book-to-market portfolios. Over half (51.8%) of the IPO firms are in the smallest, lowest book to market portfolio, the (1,1) portfolio.[2] Two thirds of the IPO firms are in

[2] 'The (X, Y) portfolio' refers to the *X*th size row and the *Y*th book-to-market column in the $5 \times 5$ display of the 25 size and book-to-market portfolios.

Table 2
The distribution of SEOs by book-to-market and size.

The sample is all SEOs from 1975 through 1992. Size breakpoints are formed quarterly by dividing all NYSE stocks into size quintiles. Book-to-market breakpoints are formed quarterly with equal numbers of NYSE firms allocated to each of five book-to-market portfolios. The intersection of these quintile breakpoints results in 25 possible allocations

| Book-to-market quintiles | Size quintile | | | | | |
|---|---|---|---|---|---|---|
| | Smallest (%) | Quintile 2 (%) | Quintile 3 (%) | Quintile 4 (%) | Largest (%) | Total (%) |
| Low | 24.10 | 12.60 | 7.30 | 4.20 | 2.40 | 50.70 |
| 2 | 7.40 | 5.10 | 3.30 | 1.70 | 1.30 | 18.70 |
| 3 | 4.10 | 3.20 | 2.20 | 2.30 | 1.50 | 13.20 |
| 4 | 2.70 | 2.00 | 1.90 | 1.80 | 1.20 | 9.70 |
| High | 2.20 | 1.50 | 1.30 | 1.40 | 1.40 | 7.80 |
| Total | 40.50 | 24.50 | 16.00 | 11.30 | 7.80 | 100.00 |

the smallest quintile of stocks. Similarly, less than 1% of the IPOs are in the largest quintile of stocks when breakpoints are defined by NYSE firms. In terms of book-to-market ratios, over 77% of the IPO firms have book-to-market ratios in the lowest quintile when breakpoints are defined by NYSE stocks.

It is not surprising that the sample tends to have this pattern. Smaller firms may generate less internal cash and thus issue equity to finance expansion. Similarly, managers of smaller firms may have substantially larger equity stakes in the firms and want to reduce their holdings via secondary offerings. The low book-to-market grouping may be explained in one of two ways. First, these may represent future growth options. Smaller firms are growth firms and may have many good investment opportunities for which they need to raise cash. On the other hand, the low book-to-market ratio for these firms may just be an indicator of overpricing. Loughran and Ritter (1995) for example argue that issuers time the market for new shares when their firms are relatively overvalued.

We present summary statistics for the SEO firms in Table 2, where the distribution is shown in the $5 \times 5$ size and book-to-market portfolios. The SEO sample is more evenly distributed across size and book-to-market quintiles than the IPO sample. Only 24% of the SEO sample is in the (1,1) portfolio, less than half the fraction of IPO firms that fall in the (1,1) portfolio. Almost 8% of the seasoned equity-issuing firms are in the largest quintile of NYSE stocks and almost 50% of SEO firms are outside of the lowest book-to-market quintile. These differences lead us to examine the performance of IPO and SEO firms separately.

## 4. Underperformance of equity issuers

### *4.1. Event time returns*

Various benchmarks are utilized to measure IPO and SEO long-run performance throughout this paper. First, the performance of issuing firms is matched to the following broad market indexes: the S&P 500, Nasdaq composite index, CRSP value weight index, and CRSP equal weight index. CRSP value and equal weight indexes include all stocks listed on the NYSE, Amex, and Nasdaq. We also create benchmark portfolios which will be assumed to represent normal returns by matching issuing firms with groups of firms drawn from the universe of stocks (NYSE, AMEX, and Nasdaq) based on firm characteristics. These characteristics are either firm size and book-to-market or size, book-to-market, and price momentum portfolios.

We form size and book-to-market portfolios as described in the previous section. In order to eliminate the benchmark bias discussed in Loughran and Ritter (1999), we eliminate all IPO and SEO firms from the benchmark portfolios for a period of five years after their issuance. We further reform our benchmark portfolios each quarter and calculate equal weighted returns for the next three months, repeating the above procedure in January, April, July, and October of each year.

We form the size, book-to-market, and momentum portfolios as follows. Starting in January 1964, we form size quartile breakpoints using NYSE firms only. Within each size quartile, we then form quartile book-to-market breakpoints. Each of the 16 ($4 \times 4$) size and book-to-market portfolios is in turn split further into price momentum quartiles. Size and book-to-market are calculated as described in the previous paragraph. Price momentum is calculated as the buy-and-hold return over the previous year excluding the month before the sorting date, i.e., the same procedure used in Carhart (1997). This sorting procedure results in 64 ($4 \times 4 \times 4$) possible portfolios into which we allocate the entire universe of CRSP-listed firms (i.e., all NYSE, Amex, and Nasdaq stocks). We use only quartile breakpoints (based on NYSE firms) when we form size, book-to-market, and price momentum benchmarks because finer divisions of firms (i.e., quintiles) leave certain portfolios with few stocks. Unlike portfolio formation based on accounting measures, we repeat the momentum-based formation process monthly. For each of the 64 benchmark portfolios, we calculate equal weighted monthly returns.

Table 3 presents long-run performance for the sample of SEO stocks from an event time strategy in which each SEO constitutes an event. Panel A calculates buy-and-hold returns. To construct our figures, we use the monthly tapes and follow each offering beginning in the month after the event for the earlier of 60 months or the delisting month. Our five-year buy-and-hold intervals are set to match those chosen by Loughran and Ritter (1995).

On the left-hand side of Panel A, we equal weight the returns of the SEOs and their benchmarks. Loughran and Ritter (1995) and Spiess and Affleck-Graves (1995) calculate wealth relatives for the five year period by taking the ratio of one plus the equal weighted return on the SEO portfolio over one plus the equal weighted return on the chosen benchmark. We also report the ratio of the average return on the SEOs relative to the chosen benchmark.

The wealth relatives in Panel A are very similar to those in Loughran and Ritter and Spiess and Graves reassuring us that any differences in sample selection has negligible impact on our results. The five-year wealth relative is less than 1.0 for all benchmarks, ranging from 0.84 to 0.89. The five-year excess returns are all negative, anywhere from − 19.5% versus the Nasdaq Composite index to − 30.1% versus the S and P 500 index.

Unlike Ritter and Loughran, no attempt is made to match SEOs to individual firms. Loughran and Ritter (1995) match firms on size and require the matching firms to be nonissuing firms for at least five years. Therefore, because Nasdaq returns are picked up by CRSP in 1972, 1978 is the first year that any Nasdaq firm can be used as a matching firm in their study. As Table 2 shows, most issuing firms tend to be small. By matching the early sample only to small NYSE/ASE firms, Loughran and Ritter may be matching SEO firms to the De Bondt and Thaler (1985, 1987) long-term loser stocks that we know outperform similarly sized stocks. Their benchmarks therefore are likely to be biased towards finding underperformance. This potential problem is avoided by our use of all CRSP-listed firms, including Nasdaq.

The right half of panel A presents value weighted results for our sample. In Panel A value weighting reduces, but does not eliminate, underperformance. Wealth relatives are now between 0.87 and 0.93 and the excess return is between − 14.2% and − 25%. This indicates that small issuers underperform more than large issuers.

In Panel B of Table 3, we calculate the cumulative abnormal returns (CARs) for the five years following the issuance. The CARs are all closer to zero than the excess returns calculated in Panel A. In fact, average CARs are between − 8% and − 17% in the value weighted SEO sample. While value weighting increases CARs relative to the broad market benchmarks, there is little change in performance relative to the size and book-to-market or size, book-to-market, and price momentum portfolios. The results in Table 3 also show that the underperformance of SEO stocks is magnified by the calculation of buy-and-hold returns.

The returns of the IPO sample are similarly examined in Table 4 where we again present buy-and-hold returns in Panel A and cumulative abnormal returns in Panel B. The results are similar in both panels. On an equal-weighted basis, IPO firms underperform broad market benchmarks by a wide margin, underperforming the S&P by 44% and Nasdaq by 31%. Value weighting the IPO stock returns, however, cuts this underperformance in half. Once IPO firm returns are matched to size and book-to-market portfolios, which are

Table 3
The long-run performance of seasoned equity offerings. The sample is 4526 seasoned equity offerings from 1975 through 1992.

Five year equal weighted and value weighted buy and hold returns on SEOs are compared with alternative benchmarks. In the first four rows we employ the S&P 500, Nasdaq Composite, and NYSE-ASE-Nasdaq equal and value weighted indices. Value weighted results for these indices employ 4512 observations because market capitalization in the month after the SEO for 14 firms could not be found. Value weighted results are adjusted for inflation. Rows five through seven present abnormal performance measured relative to attribute-based portfolios. Size and book-to-market portfolios are generated by first forming size quintile breakpoints using NYSE firms only. These quintiles are split further into book-to-market quintiles using NYSE breakpoints only. The universe of NYSE, ASE and Nasdaq firms is allocated into the resulting 25 portfolios and equal weighted monthly returns are calculated. The breakpoints for these portfolios are recalculated quarterly. Size, book-to-market and momentum portfolios are formed as follows. We first form size quartile breakpoints using NYSE firms only and then, within each size quartile, form book-to-market quartile breakpoints using NYSE firms only. We allocate the universe of NYSE, ASE, and Nasdaq firms into these 16 portfolios and then within each portfolio form additional quartile breakpoints based on prior year returns excluding the previous month. We calculate the resulting portfolio average returns for these 64 portfolios. This portfolio formation is repeated monthly. In the first six rows we report buy-and-hold results while in the seventh row we report event-time rebalanced results. Buy-and-hold returns are generated by compounding 60 monthly returns starting in the month following the equity issue. If the SEO delists before the 60th month we compound the return up until the delisting month. Event-time rebalancing results are generated by compounding event-time monthly averages for the SEOs and their benchmark. Since some firms lack the accounting information necessary for the attribute matching, we report results for 3775 firms in rows five and six and for 4091 in row seven. Abnormal return is the simple difference between SEO five-year average return and the corresponding benchmark. Wealth relatives are calculated as $\Sigma(1 + R_{i,T})/\Sigma(1 + R_{\text{bench},T})$, where $R_{i,T}$ is the holding period return on the SEO $i$ for period $T$ and $R_{\text{bench},T}$ is the return on the benchmark portfolio over the same period. All returns on the SEOs and benchmark portfolios are taken from the CRSP files.

*Panel A: Buy-and-hold returns*

| Benchmarks | Equal weighted buy-and-hold returns (%) | | | | Value weighted buy-and-hold returns (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | SEO | Benchmark | Abnormal return | Wealth relative | SEO | Benchmark | Abnormal return | Wealth relative |
| S&P 500 index | 57.5 | 87.6 | – 30.1 | 0.84 | 75.3 | 94.3 | – 19.0 | 0.90 |
| Nasdaq Comp. | 57.5 | 76.9 | – 19.5 | 0.89 | 75.3 | 89.5 | – 14.2 | 0.93 |
| CRSP VW | 57.5 | 81.5 | – 24.0 | 0.87 | 75.3 | 89.5 | – 14.1 | 0.93 |
| CRSP EW | 57.5 | 81.6 | – 24.2 | 0.87 | 75.3 | 102.2 | – 26.9 | 0.87 |
| Size and Book-to-Market (3,775 obs) | 57.6 | 83.9 | – 26.3 | 0.86 | 72.5 | 97.5 | – 25.0 | 0.87 |
| Size and Book-to-Market and PR12 (3775 obs) | 57.0 | 84.3 | – 27.3 | 0.85 | 75.7 | 99.5 | – 23.8 | 0.88 |

The long-run performance of seasoned equity offerings.
The sample is 4526 seasoned equity offerings from 1975 through 1992. Five year equal weighted and value weighted cumulative abnormal returns on SEOs are compared with alternative benchmarks. In the first four rows we employ the S&P 500, Nasdaq Composite, and NYSE-ASE-Nasdaq equal and value weighted indices. Value weighted results for these indices employ 4512 observations because market capitalization in the month after the SEO for 14 firms could not be found. Value weighted results are adjusted for inflation. Rows five through seven present abnormal performance measured relative to attribute-based portfolios. Size and book-to market portfolios are generated by first forming size quintile breakpoints using NYSE firms only. These quintiles are split further into book-to-market quintiles using NYSE breakpoints only. The universe of NYSE, ASE and Nasdaq firms are allocated into the resulting 25 portfolios and equal weighted monthly returns are calculated. The breakpoints for these portfolios are recalculated quarterly. Size, book-to-market, and momentum portfolios are formed as follows. We first form size quartile breakpoints using NYSE firms only and then, within each size quartile, form book-to-market quartile breakpoints using NYSE firms only. We allocate the universe of NYSE, ASE, and Nasdaq firms into these 16 portfolios and then within each portfolio form additional quartile breakpoints based on prior year returns excluding the previous month. We calculate the resulting portfolio average returns for these 64 portfolios. This portfolio formation is repeated monthly. Cumulative abnormal returns are generated by summing 60 monthly abnormal returns starting in the month following the equity issue. If the SEO delists before the 60th month, we sum the return up to the delisting month. Event-time rebalancing results are generated by summing event-time monthly averages for the SEOs and their benchmark. Since some firms lack the accounting information necessary for the attribute matching, we report results for 3775 firms in rows five and six. All returns on the SEOs and benchmark portfolios are taken from the CRSP files.

*Panel B: Cumulative abnormal returns*

| Benchmarks | Equal weighted CARs (%) | | | Value weighted CARs (%) | | |
|---|---|---|---|---|---|---|
| | SEO | Benchmark | CAR | SEO | Benchmark | CAR |
| S&P 500 index | 51.5 | 75.5 | – 24.0 | 60.4 | 70.2 | – 9.8 |
| Nasdaq composite | 51.5 | 70.7 | – 19.2 | 60.4 | 69.2 | – 8.8 |
| CRSP value-weighted | 51.5 | 72.0 | – 20.5 | 60.4 | 68.1 | – 7.8 |
| CRSP equal-weighted | 51.5 | 68.7 | – 17.15 | 60.4 | 70.4 | – 10.1 |
| Size and book-to-market (3775 obs) | 53.2 | 68.6 | – 15.4 | 56.0 | 71.9 | – 15.9 |
| Size and book-to-market and PR12 (3775 obs) | 52.4 | 67.7 | – 15.3 | 56.6 | 73.8 | – 17.1 |

Table 4
The long-run performance of initial public offerings.

The sample is 4622 initial public offerings from 1975 through 1992. Five year equal weighted and value weighted buy-and-hold returns on IPOs are compared with alternative benchmarks. In the first four rows we employ the S&P 500, Nasdaq Composite, and NYSE-ASE-Nasdaq equal and value weighted indices. Throughout, value weighted results are adjusted for inflation. In row five we present abnormal performance measured relative to size and book-to market portfolios. These portfolios are generated by first forming size quintile breakpoints using NYSE firms only. These quintiles are split further into book-to-market quintiles using NYSE breakpoints only. The universe of NYSE, ASE and Nasdaq firms is allocated into the resulting 25 portfolios and we calculate equal weighted monthly returns. The breakpoints for these portfolios are recalculated quarterly. Buy-and-hold returns are generated by compounding 60 monthly returns starting in the month following the equity issue. Since some firms lack the accounting information necessary for the attribute matching, we report results for 3501 in row five. If the IPO delists before the 60th month, we compound the return up to the delisting month. Abnormal return is the simple difference between IPO five-year average return and the corresponding benchmark. Wealth relatives are calculated as $\Sigma(1+R_{i,T})/\Sigma(1+R_{\text{bench},T})$, where $R_{i,T}$ is the holding period return on the IPO $i$ for period $T$ and $R_{\text{bench},T}$ is the return on the benchmark portfolio over the same period. All returns on the IPOs and benchmark portfolios are taken from the CRSP files.

*Panel A: Buy-and-hold returns*

| Benchmarks | Equal weighted buy-and-hold returns (%) | | | | Value weighted buy-and-hold returns (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | IPO | Benchmark | Abnormal return | Wealth relative | IPO | Benchmark | Abnormal return | Wealth relative |
| S&P 500 index | 33.1 | 77.3 | − 44.2 | 0.75 | 52.6 | 78.3 | − 25.7 | 0.86 |
| Nasdaq composite | 33.1 | 64.2 | − 31.1 | 0.81 | 52.6 | 68.2 | − 15.6 | 0.91 |
| CRSP VW | 33.1 | 71.7 | − 38.6 | 0.78 | 52.6 | 72.4 | − 19.8 | 0.89 |
| CRSP EW | 33.1 | 61.5 | − 28.4 | 0.82 | 52.6 | 61.4 | − 8.8 | 0.95 |
| Size and book-to-market (3501 obs) | 35.8 | 29.2 | 6.6 | 1.05 | 56.6 | 55.2 | 1.4 | 1.01 |

The long-run performance of initial public offerings.
The sample is 4622 initial public offerings from 1975 through 1992. Five year equal weighted and value weighted cumulative abnormal returns on IPOs are compared with alternative benchmarks. In the first four rows we employ the S&P 500, Nasdaq Composite and NYSE-ASE-Nasdaq equal and value weighted indices. Throughout, value weighted results are adjusted for inflation. In row five we present abnormal performance measured relative to size and book-to market portfolios. These portfolios are generated by first forming size quintile breakpoints using NYSE firms only. These quintiles are split further into book-to-market quintiles using NYSE breakpoints only. The universe of NYSE, ASE and Nasdaq firms is allocated into the resulting

25 portfolios and we calculate equal weighted monthly returns. The breakpoints for these portfolios are recalculated quarterly. Since some firms lack the accounting information necessary for the attribute matching, we report results for 3501 in row five. Cumulative abnormal returns are generated by summing 60 monthly abnormal returns starting in the month following the equity issue. If the IPO delists before the 60th month, we sum up to the delisting month. All returns on the IPOs and benchmark portfolios are taken from the CRSP files.

*Panel B: Cumulative abnormal returns*

| | Equal weighted CARs (%) | | | Value weighted CARs (%) | | |
|---|---|---|---|---|---|---|
| Benchmarks | IPO | Benchmark | CAR | IPO | Benchmark | CAR |
| S&P 500 index | 35.9 | 74.2 | − 38.3 | 40.7 | 61.5 | − 20.8 |
| Nasdaq composite | 35.9 | 67.9 | − 32.0 | 40.7 | 57.5 | − 16.8 |
| CRSP value-weighted | 35.9 | 70.2 | − 34.3 | 40.7 | 58.1 | − 17.4 |
| CRSP equal-weighted | 35.9 | 62.4 | − 26.5 | 40.7 | 51.8 | − 11.1 |
| Size and Book-to-market (3501 obs) | 42.3 | 32.6 | 9.7 | 53.0 | 49.7 | 3.3 |

themselves free of issuing firms, there is no underperformance. Average excess returns are actually positive. As Brav and Gompers (1997) and Brav (1999) show, initial public offering firms have returns that are comparable to similar, non-issuing size and book-to-market firms.

As we will demonstrate in a later section, the reason that matching by size and book-to-market eliminates the underperformance of the IPO stocks, but not the SEO stocks, is that the majority of IPO firms (51.8%) are in the (1, 1) portfolio; that is, the smallest, lowest book to market portfolio. Brav and Gompers (1997) show that small, growth firms do particularly poorly following heavy periods of equity issuances. SEO firms are more evenly distributed across size and book-to-market quintiles (with only 24.1% of SEO firms in the (1, 1) portfolio), and hence the size and book-to-market benchmark for 75% of SEO stocks is not the (1, 1) portfolio. However, we show in section IV that the time series of returns on SEO stocks are mimicked by the time series of returns of non-issuing firms controlling for size and book-to-market. This covariation indicates that the factors affecting the returns on small growth companies, whether they may be risk or sentiment, affect the returns on SEO firms at the same time.

### *4.2. Factor regression analysis*

The characteristics-based approach of the previous section assumes that equity risk is captured by an observable set of firm-specific characteristics such as size, book-to-market, or stock price momentum. If these observable characteristics are only imperfect proxies for risk, then the characteristics-based approach might misclassify firms' riskiness. Fama (1998a) argues that factor-based approaches to performance evaluation as documented in Fama and French (1993) are potentially useful in capturing systematic patterns in average returns, although he acknowledges that both factor-based approaches and corresponding characteristic-based approaches likely suffer from model misspecification as discussed earlier.

In the Fama–French (1993) three-factor model, the first factor is the excess return on the value weighted market portfolio (RMRF). The second factor, called SMB by Fama and French, is the return on a zero investment portfolio formed by subtracting the return on a large firm portfolio from the return on a small firm portfolio.[3] Similarly, the third factor is the return of another mimicking portfolio, named HML by Fama and French, defined as the return on a portfolio of high book-to-market stocks (This portfolio represents the top 30% of all firms on COMPUSTAT, less the return on a portfolio of low book-to-market stocks (This portfolio contains firms in the lowest 30% of the

[3] The breakpoints for small and large are determined by NYSE firms alone, but the portfolios contain all firms traded on NYSE, ASE, and Nasdaq exchanges.

COMPUSTAT universe of firms.)

$$r_{p,t} - r_{f,t} = \alpha + \beta RMRF_t + sSMB_t + hHML_t + \varepsilon_t. \tag{1}$$

Carhart (1997) explores extensions of the Fama–French model. In particular, he argues that a fourth factor, that is nearly orthogonal to the Fama–French factors, can increase the explanatory power of the Fama–French model for the returns of mutual funds. Carhart's fourth factor is based on ranking firms by their return over the previous year, or price momentum. This notion follows the empirical observation of Jegadeesh and Titman (1993) that firms having high returns in the previous year tend to continue to enjoy high returns in the next year. His factor, PR12, is formed by taking the return on high momentum stocks minus the return on low momentum stocks.[4]

$$r_{p,t} - r_{f,t} = \alpha + \beta RMRF_t + sSMB_t + hHML_t + pPR12_t + \varepsilon_t. \tag{2}$$

As discussed in Section 1, however, Loughran and Ritter (1999) argue that factor models have low statistical power for uncovering underperformance if factor returns are calculated using, in part, the returns of the sample being tested for underperformance. To deal with this, we run our factor regressions using returns created two ways: by using all CRSP-listed securities and also by using only those firms that have not issued equity in an IPO or SEO within the previous five years.

We interpret the intercept in the three and four factor time series regressions as a measure of average abnormal performance. This measure has a role analogous to Jensen's alpha in the CAPM framework. To benchmark the full sample and issuer-purged factor regressions, Table 5 presents four-factor model regression results for the 25 size and book-to-market portfolios discussed previously. These 25 portfolios contain all CRSP-listed firms. The results in Table 5 help establish how the issuer-purged factors perform in standard tests of model performance first benchmarked in Fama and French (1993). In Panel A, the full sample factors price nearly all of the test portfolios. Much like in the earlier Fama and French (1993) results, the four-factor model has difficulty pricing the (1, 1) portfolio of the smallest, lowest book-to-market firms, producing a large negative intercept of $-0.0053$, 53 basis points per month. In addition, the (2, 1) portfolio has a significantly negative intercept and the (1, 4) and the (2, 4) portfolios have significantly positive intercepts, indicating that the ability of these pricing models to explain all portfolio returns is somewhat limited.

The inability of the models to price, for example, the (1, 1) portfolio, implies that any group of stocks which strongly covaries with the return on the (1, 1)

[4] Momentum here is defined as the previous 11-month nominal stock return lagged one month. We create the factor breakpoints by taking the average return on the top 50% of all firms (winners) minus the return on the bottom 50% of all firms (losers).

Table 5
Four factor regressions for twenty-five test portfolios formed on the basis of size and book-to-market.

Panel A presents estimated coefficients from factor regressions for the 25 benchmark portfolios using factors formed from all CRSP-listed firms. Panel B forms the factors excluding all issuing firms, i.e., excluding all firms that issued equity in an initial public offering or seasoned equity offering during the previous five years. RMRF is the return on a portfolio formed by subtracting the value weighted market return on all NYSE/ASE/Nasdaq firms (RM) minus the risk free rate (RF) which is the one-month Treasury bill rate. SMB (small minus big) is the difference each month between the return on small firms and big firms. HML (high minus low) is the difference each month between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks. PR12 is the excess return on winners versus losers based on prior year returns excluding the previous month. [$t$-statistics are in brackets.]

*Panel A: Full sample factors*

| Intercept | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | – 0.0053 [4.16] | – 0.0016 [ – 1.90] | – 0.0004 [ – 0.45] | 0.0013 [1.57] | 0.0013 [1.52] |
| 2 | 0.0012 [1.33] | 0.0002 [0.21] | 0.0007 [0.90] | – 0.0004 [—0.54] | 0.0009 [1.01] |
| 3 | 0.0001 [0.09] | 0.0012 [1.64] | 0.0000 [0.02] | – 0.0005 [ – 0.59] | – 0.0005 [ – 0.45] |
| 4 | 0.0016 [2.17] | 0.0016 [2.07] | 0.0013 [1.62] | 0.0000 [0.02] | – 0.0003 [ – 0.31] |
| High | 0.0003 [0.41] | – 0.001 [ – 1.20] | – 0.0006 [ – 0.57] | 0.0004 [0.33] | – 0.0007 [ – 0.51] |

| RMFR | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | 1.0498 [34.87] | 1.1060 [57.12] | 1.0785 [54.22] | 1.0464 [52.99] | 0.9518 [46.36] |
| 2 | 1.0171 [48.70] | 1.0506 [55.73] | 1.0286 [52.57] | 1.0909 [55.84] | 1.0501 [49.48] |
| 3 | 0.9599 [58.57] | 0.9981 [57.94]] | 0.9657 51.82] | 1.0948 [49.82] | 0.9790 [40.79] |
| 4 | 0.9056 [52.80] | 0.9779 [54.41] | 0.9777 [50.35] | 1.0528 [44.48] | 1.0172 [47.02] |
| High | 0.9925 [52.60] | 1.1008 [57.18] | 1.1037 [45.03] | 1.1686 [41.20] | 1.349 |

| SMB | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | 1.3100 [27.10] | 1.0104 [32.50] | 0.7222 [22.62] | 0.3533 [11.15] | − 0.1966 [ − 5.96] |
| 2 | 1.1893 [35.47] | 0.9297 [30.71] | 0.6557 [20.87] | 0.3191 [10.17] | − 0.1690 [ − 4.96] |
| 3 | 1.0774 [40.95] | 0.8378 [30.29] | 0.6076 [20.30] | 0.3343 [9.48] | − 0.2357 [ − 6.12] |
| 4 | 1.0693 [38.83] | 0.7561 26.20] | 0.4651 [14.91] | 0.1508 [3.97] | − 0.1657 [ − 4.77] |
| High | 1.1794 [38.93] | 0.9220 [29.83] | 0.6224 [15.82] | 0.2816 [6.18] | − 0.0995 [ − 1.88] |

| HML | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | − 0.2800 [ − 5.46] | − 0.5064 [ − 15.34] | − 0.4221 [ − 12.45] | − 0.4393 [ − 13.05] | − 0.4317 [ − 12.33] |
| 2 | 0.0324 [0.91] | − 0.018 [ − 0.56] | 0.0418 [1.25] | − 0.0075 [ − 0.23] | − 0.0793 [ − 2.19] |
| 3 | 0.2237 [8.00] | 0.2179 [7.42] | 0.3069 [9.66] | 0.2895 [7.73] | 0.1444 [3.53] |
| 4 | 0.3607 [12.33] | 0.4337 [14.15] | 0.4214 [12.73] | 0.5133 [12.72] | 0.482 [13.07] |
| High | 0.6500 [20.21] | 0.6813 [20.76] | 0.7622 [18.24] | 0.7129 [14.74] | 0.8193 [14.57] |

| PR12 | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | − 0.0814 [ − 1.97] | − 0.0033 [ − 0.13] | 0.0382 [1.40] | − 0.0045 [ − 0.17] | − 0.0749 [ − 2.66] |
| 2 | − 0.1465 [ − 5.12] | 0.0124 [0.48] | 0.0249 [0.93] | − 0.0384 [ − 1.43] | 0.0078 [0.27] |
| 3 | − 0.046 [ − 2.05] | 0.0213 [0.90] | 0.0420 [1.65] | − 0.0350 [ − 1.16] | 0.0774 [2.35] |
| 4 | − 0.0673 [ − 2.86] | 0.0494 [2.00] | − 0.0337 [ − 1.27] | − 0.0667 [ − 2.06] | − 0.075 − 2.53] |
| High | − 0.0574 [ − 2.22] | 0.0273 [1.04] | 0.1213 [3.61] | 0.0205 [0.53] | − 0.0426 [ − 0.94] |

Table 5 (*continued*)

| Adjusted $R^2$ | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | 92.70 | 96.83 | 95.96 | 95.16 | 92.78 |
| 2 | 95.61 | 96.04 | 94.82 | 94.58 | 92.39 |
| 3 | 96.68 | 95.97 | 94.25 | 92.72 | 88.22 |
| 4 | 96.00 | 95.07 | 93.24 | 89.98 | 90.03 |
| High | 95.92 | 95.63 | 91.92 | 88.87 | 80.36 |

*Panel B: Purged factor regressions*

| Intercept | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | − 0.0060 [ − 4.26] | − 0.0015 [ − 1.39] | 0.0001 [0.06] | 0.0013 [1.45] | 0.0015 [1.78] |
| 2 | 0.0004 [0.44] | 0.0005 [0.60] | 0.0011 [1.30] | − 0.0007 [ − 0.86] | 0.0007 [0.83] |
| 3 | − 0.0001 [ − 0.06] | 0.0016 [2.08] | 0.0003 [0.42] | − 0.0004 [ − 0.47] | − 0.0008 [ − 0.78] |
| 4 | 0.0015 [1.80] | 0.0018 [2.28] | 0.0013 [1.53] | − 0.0002 [ − 0.23] | − 0.0009 [ − 0.95] |
| High | 0.0000 [0.00] | − 0.0005 [ − 0.53] | − 0.0001 [ − 0.06] | 0.0005 [0.39] | − 0.0009 [ − 0.58] |

| RMRF | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | 1.1018 [33.34] | 1.1685 [47.35] | 1.1248 [50.48] | 1.0804 [50.56] | 0.9489 [47.33] |
| 2 | 1.0483 [43.84] | 1.0819 [53.19] | 1.0524 [52.01] | 1.1042 [58.16] | 1.0497 [50.10] |
| 3 | 0.9798 [51.58] | 1.0192 [56.59] | 0.9773 [50.72] | 1.0978 [51.14] | 0.9744 [41.93] |
| 4 | 0.9097 [45.70] | 0.9909 [53.37] | 0.9793 [50.87] | 1.0441 [47.00] | 0.9989 [47.17] |
| High | 0.9903 [42.58] | 1.0928 [45.79] | 1.0883 [39.47] | 1.1468 [37.65] | 0.9834 [27.12] |

| SMB | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | 1.2635 [23.80] | 0.9235 [23.29] | 0.6543 [18.27] | 0.3097 [9.02] | – 0.2019 [ – 6.27] |
| 2 | 1.1869 [30.89] | 0.8928 [27.31] | 0.6241 [19.19] | 0.3252 [10.66] | – 0.1590 [ – 4.72] |
| 3 | 1.0759 [35.25] | 0.8252 [28.51] | 0.6020 [19.44] | 0.3421 [9.92] | – 0.2152 [ – 5.76] |
| 4 | 1.0948 [34.23] | 0.7648 [25.63] | 0.4911 [15.88] | 0.2020 [5.66] | – 0.1223 [ – 3.59] |
| High | 1.2296 [38.90] | 0.9500 [24.78] | 0.6599 [14.88] | 0.3183 [6.50] | – 0.0097 [ – 0.17] |

| HML | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | – 0.3701 [[ – 5.62] | – 0.5854 [ – 11.90] | – 0.5037 [ – 11.34] | – 0.4644 [ – 10.90] | – 0.4791 [ – 11.99] |
| 2 | – 0.0462[ – 0.97] | – 0.1227 [ – 3.03] | – 0.0247 [ – 0.61] | – 0.0066 [ – 0.17] | – 0.0468 [ – 1.12] |
| 3 | 0.1196 [3.16] | 0.1351 [3.76] | 0.2545 [6.63] | 0.2769 [6.47] | 0.2166 [4.67] |
| 4 | 0.2235 [5.63] | 0.3847 [10.39] | 0.4118 [10.73] | 0.5625 [12.70] | 0.5686 [13.47] |
| High | 0.5331 [11.50] | 0.5517 [11.60] | 0.6734 [12.25] | 0.6878 [11.33] | 0.8093 [11.20] |

| PR12 | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | – 0.0044 [ – 0.06] | – 0.0894 [ – 1.55] | – 0.0643 [ – 1.23] | – 0.0798 [ – 1.60] | – 0.2185 [ – 4.66] |
| 2 | – 0.1232 [ – 2.20] | – 0.0329 [ – 0.69] | – 0.0240 [ – 0.51] | – 0.0552 [ – 1.24] | 0.0230 [0.47] |
| 3 | – 0.0073 [ – 0.16] | – 0.0254 [ – 0.60] | 0.0458 [1.01] | – 0.0948 [ – 1.89] | 0.2126 [3.91] |
| 4 | – 0.0240 [ – 0.52] | 0.0792 [1.82] | – 0.0410 [ – 0.91] | – 0.1063 [ – 2.04] | – 0.0286 [ – 0.58] |
| High | 0.0843 [1.55] | 0.1024 [1.83] | 0.2756 [4.27] | 0.1244 [1.75] | 0.0911 [1.07] |

Table 5 (*continued*)

| Adjusted $R^2$ | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | 90.73 | 94.58 | 94.65 | 94.03 | 92.74 |
| 2 | 93.94 | 95.14 | 94.16 | 94.60 | 92.19 |
| 3 | 95.30 | 95.36 | 93.51 | 92.68 | 88.36 |
| 4 | 94.33 | 94.46 | 93.00 | 90.70 | 89.93 |
| High | 93.46 | 92.92 | 89.20 | 86.47 | 74.97 |

may also display underperformance even if the negative intercept is due to the model misspecification problem. In Section 5, we demonstrate quantitatively that the returns on underperforming SEO firms covary with small growth companies in general. For instance, the simple correlation between the monthly return over the market of the (1, 1) portfolio and the smallest SEO tercile is 0.867 ($p = 0.000$), between the (1, 1) and the middle tercile is 0.625 ( $p = 0.000$), and between the (1, 1) and the largest tercile of SEOs is 0.101 ( $p = 0.129$). Section 5 also develops a new HML factor that helps the models to price the (1, 1) portfolio. As the results there show, the new HML factor can price both SEO and IPO stock returns.

In Panel B, the purged factor returns appear to price the test portfolios almost as well as the full sample returns. While the coefficients do change slightly, there is no dramatic shift in the average pricing errors, or intercepts, from Panel A. For example, the issuer-purged factor returns still have difficulty pricing small growth companies. The largest effect of purging the factor returns is on the PR12 coefficients. It seems that issuing firms contribute significantly to PR12 returns. Similarly, the adjusted $R^{2'}$s are slightly smaller in all the regressions with the purged factor returns, although the models continue to explain the vast majority of the time series of returns.

Table 6 presents the three and four factor regressions for various SEO portfolios using both the full sample factor returns (Panel A) and the issuer purged factor returns (Panel B). The results in Panel A show that both the three and four factor regressions have difficulty pricing the equal-weighted SEO portfolio returns. Once returns are value weighted, however, intercepts in three and four factor regressions become small and statistically insignificant. If issuers are broken down by size tercile, only the small and medium size terciles display significant underperformance with intercepts of $-0.0069$ and $-0.0026$ per month. Interestingly, all SEO portfolios load negatively on PR12, meaning they covary positively with low momentum stocks. This is one reason that matching the buy-and-hold returns on the basis of momentum in Table 3 did not lower the underperformance. SEO firms actually have high past returns prior to issuing. The average stock return in the year prior to issuance is 76%. But in the period immediately following the SEO, their returns look like the returns of low past return stocks. A risk-based interpretation of the negative factor loading on PR12 would imply that SEO stocks are less risky after they issue. A sentiment-based interpretation would argue that PR12 is just picking up SEO mispricing. The results in Panel B with the purged factors are qualitatively similar to the full sample results except that the $R^2$'s of the regressions decline slightly. It therefore does not appear that a large portion of the explanatory power of the Fama–French model comes from factor contamination; as Loughran and Ritter (1999) claim.

We present similar results for IPO firms in Table 7. In the three factor regressions for IPO returns, only the equal weighted and smallest tercile returns

Table 6
Fama–French (1993) time-series regressions on SEO rolling portfolios for the whole sample and sorted on the basis of size.

The sample of SEOs is all firms that issued equity between 1975 and 1992. Portfolios of SEOs are formed by including all issues that were done within the previous five years. RMRF is the return on a portfolio formed by subtracting the value weighted market return on all NYSE/ASE/Nasdaq firms (RM) minus the risk free rate (RF) which is the one – month Treasury bill rate. SMB (small minus big) is the difference each month between the return on small firms and big firms. HML (high minus low) is the difference each month between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks. PR12 is the excess return on winners versus losers based on prior year returns excluding the previous month. The first five columns presents results using the Fama and French three factor model. The next five columns add Carhart's momentum factor to the Fama and French three factors. Within each set of regressions we report equal and value weighted results for the entire sample as well as equal weighted results for three size sorts. [*t*-statistics are in brackets.]

*Panel A: SEOs – Fama–French and Carhart's factors/size terciles*

| | Full sample | | Size terciles | | | Full sample | | Size terciles | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal weighted | Value weighted | Small | Medium | Large | Equal weighted | Value weighted | Small | Medium | Large |
| Intercepts | – 0.0037 | – 0.0014 | – 0.0069 | – 0.0026 | – 0.0016 | – 0.0019 | – 0.0019 | – 0.0006 | – 0.0021 | – 0.0008 |
| | [ – 4.81] | [ – 1.36] | [ – 4.32] | [ – 3.16] | [ – 1.77] | [ – 1.77] | [ – 2.56] | [ – 0.53] | [ – 2.42] | [ – 0.85] |
| RMRF | 1.0491 | 0.9238 | 1.0693 | 1.0697 | 1.0082 | 1.0722 | 0.9340 | 1.1219 | 1.0762 | 1.0184 |
| | [53.72] | [36.10] | [26.60] | [50.76] | [42.72] | [60.87] | [36.42] | [31.90] | [50.73] | [43.16] |
| SMB | 0.7668 | 0.0328 | 1.2771 | 0.8292 | 0.1950 | 0.7364 | 0.0194 | 1.2078 | 0.8207 | 0.1816 |
| | [25.09] | [0.82] | [20.30] | [25.14] | [5.28] | [26.81] | [0.49] | [22.02] | [24.81] | [4.94] |
| HML | – 0.1021 | – 0.0264 | 0.0887 | – 0.2547 | – 0.1408 | – 0.1507 | – 0.0478 | – 0.0218 | – 0.2683 | – 0.1623 |
| | [ – 3.17] | [ – 0.63] | [1.34] | [ – 7.34] | [ – 3.62] | [ – 5.15] | [ – 1.12] | [ – 0.37] | [ – 7.61] | [ – 4.14] |
| PR12 | | | | | | – 0.1984 | – 0.0874 | – 0.4518 | – 0.0557 | – 0.0876 |
| | | | | | | [ – 7.94] | [ – 2.40] | [ – 9.05] | [ – 1.85] | [ – 2.61] |
| Adjusted $R^2$ | 95.69 | 87.65 | 86.95 | 95.58 | 91.76 | 96.57 | 87.89 | 90.24 | 95.62 | 91.95 |

*Panel B: SEOs – issuer purged factors/size terciles*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Intercepts | − 0.0040 | − 0.0017 | − 0.0069 | − 0.0030 | − 0.0020 | − 0.0028 | − 0.0007 | − 0.0050 | − 0.0023 | − 0.0010 |
| | [ − 4.65] | [ − 1.63] | [ − 4.17] | [ − 3.01] | [ − 2.14] | [ − 3.34] | [ − 0.65] | [ − 3.04] | [ − 2.30] | [ − 1.04] |
| RMRF | 1.0900 | 0.9345 | 1.1157 | 1.1205 | 1.0336 | 1.0971 | 0.9402 | 1.1269 | 1.1244 | 1.0398 |
| | [50.39] | [36.74] | [26.68] | [44.61] | [42.95] | [54.03] | [38.01] | [28.07] | [45.30] | [44.83] |
| SMB | 0.7355 | 0.0514 | 1.2557 | 0.7667 | 0.1848 | 0.7355 | 0.0515 | 1.2558 | 0.7667 | 0.1849 |
| | [20.42] | [1.27] | [18.92] | [19.23] | [4.84] | [22.86] | [1.31] | [19.74] | [19.50] | [5.03] |
| HML | − 0.1183 | 0.0171 | − 0.0064 | − 0.2693 | − 0.0925 | − 0.1742 | − 0.0283 | − 0.0820 | − 0.3000 | − 0.1411 |
| | [ − 2.83] | [0.35] | [ − 0.08] | [ − 5.54] | [ − 1.99] | [ − 4.31] | [ − 0.58] | [ − 1.03] | [ − 6.07] | [ − 3.06] |
| PR12 | | | | | | − 0.2745 | − 0.2227 | − 0.4339 | − 0.1506 | − 0.2386 |
| | | | | | | [ − 5.76] | [ − 3.84] | [ − 4.61] | [ − 2.59] | [ − 4.39] |
| Adjusted $R^2$ | 94.66 | 87.68 | 85.74 | 93.66 | 91.35 | 95.29 | 88.35 | 86.85 | 93.81 | 91.96 |

Table 7
Fama–French (1993) time-series regressions on IPO rolling portfolios for the whole sample and sorted on the basis of size.

The sample is all IPOs that issued equity between 1975 and 1992. Portfolios of IPOs are formed by including all issues that were done within the previous five years. RMRF is the return on a portfolio formed by subtracting the value weighted market return on all NYSE/ASE/Nasdaq firms (RM) minus the risk free rate (RF) which is the one-month Treasury bill rate. SMB (small minus big) is the difference each month between the return on small firms and big firms. HML (high minus low) is the difference each month between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks. PR12 is the excess return on winners versus losers based on prior year returns excluding the previous month. The first five columns presents results using the Fama and French three factor model. The next five columns add Carhart's momentum factor to the Fama and French three factors. Within each set of regressions we report equal and value weighted results for the entire sample as well as equal weighted results for three size sorts. [*t*-statistics are in brackets.]

*Panel A: IPOs – Fama–French and Carhart's factors/size terciles*

| | Full sample | | Size terciles | | | Full sample | | Size terciles | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal weighted | Value weighted | Small | Medium | Large | Equal weighted | Value weighted | Small | Medium | Large |
| Intercepts | − 0.0037 | − 0.0011 | − 0.0065 | − 0.0021 | − 0.0006 | − 0.0019 | − 0.0015 | − 0.0011 | − 0.0006 | − 0.0010 |
| | [ − 1.94] | [ − 0.66] | [ − 2.29] | [ − 1.15] | [ − 0.39] | [ − 0.57] | [ − 0.87] | [ − 0.39] | [ − 0.33] | [ − 0.60] |
| RMRF | 0.9798 | 1.0684 | 0.8385 | 1.0005 | 1.1013 | 1.0067 | 1.0633 | 0.9055 | 1.0189 | 1.0966 |
| | [24.39] | [25.62] | [11.73] | [21.31] | [28.06] | [25.58] | [25.17] | [13.40] | [21.65] | [27.58] |
| SMB | 1.2214 | 0.8459 | 1.4267 | 1.2729 | 0.9640 | 1.1860 | 0.8527 | 1.3384 | 1.2486 | 0.9702 |
| | [19.42] | [12.96] | [12.75] | [17.32] | [15.69] | [19.33] | [12.95] | [12.71] | [17.02] | [15.65] |
| HML | − 0.2568 | − 0.5808 | 0.0784 | − 0.2795 | − 0.5637 | − 0.3134 | − 0.570 | − 0.0624 | − 0.3183 | − 0.5539 |
| | [ − 3.88] | [ − 8.45] | [0.67] | [ − 3.61] | [ − 8.72] | [ − 4.79] | [ − 8.12] | [ − 0.56] | [ − 4.07] | [ − 8.38] |
| PR12 | | | | | | − 0.2310 | − 0.0443 | − 0.5752 | − 0.1584 | − 0.0403 |
| | | | | | | [ − 4.13] | [0.74] | [ − 6.00] | [ − 2.37] | [0.71] |
| Adjusted $R^2$ | 86.68 | 86.57 | 63.59 | 83.53 | 88.79 | 87.52 | 86.54 | 68.22 | 83.84 | 88.76 |

*Panel B: IPOs – issuer purged factors/size terciles*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Intercepts | − 0.0030 | − 0.0017 | − 0.0059 | − 0.0019 | − 0.0011 | − 0.0023 | − 0.0019 | − 0.0041 | − 0.0016 | − 0.0012 |
| | [ − 1.79] | [ − 0.91] | [ − 2.05] | [ − 1.01] | [ − 0.61] | [ − 1.35] | [ − 1.03] | [ − 1.41] | [ − 0.79] | [ − 0.69] |
| RMRF | 1.0174 | 1.1295 | 0.8530 | 1.0360 | 1.1633 | 1.0212 | 1.1279 | 0.8631 | 1.0381 | 1.1624 |
| | [24.13] | [24.75] | [11.86] | [21.33] | [26.59] | [24.29] | [24.69] | [12.11] | [21.36] | [26.53] |
| SMB | 1.1548 | 0.7498 | 1.4044 | 1.2023 | 0.8579 | 1.1548 | 0.7498 | 1.4045 | 1.2023 | 0.8578 |
| | [17.25] | [10.35] | [12.30] | [15.59] | [12.35] | [17.33] | [10.36] | [12.44] | [15.61] | [12.35] |
| HML | − 0.4175 | 0.6010 | − 0.1767 | − 0.4648 | − 0.6082 | − 0.4472 | − 0.5879 | − 0.2564 | − 0.4818 | − 0.6006 |
| | [ − 5.12] | [6.81] | [ − 1.27] | [ − 4.95] | [ − 7.18] | [ − 5.35] | [ − 6.47] | [ − 1.81] | [ − 4.98] | [ − 6.89] |
| PR12 | | | | | | − 0.1456 | − 0.0642 | − 0.3911 | − 0.0836 | − 0.0373 |
| | | | | | | [ − 1.48] | [ − 0.60] | [ − 2.34] | [ − 0.73] | [ − 0.36] |
| Adjusted $R^2$ | 85.19 | 83.77 | 62.76 | 82.20 | 85.94 | 85.26 | 83.72 | 63.44 | 82.16 | 85.88 |

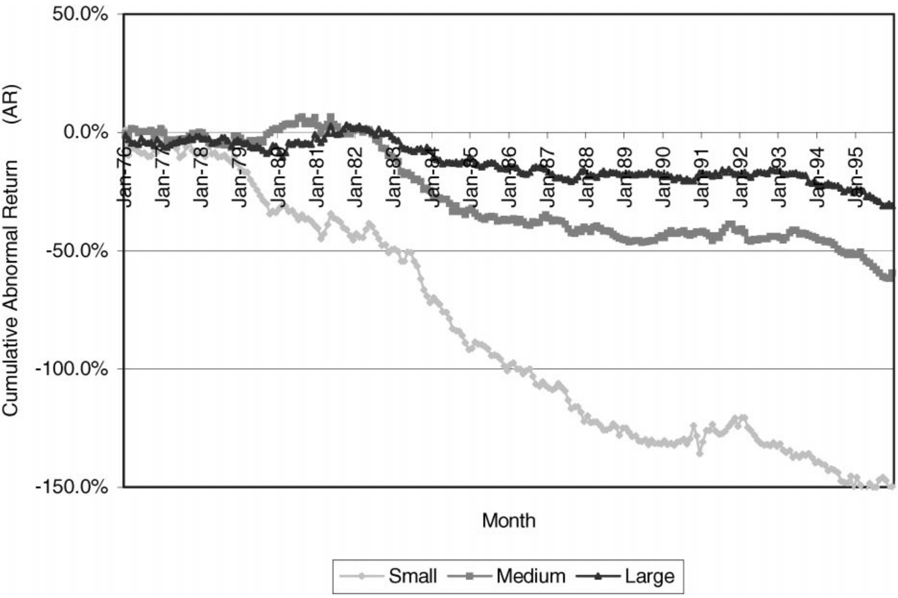


Fig. 3. Calendar–time cumulative abnormal returns by size of SEO issuer. The sample is 4526 seasoned equity offering (SEO) firms that issued equity between 1976 and 1992. For each firm in the sample we calculate a time–series regression of its excess return on the Fama and French three factors including a momentum factor where all factors have been purged of issuing firms. From each such regression we keep the intercept and residuals. We calculate size breakpoints each month using market capitalization at the beginning of the month and plot the equal weighted cumulative sum of these estimates for three size sorts.

show any underperformance. The four factor results, however, show that even the equal weight portfolio and the smallest IPO firm returns can be priced. Intercepts are insignificant in all of the four-factor regressions.

The results from both the IPO and SEO sample indicate that the explanatory power of the four-factor model declines modestly when the factors are purged of issuers. This explanatory power is particularly low for the smallest tercile of IPO and SEO stocks. Similarly, IPO and SEO stocks tend to load negatively on PR12, the price momentum factor.

### 4.3. Calendar time returns

Loughran and Ritter (1999) also express concern that the time-series regression approach weights each calendar month equally rather than taking into account the number of observations in each month. They argue that managers will respond to temporary misvaluations by issuing overpriced equity that tends to underperform subsequently. As a result, the time-series approach, which weights each period equally, understates the severity of the underperformance following equity issues.

To address this concern, we undertake the following analysis. For each SEO firm we regress each firm's post-issuance excess return on the Fama and French factor returns including Carhart's momentum factor from Eq. (2), where all factor returns have been purged of equity issuers. From each such regression, the intercept and the residual are summed to measure firm-level time-series abnormal returns (ARs). Using the individual ARs, we form three equal weighted size portfolios – small, medium and large – monthly whose breakpoints are based on market capitalizations at the beginning of the month. In Fig. 3 we plot the equal weighted cumulative sum of these ARs is plotted for the three size sorts beginning on the first date of our sample, January 1976.

As the figure shows, the smallest tercile of issuers has consistently negative abnormal performance. The medium and large issuers, however, do not exhibit substantial underperformance over the entire sample period, although they do substantially decline in value relative to the benchmarks between 1983 and 1984 and again in 1995. Fama and French (1995) argue that a potentially unexpected earnings shock affected small, growth companies in the early and mid-1980s. This is also the same period in which Brav and Gompers (1997) show that IPO firms underperformed.

Since the cumulative abnormal returns in Fig. 3 are averages of individual SEO firms' abnormal returns, the Loughran and Ritter (1999) critique that weighting time periods equally reduces the power of tests of no underperformance does not apply here. It can be seen that for the large and medium size terciles, the exact number of observations in each month is virtually irrelevant. Apart from a two-year period of underperformance from 1983 to 1984 and a small decline in 1995, both graphs are nearly flat, indicating that weighting the calendar months equally does not lead to reduced power to reject the null hypothesis of no underperformance.[5]

## 5. Model misspecification

In this section, we extend the analysis conducted in Section 4. In particular, we demonstrate that the measured underperformance of equity issuers is likely driven by the problem that the benchmark models available misprice certain

[5] Fama (1998a) discusses how this time series portfolio approach can be modified to allow for alternative weighting schemes and suggests the approach of Jaffee (1974) and Mandelker (1975), which corrects for heteroskedasticity in portfolios' abnormal returns arising from changing compositions over time. While we do not explicitly correct for possible heteroskedasticity, the evidence in Fig. 3 makes the relevant point notwithstanding.

Table 8
Fama–French (1993) time-series regressions on SEO and IPO rolling portfolios for the whole sample and sorted on the basis of size.

The sample is all firms that issued equity between 1975 and 1992. Portfolios of issuers are formed by including all issues that were done within the previous five years. RMRF is the return on a portfolio formed by subtracting the value weighted market return on all NYSE/ASE/Nasdaq firms (RM) minus the risk free rate (RF) which is the one-month Treasury bill rate. SMB (small minus big) is the difference each month between the return on small firms and big firms. HML* (high minus low) is the difference each month between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks *excluding firms listed on the NYSE*. PR12 is the excess return on winners versus losers based on prior year returns excluding the previous month. The first five columns presents results using the Fama and French three factor model. The next five columns add Carhart's momentum factor to the Fama and French three factors. Within each set of regressions we report equal and value weighted results for the entire sample as well as equal weighted results for three size sorts. [$t$-statistics are in brackets.]

*Panel A: SEOs – Fama–French and Carhart's issuers purged factors/size terciles*

| | Full sample | | Size terciles | | | Full sample | | Size terciles | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal weighted | Value weighted | Small | Medium | Large | Equal weighted | Value weighted | Small | Medium | Large |
| Intercepts | − 0.0023 | − 0.0017 | − 0.0036 | − 0.0015 | − 0.0019 | − 0.0007 | − 0.0006 | − 0.0007 | − 0.0007 | − 0.0007 |
| | [ − 2.79] | [ − 1.60] | [ − 2.17] | [ − 1.51] | [ − 1.89] | [ − 0.91] | [ − 0.52] | [ − 0.46] | [ − 0.65] | [ − 0.72] |
| RMRF | 1.0560 | 0.9341 | 1.0213 | 1.1072 | 1.0395 | 1.0647 | 0.9402 | 1.0365 | 1.1117 | 1.0458 |
| | [52.70] | [36.78] | [25.89] | [45.65] | [43.10] | [58.90] | [38.06] | [28.44] | [46.58] | [44.84] |
| SMB | 0.7058 | 0.0529 | 1.2058 | 0.7334 | 0.1790 | 0.6999 | 0.0487 | 1.1954 | 0.7303 | 0.1747 |
| | [21.93] | [1.30] | [19.03] | [18.82] | [4.62] | [24.14] | [1.22] | [20.45] | [19.08] | [4.67] |
| HML* | − 0.1911 | 0.0110 | − 0.2911 | − 0.2348 | − 0.0478 | − 0.3170 | − 0.2226 | − 0.5545 | − 0.1662 | − 0.2300 |
| | [ − 6.92] | [0.32] | [ − 5.36] | [ − 7.03] | [ − 1.44] | [ − 7.48] | [ − 3.84] | [ − 6.49] | [ − 2.97] | [ − 4.20] |
| PR12 | | | | | | − 0.2359 | − 0.0205 | − 0.3695 | − 0.2583 | − 0.0804 |
| | | | | | | [ − 9.23] | [ − 0.59] | [ − 7.17] | [ − 7.65] | [ − 4.20] |
| Adjusted $R^2$ | 95.40 | 87.68 | 87.27 | 94.07 | 91.28 | 96.26 | 88.35 | 89.13 | 94.26 | 91.85 |

*Panel B: IPOs – Fama–French and Carhart's Issuer purged factors/size terciles*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Intercepts | 0.0009 | 0.0012 | − 0.0012 | 0.0027 | 0.0014 | 0.0021 | 0.0010 | 0.0015 | 0.0036 | 0.0012 |
| | [0.59] | [0.64] | [ − 0.43] | [1.48] | [0.77] | [1.30] | [0.49] | [0.52] | [1.94] | [0.66] |
| RMRF | 0.9516 | 1.1125 | 0.7415 | 0.9554 | 1.1574 | 0.9578 | 1.1112 | 0.7561 | 0.9604 | 1.1565 |
| | [25.41] | [25.12] | [10.82] | [22.29] | [26.80] | [25.89] | [25.05] | [11.28] | [22.53] | [26.73] |
| SMB | 1.0790 | 0.6824 | 1.3276 | 1.1141 | 0.7957 | 1.0748 | 0.6832 | 1.3176 | 1.1106 | 0.7963 |
| | [17.93] | [9.59] | [12.06] | [16.18] | [11.47] | [18.11] | [9.60] | [12.25] | [16.24] | [11.48] |
| HML* | − 0.5054 | − 0.4841 | − 0.4758 | − 0.5855 | − 0.4544 | − 0.2283 | 0.0447 | − 0.5332 | − 0.1853 | 0.0322 |
| | [ − 9.80] | [ − 7.94] | [ − 5.04] | [ − 9.92] | [ − 7.64] | [ − 2.63] | [0.43] | [ − 3.39] | [ − 1.85] | [0.32] |
| PR12 | | | | | | − 0.5377 | − 0.4777 | − 0.5512 | − 0.6117 | − 0.4499 |
| | | | | | | [ − 10.28] | [ − 7.62] | [ − 5.81] | [ − 10.15] | [ − 7.35] |
| Adjusted $R^2$ | 88.28 | 84.66 | 66.12 | 86.10 | 86.26 | 88.56 | 84.61 | 67.53 | 86.24 | 86.20 |

Table 9
Four factor regressions for twenty-five test portfolios formed on the basis of size and book-to-market.

Coefficients from four factor regressions for the 25 benchmark portfolios using purged factors, i.e., excluding all firms that issued equity in an initial public offering or seasoned equity offering during the previous five years. RMRF is the return on a portfolio formed by subtracting the value weighted market return on all NYSE/ASE/Nasdaq firms (RM) minus the risk free rate (RF) which is the one-month Treasury bill rate. SMB (small minus big) is the difference each month between the return on small firms and big firms. HML* (high minus low) is the difference each month between the return on a portfolio of high book-to-market stocks and the return on a portfolio of low book-to-market stocks *excluding firms listed on the NYSE*. PR12 is the excess return on winners versus losers based on prior year returns excluding the previous month. [*t*-statistics are in brackets.]

| Intercept | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | – 0.0011[ – 1.01] | – 0.0003 [ – 0.24] | – 0.0002 [ – 0.13] | 0.0015 [1.38] | – 0.0002 [ – 0.17] |
| 2 | 0.0026 [2.52] | 0.0001 [0.14] | 0.0004 [0.40] | – 0.0007 [ – 0.87] | 0.0004 [0.44] |
| 3 | 0.0004 [0.42] | 0.0010 [1.27] | 0.0001 [0.12] | – 0.0008 [ – 0.82] | – 0.0004 [ – 0.41] |
| 4 | 0.0015 [1.63] | 0.0017 [1.84] | 0.0014 [1.39] | 0.0002 [0.18] | 0.0006 [0.52] |
| High | – 0.0007 [ – 0.59] | – 0.0013 [ – 1.12] | – 0.0002 [ – 0.17] | 0.0010 [0.63] | 0.0004 [0.19] |

| RMRF | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | 1.0024 [38.83] | 1.1650 [43.08] | 1.1507 [43.66] | 1.0959 [44.65] | 1.0092 [39.57] |
| 2 | 1.0006 [43.31] | 1.0962 [51.63] | 1.0713 [51.81] | 1.1056 [56.70] | 1.0594 [49.12] |
| 3 | 0.9650 [48.59] | 1.0274 [55.96] | 0.9723 [47.36] | 1.0953 [48.25] | 0.9574 [38.84] |
| 4 | 0.9010 [42.59] | 0.9777 [46.21] | 0.9599 [42.90] | 1.0107 [36.95] | 0.9402 [33.88] |
| High | 0.9842 [37.61] | 1.0882 [40.67] | 1.0646 [32.66] | 1.1068 [30.51] | 0.9201 [20.99] |

| SMB | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | 1.1708 [28.75] | 0.8529 [19.99] | 0.6078 [14.62] | 0.2628 [6.79] | − 0.2283 [ − 5.67] |
| 2 | 1.1579 [31.77] | 0.8855 [26.43] | 0.6306 [19.32] | 0.3251 [10.57] | − 0.1598 [ − 4.70] |
| 3 | 1.0827 [34.55] | 0.8451 [29.18] | 0.6295 [19.43] | 0.3734 [10.42] | − 0.1981 [ − 5.09] |
| 4 | 1.1168 [33.47] | 0.8034 [24.07] | 0.5299 [15.01] | 0.2516 [5.83] | − 0.0845 [ − 1.93] |
| High | 1.2892 [31.23] | 1.0126 [23.99] | 0.7273 [14.14] | 0.3793 [6.63] | 0.0541 [0.78] |

| HML | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | − 0.5759 [ − 15.41] | − 0.3792 [ − 9.68] | − 0.2262 [ − 5.93] | − 0.2375 [ − 6.68] | − 0.0917 [ − 2.48] |
| 2 | − 0.1937 [ − 5.79] | − 0.0275 [ − 0.89] | 0.0499 [1.66] | 0.0007 [0.03] | 0.0041 [0.13] |
| 3 | 0.0240 [0.83] | 0.1130 [4.25] | 0.1423 [4.79] | 0.1649 [5.02] | 0.0771 [2.16] |
| 4 | 0.1102 [3.60] | 0.1952 [6.37] | 0.1911 [5.89] | 0.2371 [5.98] | 0.1535 [3.82] |
| High | 0.3130 [8.26] | 0.3298 [8.51] | 0.3400 [7.20] | 0.2927 [5.57] | 0.2883 [4.54] |

| PR12 | Size quintiles | | | | |
|---|---|---|---|---|---|
| Book-to-market quintiles | Small | 2 | 3 | 4 | Large |
| Low | − 0.0893 [ − 1.57] | 0.0023 [0.04] | 0.0571 [0.98] | 0.0198 [0.37] | − 0.0506 [ − 0.90] |
| 2 | − 0.1856 [ − 3.64] | 0.0084 [0.18] | 0.0079 [0.17] | − 0.0521 [ − 1.21] | 0.0449 [0.94] |
| 3 | − 0.0487 [ − 1.11] | − 0.0357 [ − 0.88] | − 0.0037 [ − 0.08] | − 0.1443 [ − 2.88] | 0.1518 [2.79] |
| 4 | − 0.0737 [ − 1.58] | − 0.0040 [ − 0.08] | − 0.1377 [ − 2.79] | − 0.2484 [ − 4.12] | − 0.2089 [ − 3.41] |
| High | − 0.0129 [ − 0.22] | 0.0043 [0.07] | 0.1293 [1.80] | − 0.0482 [ − 0.60] | − 0.1359 [ − 1.40] |

Table 9 (*continued*)

Adusted $R^2$

| Book-to-market quintiles | Size quintiles: Small | 2 | 3 | 4 | Large |
|---|---|---|---|---|---|
| Low | 94.64 | 93.82 | 92.90 | 92.53 | 88.86 |
| 2 | 94.63 | 94.98 | 94.22 | 94.60 | 92.15 |
| 3 | 95.13 | 95.43 | 93.01 | 92.23 | 87.57 |
| 4 | 93.92 | 93.17 | 91.03 | 86.62 | 83.60 |
| High | 92.15 | 91.56 | 85.70 | 81.80 | 65.31 |

classes of stocks of which issuing firms are a part. To motivate the analysis in this section, it is useful to review recent research that bears directly on the alternative specifications we suggest in response.

Loughran (1993) examines the return differentials between firms listed on Nasdaq and the NYSE. He documents that during the period July 1981 to December 1988, Nasdaq-listed stocks underperform NYSE-listed stocks by about 5.8% per year, controlling for differences in book-to-market and the fact that Nasdaq is populated by young IPO firms.[6] He concludes that the underperformance of Nasdaq-listed firms is partially explained by the low returns on recent IPOs. More recently, Hansen (1998) examines NYSE, Amex and Nasdaq industries around initial public offering announcements. He finds that the long run abnormal performance of Nasdaq industries is similar to that of IPO firms, whereas NYSE and Amex industries do not underperform subsequent to public offerings.

In addition, Loughran (1997) examines the robustness of the book-to-market in explaining differences in average returns. He finds that for NYSE-listed firms, the book-to-market effect exists only in the month of January. Furthermore, this January seasonal is confined to small firms on the NYSE. By contrast, book-to-market does explain differences in average returns for Nasdaq-listed stocks outside January. Loughran attributes the latter fact to the mispricing of young, growth firms which tend to list mainly on Nasdaq.

Taken together, these studies imply that if we are interested in capturing common covariation due to book-to-market as in Fama and French (1993), then using NYSE-listed firms may bias our performance tests and exacerbate the effects of model misspecification.

To examine this possibility, we replace the book-to-market factor-mimicking portfolio, HML, used in the previous time-series regressions with an alternative zero investment portfolio HML*. The latter portfolio is formed as follows. Using the $5 \times 5$ size and book-to-market cutoffs introduced earlier, we equal weight the returns of Amex and Nasdaq listed stocks which have not issued equity in the previous five years and belong to the smallest size and lowest book-to-market portfolio, the (1, 1) portfolio. Second, we equal weight the return of Amex and Nasdaq listed stocks which have not issued equity and belong to the smallest size and highest book-to-market allocation, the (1, 5) portfolio. HML* is formed monthly by subtracting the average return on the latter portfolio from the former. As in Fama and French (1993), the construction of HML* guarantees a focus on the differences in returns due to book-to-market effects since any other exposures are netted out by forming the spread between tails of the book-to-market distribution of stocks at portfolio formation. At the same time, we are focusing on small, non-issuing firms that are listed either on

[6] See Loughran (1993, p. 257–259). These results pertain to firms in the smallest two deciles based on NYSE cutoffs.

the Amex or Nasdaq which, according to Loughran (1997), drive much of the book-to-market effect.[7]

Table 8 presents the time-series results which employ HML* in place of HML both for SEO and IPO portfolios. For SEOs, the underperformance of the full sample relative to the three-factor model is halved. Small size SEO underperformance has declined from 69 basis points per month in Table 6 panel A to 36 basis points per month, although it remains statistically significant. Medium size SEO underperformance has declined from 26 basis points to 15 basis points and is not statistically significant at traditional levels. For IPOs, it can be seen that relative to the three-factor model there is no discernible underperformance for the full sample or any of the three size sorts. The four factor regressions which include HML* provide the strongest support for the model misspecification explanation for measured underperformance. The intercepts for both the SEO and IPO portfolios are economically and statistically negligible.

The above analysis, and our contention that issuer underperformance is likely driven by a model misspecification problem, could be criticized as an outcome of data mining. We may have by chance found a formulation that works in sample. We believe, however, that the motivation for the formulation of HML* given in the beginning of this section as well as in the analysis in the remainder of this section are sufficient to alleviate such concerns. Below we provide an out of sample test that addresses this issue.

We use the 25 size and book-to-market portfolios presented in Section 3 as test portfolios and price them using the four factor model which has been purged from recent issuers including the new definition of HML. If book-to-market effects are better captured by HML*, our alternative specification should price these portfolios better than the original four factor model (see Table 5). Table 9 presents the regression results. All but one of the 25 intercepts are insignificantly different from zero, and most have economically negligible intercepts. The ability of our model with HML* to price these test portfolios gives us confidence in their ability to capture general covariation in returns.

These results can be interpreted in one or both of two ways. First, we have shown that slight variation in the formation of one factor mimicking portfolio leads to the disappearance of underperformance. Second, these results support the view that underperformance is not unique to issuers; issuer returns covary with returns of nonissuing stocks.

[7] The original Fama and French (1993) model is an empirically motivated specification. Likewise, we use additional information to create factor-mimicking portfolios that maximize the possibility of matching return differentials.

## 6. Recent research on the returns of equity issuers

The abnormal price performance of SEOs has recently attracted further scrutiny from several researchers. Mitchell and Stafford (1998), Eckbo et al. (2000), Brous et al. (1998), and Jegadeesh (1998) examine different samples of seasoned equity offerings to test the abnormal performance hypothesis. In this section we contrast their results with those reported here.

Mitchell and Stafford (1998) examine a large sample of SEOs over the period 1958–1993. Much like Brav et al. (1996) and this paper, they also measure abnormal performance by employing both factor regressions as well as attribute-based control portfolios. Consistent with the finding in this paper, they show that value-weighting the abnormal returns of issuers reduces the measured abnormal performance. Mitchell and Stafford's paper differs from ours in two main aspects. First, since they examine several corporate events (acquisitions, SEOs, and repurchases), they do not focus on the general equity issuance underperformance and the relationship between IPO and SEO abnormal performance. Second, we explicitly examine the relation between equity issuer underperformance and common co-movement of equity issuer and nonissuer firms' stock returns.

More recently, Eckbo et al. (2000) have questioned the existence of underperformance for a sample of SEOs from the period 1963–1995. Following Brav et al. (1996) they also employ factor regressions as well as attribute matching to evaluate abnormal performance. Their main result is that a six-factor asset-pricing model can price portfolios of issuing firms. Eckbo et al. argue that SEO firms are less risky than similar size and book-to-market matched firms since their exposure to unexpected inflation and default risks are lower. Since their factor model is based on macroeconomic risk factors it is hard to compare the results to those presented in this paper. We leave such comparison for future research.

Brous et al. (1998) have recently examined the performance of seasoned equity offering firms. Brous et al. (1998) however, do not focus on abnormal performance measurement. Instead, they argue that if SEO firms are indeed mispriced due to excessive optimism by the market as suggested by Loughran and Ritter (1995), these erroneous expectations should disproportionately correct themselves when SEO firms make subsequent earning announcements. Brous et al. (1998) find little evidence that investors are systematically disappointed by earnings announcements that follow equity offerings, implying that the negative abnormal performance of SEO firms is not systematically concentrated at times of earnings news.

Jegadeesh (1998) explores equity issuer underperformance in a sample of seasoned equity offerings as well. He examines returns of issuers using a characteristics-based approach and finds results that are similar to our characteristics-based results. Jegadeesh does not utilize factor regressions and in fact critiques their use based on Daniel and Titman (1997). Recent evidence by Berk (2000) and Davis et al. (2000) call the Daniel and Titman results into question. Similarly, an objective researcher should not disregard factor models altogether. The researcher should see what the factor models say to potentially gain deeper insights into the phenomenon. Jegadeesh also presents evidence that a large portion of the negative SEO return occurs on or around earnings announcements. Jegadeesh's earnings announcement results, however, are contradictory to those of the Brous, et al. paper mentioned above. It is difficult to assess which paper has the correct result.

## 7. Conclusions

Our paper sheds light on the distinctiveness of equity issuer returns and the robustness of various long-horizon stock performance tests. We explore the effect that various long horizon test methodologies have on measured performance. The results demonstrate that IPO returns are similar to nonissuing firm returns matched on the basis of size and book-to-market ratios. While SEO returns underperform various characteristic-based benchmarks in event time performance tests, time series factor models, which can price SEO portfolio returns, show that SEO returns covary with nonissuing firm returns. Finally, we show that model misspecification is an important consideration in long horizon performance tests. Small changes to the factor specification in Fama and French's model improve its ability to price equity issuer returns as well as commonly used test portfolios.

The evidence suggests that many of the long-run stock return anomalies found in the finance literature are manifestations of the same return pattern in the data. Various types of corporate decisions may be more heavily weighted in the types of firms that underperform without the decision or event being studied causing the underperformance.[8] This co-movement is shown in our multi-factor time-series models and our event time return calculations. In other words, our evidence shows that equity issuers' return patterns are not distinct. They are part of more systematic price movements observed for Amex and Nasdaq companies that have not issued equity.

Recent papers by Teoh et al. (1998, 2000) and Lee (1997) indicate that various attributes of the IPO or SEO firms can predict which issuers will underperform. Teoh et al. (1998, 2000) find that a higher level of discretionary accruals prior to issuance, potentially to boost earnings, is associated with poorer post-issue performance. Lee (1997) shows that SEOs in which sell equity holdings, perform better than SEOs in which managers do not sell. In addition, firms with higher

[8] In a previous version of this paper we have shown that the post-listing negative drift documented by Dharan and Ikenberry (1995) is largely caused by equity issuing firms in their sample. These results are available from the authors upon request.

levels of discretionary accruals and that issue pure primary shares tend to be smaller IPO and SEO stocks, so it is not surprising that their measures are correlated with relative underperformance. Thus, our results are consistent with their findings.

Our results are consistent with both behavioral finance and equilibrium rational asset pricing interpretations. As Fama (1998b) argues, our results may imply that we do not yet have the correct model of security returns. In fact, the ability to narrow the underperformance or explain it with various factor models is evidence in that direction. A behavioral explanation of our evidence would suggest that investor sentiment affects a large number of firms simultaneously. While we do not offer such a unified theory of behavioral finance, our results point to the need for one.

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