Re-Assessing the Long-Term Under-Performance of UK Initial Public Offerings

by

Susanne Espenlaub*

Alan Gregory**

and

Ian Tonks***

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* Manchester School of Accounting and Finance, University of Manchester; **Department of Management, University of Exeter; and *** Department of Economics, University of Bristol.

Abstract

Previous work has identified that IPOs underperform a market index, and the purpose of this paper is to examine the robustness of this finding. We re-examine the evidence on the long-term returns of IPOs in the UK using a new data set of firms over the period 1985-92, in which we compare abnormal performance based on a number of alternative methods including a calendar-time approach. We find that, using an event-time approach, there are substantial negative abnormal returns to an IPO after the first three years irrespective of the benchmark used. However, over the five years after an IPO, abnormal returns exhibit less dramatic underperformance, and the conclusion on negative abnormal returns depends on the benchmark applied. Further if these returns are measured in calendar time, we find that the (statistical) significance of underperformance is even less marked.

I. INTRODUCTION

The long-term share price performance of Initial Public Offerings (IPOs) has recently become the focus of attention. The seminal article by Ibbotson (1975) reported a negative relation between initial returns at the IPO and long-term share price performance. Ibbotson found that although initial returns were not erased in the aftermarket, average returns for one month holding periods were positive in the first year after the IPO, negative during the following three years, and again positive in the fifth year. Ritter (1991) analysed the performance of US IPOs issued between 1975-84 and found that for a three-year holding period, IPOs underperformed a control sample of matching seasoned firms. He concluded that IPOs make bad medium- to long-term investments. In the UK, Levis (1993) identified IPO under-performance of a similar magnitude over the longer-term. Summarising a wealth of other international IPO evidence, Loughran, Ritter and Rydqvist (1994) report that market-adjusted three-year abnormal performance following an IPO is always small and mostly negative in all countries, with the exception of Japan. However, more recently Brav and Gompers (1997) have challenged these findings for the US. They find that the underperformance result is sensitive to the method used to evaluate abnormal performance. In their sample, underperformance is mostly concentrated in the smallest group of IPOs that are not backed by venture capitalists, and they report that underperformance is not unique to issuing (IPO or SEO) companies, but shared by small, non-IPO firms with similar low book-to-market values.

The original IPO underperformance results by Ritter (1991), Loughran and Ritter (1995), and Levis (1993), are dramatic, and imply that investing in recent IPOs is a poor investment. But the recent findings of Brav and Gompers (1997) and the critical review of the anomalies literature by Fama (1998) suggest that the underperformance phenomenon merits further investigation. Therefore, before we accept IPO performance as an example of market inefficiency, it seems reasonable to further examine the robustness of the US findings using non-US data. An issue noted by Loughran *et al.* (1994) in relation to the international (non-US) evidence is that the data samples used are typically very small. In this paper we re-examine the evidence on the long-term returns of 588 IPOs in the UK using a new data set of firms which came to the market over the period 1985-92. Moreover, the UK stock market provides a unique opportunity to examine the robustness of the findings on the performance of US IPOs within the setting of another ‘market-based’ financial system, in which stock markets are supposed to play a crucial role in providing company finance (see e.g., Table 1 in Roell, 1995).

An obvious difficulty with an 'event study' research model is the choice of an appropriate benchmark. There is considerable evidence that benchmark selection can have an important impact on the scale of abnormal returns from event studies (e.g., Dimson and Marsh, 1986; Gregory, Matatko, Tonks and Purkis, 1994; Fama and French, 1996), and this problem is particularly acute given the current state of asset pricing theory (Fama and French, 1992). We compare abnormal returns under a number of alternative benchmarks. We compute abnormal returns up to five years (in event time) after the offering, so the accumulation period in this study is over the period 1985-97. Our study employs the basic capital asset pricing model (CAPM), the simple size-adjusted model of Dimson and Marsh (1986), a CAPM-type model extended for 'size effects', the Fama and French (1996) three-factor model, and Ibbotson's (1975) Returns Across Securities and Times (RATS) approach.

We find that, using the event-time approach, there is significant underperformance in the first 18 months after the issue for all benchmarks except the CAPM. Over the next tenty four months there is even more severe underperformance across all benchmarks. We therefore identify underperformance as a robust feature of these event-time returns over the first 42 months. However over the next 18 months the extent of the underperformance depends on the benchmark portfolio adopted. We find that 60 month long-run excess returns measured relative to the CAPM and Fama-French benchmarks continue to display significant underperformance. But, while one of the size-adjusted benchmarks finds significant underperformance, and demonstrates that the rate of underperformance declines over time, an alternative size-adjustment model reveals abnormal returns which are not statistically significantly different from zero.

We go on to investigate the possible explanations for the underperformance phenomenon. Loughran and Ritter (1995) point out that cross-sectional t-statistics assessing the significance of abnormal returns are likely to be overstated because the t-tests assume that contemporaneous observations are independent. To control for the likely presence of cross-correlation in returns, Loughran and Ritter (1995), and more recently, Brav and Gompers (1997), adopt a method developed by Jaffe (1974) and Mandelker (1974), which involves calculating average returns of rolling, calendar-time portfolios of event stocks. This approach is discussed by Fama (1998), who recommends it over the event-time approach, and Lyon *et al.* (1998) show that it yields well-specified test statistics. We follow this approach and find that in calendar-time there is considerably less evidence of underperformance. As in event-time, we also find that the two approaches to adjust for size effects produce significantly different results. This is similar to the results of Brav and Gompers (1997), who find that similar approaches to control for size and book-to-market value produce quite dissimilar results. Thus, the present study adds further evidence on the sensitivity of the underperformance finding with respect to the choice of empirical method. This finding is of particular relevance against the background of Fama’s (1998) recent critical review of the anomalies literature, in which he concludes that “apparent anomalies can due to methodology [and] most long-term return anomalies tend to disappear with reasonable changes in technique”.

The structure of this paper is as follows. Section II relates our study to the existing literature on IPO underperformance. The techniques used to assess abnormal performance are outline in Section III. Data descriptions and descriptive statistics are presented in Section IV, and the results of the more formal analysis are discussed in Section V.

II. RELATED LITERATURE

Levis (1993) investigates the long-run performance of a sample of 712 UK IPOs issued during 1980-88 using share-price data from 1980 until the end of 1990. Levis recognises the importance of the size effect for UK stocks and reports long-run abnormal returns based on three alternative benchmarks: the Financial Times Actuaries All Share (FTA) Index, the Hoare Govett Smaller Companies (HGSC) Index and a specially constructed all-share equally-weighted index. Levis confirms Ritter’s (1991) finding of statistically significant long-run IPO under-performance, although he notes that average underperformance in his UK sample appears to be less excessive than that in Ritter’s US sample. While Ritter reports underperformance of up to -29% over the first three-years after the IPO, Levis finds underperformance of between -8% and -23% depending on the market benchmark.

There are important differences between Levis (1993) and the present study. First, unlike this study, Levis makes no explicit adjustments for (systematic) risk or cross-sectionally varying exposure to size effects, adopting instead a 'zero-one model' to calculate abnormal returns, that is, the abnormal return of an individual IPO is measured as the difference between the return on the stock and the return on the benchmark index.[1] By contrast, this study examines long-run IPO performance using a wide range of alternative benchmarks and models including two models designed to adjust for size effects, Ibbotson's (1975) RATS method and the three-factor model of Fama and French (1996). Further details are given in Section III. However, the main innovation of this study is the adoption of the calendar-time approach developed by Jaffe (1974) and Mandelker (1974) to control for event clustering and cross-correlation in IPO returns. For each calendar month the average abnormal monthly return on a portfolio containing all firms that conducted an IPO within the past t-τ month is calculated and regressed on the corresponding benchmark return (cf. Section III). The calendar-time method was employed by Brav and Gompers' (1997) IPO study to estimate a calendar-time version of the Fama-French (1996) three-factor model. In Section V, we report corresponding estimates for UK IPOs and in addition we present the results of calendar-time regressions employing a number of alternative benchmarks and asset pricing models.

A further difference between Levis (1993) and this study is that Levis measures share-price performance over the period 1980-1990, a period during (most of) which small market-capitalisation stocks outperformed larger stocks. By contrast, the period under study here spans 1985-97, a period during which there was much greater time-series variation in the size effect as smaller stocks overperformed during the initial part (1985-88), and underperformed during 1989-92; and there were further reversals in the direction of the size effect during 1992-97.[2] Moreover, Levis' sample is restricted to IPOs issued before 1989, while this study examines a more recent sample. Finally, Levis only considers long-run returns up to three years after the IPO, whereas this study examines long-term performance over a substantially longer, five-year, period.

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[1] Levis (1993) also reports wealth relatives.
[2] The magnitude of the size effect may be gauged e.g. from the difference between the Hoare Govett Smaller Companies Index and the Financial Times Actuaries All Share Index which was positive during 1985-88, negative during 1989-92 (especially for 1989 when the

III. METHODOLOGY

It is well documented that although beta does have a role in explaining returns, so does firm size and book-to-market effects (Fama and French, 1992). Size effects have been taken into account in empirical studies in a variety of ways. Most simply, Dimson and Marsh (1986) used size decile control portfolios, where each company is assigned a decile membership based upon its market capitalisation at the beginning of each year. More recent studies (Fama, Booth and Sinquefield, 1993; Loughran and Ritter, 1995; Fama and French, 1996) have used a multi-factor benchmark approach. In particular, Fama and French (1996) suggest that many apparent anomalies in 'efficient markets' studies can be explained by the use of a three-factor model, where the factors are the excess returns on the market, the difference in returns between companies with high book-to-market value (BMV) and low BMV ratios, and the difference in returns between large and small companies.

To analyse long-term performance after an IPO we apply the standard event-study methodology. For a particular benchmark, monthly abnormal returns are computed for up to 60 months after the IPO (excluding the month of new issue); the minimum criterion for inclusion was 12 monthly observations post-IPO. To avoid any downward bias in returns caused by Jensen's inequality when averaging returns across portfolios, discrete (as opposed to logarithmic) returns are used throughout this paper.[3]

Event studies around IPOs are faced with the problem that data is not available to obtain estimates of the benchmark parameters in a pre-event period (Ibbotson. 1975)]. In fact this problem is generic to a number of event study situations, since the event itself may change the underlying structural parameters.[4] Thompson (1985) discusses the use of conditional (pre-event period only) and unconditional (pre- and post-event period) parameter estimates, and argues that in the case where the benchmark and the event are correlated that unconditional

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difference amounted to -24.8%), positive for 1993-94 and again negative for 1995 (Dimson and Marsh, 1996).

[3] Barber and Lyon (1997), p. 349-350.

[4] Boehmer, Musimeci and Poulson (1991) investigate the power of event study methods when the event induces changes to the variance of returns.

estimation is preferred. In this paper we follow Agrawal, Jaffe and Mandelker (1992) who investigate the long-run returns following a merger, and estimate the model parameters and the excess returns jointly and use in-sample estimates of abnormal returns.

Abnormal returns with respect to each of five benchmarks are computed, and are cumulated over time up to period T after the IPO, using the Cumulative Average Abnormal Return *($CAAR_T$)* measure

$$CAAR_T = \sum_{t=+1}^{T} \frac{1}{N} \sum_i \varepsilon_{it}$$

where ε_{it} is the abnormal return in month *t* after the IPO for firm *i*, and there are *N* firms in the sample. The t-test statistics are based on Brown and Warner's (1980, p. 251-2) Crude Dependence Adjustment test for the CAARs in order to correct for cross-sectional dependence,

$$t - test = \frac{CAAR_T}{\sqrt{T * \left(\sum_{t=+1}^{36} (\bar{\varepsilon}_t - \frac{1}{36} \sum_{t=+1}^{36} \bar{\varepsilon}_t)^2 \right) / 35}}$$

where $$\bar{\varepsilon}_t = \frac{1}{N} \sum_i \varepsilon_{it}$$

To calculate the abnormal return ε_{it}, the first benchmark in Model 1 below, is the standard Capital Asset Pricing Model. The second is a simple size adjustment where the benchmark is the return on the relevant size-decile portfolio. The third is a multi-index model using the market index (the Financial Times Actuaries All Share Index) as one factor and the difference between the Hoare-Govett Smaller Companies Index (Dimson and Marsh, 1996) and the market index as the measure of smaller company outperformance.[5] The fourth is another multi-index model where the factors are those specified in Fama and French (1993). In the case of those models where the parameters are directly estimated from a single regression

[5] The Financial Times Actuaries All Share (FTA) Index is a value-weighted index comprising approx. 90% of UK stocks by value (Levis, 1993).

(Models 1, 3 and 4), the abnormal post-IPO performance is estimated by deducting the expected return calculated using parameters from the regression equation.

Model 1: CAPM

$$\varepsilon_{it}^{c} = R_{it} - \left[R_{ft} + \hat{\beta}_i (R_{mt} - R_{ft}) \right] \quad (1)$$

where R_{it} is the return on company *i* in event month *t*, R_{mt} is the return on the market in event month *t* as measured by the return on the Financial Times Actuaries All Share Index, R_{ft} is the treasury bill return in event month *t*, β_i is the CAPM beta of company *i*, estimated by an OLS regression up to 36 months after the IPO.

Model 2: Size control portfolio (SD):

$$\varepsilon_{it}^{ss} = R_{it} - R_{st} \quad (2)$$

where R_{st} is the return on the size control portfolio in event month *t*. In this model, the control portfolio returns are equally weighted average returns on a portfolio of all firms in the market-capitalisation decile to which firm *i* belongs in a given sample year. Stocks are allocated to deciles based on their market-capitalisation at the start of each sample year.[6] Note that Model 2 does not depend on any estimated parameters, neither conditional nor unconditional.

Model 3: Value weighted multi-index model using the Hoare-Govett Index as the measure of smaller company performance:

$$\varepsilon_{it}^{hg} = R_{it} - \left[R_{ft} + \hat{\beta}_i^{hg} (R_{mt} - R_{ft}) + \hat{\gamma}_i^{hg} (R_{ht} - R_{mt}) \right] \quad (3)$$

where R_{ht} is the return on the Hoare-Govett Smaller Companies index in the event month *t*. The motivation for using the Hoare-Govett Smaller Companies (HGSC) Index is that this is a value-weighted index of the bottom 80% by market capitalisation of the companies quoted on the UK stock market. For further details of the index, see e.g. Dimson and Marsh (1996).

Fama and French (1996) report that many efficient markets 'anomalies' can be explained by taking into account size and book-to-market effects through the use of a three factor benchmark. Under this model, abnormal returns are calculated as follows:

Model 4: Fama and French (1996) Value-weighted three factor model:

$$\varepsilon_{it}^{ff} = R_{it} - \left[R_{ft} + \hat{\beta}_i^{ff}\left(R_{mt} - R_{ft}\right) + \hat{\gamma}_i^{ff}\left(SMB_t\right) + \hat{\delta}_i^{ff}\left(HML_t\right)\right] \qquad (4)$$

where *SMB* is the value weighted return on small firms minus the value-weighted return on large firms, and *HML* is the value-weighted return on high book-to-market value (BMV) firms minus the value-weighted return on low BMV firms.

The SMB and HML portfolios in Model (4) above are formed, as in Fama and French (1996) by sorting all companies in each year by BMV and market capitalisations; only companies for which both figures are available are included in the portfolios. Again as in Fama and French (1996), value weighted returns are calculated for the bottom 30% of companies by market capitalisation and the top 30% of companies by market capitalisation, and the top 50% of companies by BMV and the bottom 50% of companies by BMV. The differences between these value-weighted returns form the 'small minus big' (SMB) and 'high minus low BMV' (HML) returns.

Having computed the CAARs for each of the above four benchmarks, following Franks *et al* (1991) we calculate a second set of tests of long-run performance using the tools developed for performance measurement. This literature suggests that Jensen's alphas, which may be obtained from the intercepts in a regression of excess returns of the investment strategy on the excess return of the benchmark, provides an appropriate measure of performance. For Models (1), (3) and (4) above, and for each IPO we regress 60-month excess returns against the respective benchmarks. We present cross-sectional averages of the parameters from these event-time regressions, and the average intercept value from these regressions will be a measure of average long-run abnormal returns following an IPO. In the case of the size-decile

[6] In the year of issue, IPO stocks are categorised on the basis of year-end market capitalisation.

benchmark for each IPO we regress the 60-month excess return against the excess return on the respective size decile portfolio, and the average value of the intercepts across each IPO event-time regression is recorded.[7]

Model 5: RATS

Models 1, 3 and 4 compute abnormal returns as an in-sample forecast. To obtain an out-of-sample forecast we would first need to estimate parameter estimates from prior data. Ibbotson (1975) recognised that the parameter estimates for new issues could not be estimated in a pre-event estimation period, since the stock was not quoted. Ibbotson pioneered the RATS method which allows the estimate of beta to vary during the returns window, and which we estimate in the modified form used in Agrawal *et al* (1992). The modification allows for size effects by subtracting the decile return R_{st} from the realised return R_{it} in each case. For the RATS model we do not plot CAARs, but estimate abnormal performance by the intercepts in the regression of excess returns minus the decile return over consecutive 12 month periods.

$$R_{it} - R_{st} = \hat{\alpha}_t - \hat{\beta}_t (R_{mt} - R_{ft}) + \varepsilon_{it}^{RATS} \tag{5}$$

Whereas the alphas from the regressions run for models (1, 3 and 4) above assume beta (and other coefficients) remain constant through time for each firm, the RATS model in the form of (5) implicitly assumes that the difference between decile and firm betas captured by β_t is constant across firms in any time period.

In addition to the event-time analysis using the five models outlined above, we employ the calendar-time method developed by Jaffe (1974) and Mandelker (1974), which was also adopted by Loughran and Ritter (1995), and more recently, by Brav and Gompers (1997). Loughran and Ritter (1995) point out that in the presence of cross-correlation in contemporaneous returns, t-statistics assessing the significance of abnormal returns are likely to be overstated since the test assumes that the observations are independent. The calendar-time approach controls for cross-correlation, and Lyon *et al.* (1998) show that it yields well-specified test statistics. This approach involves calculating average returns of rolling, calendar-time portfolios of event stocks. Specifically, for each calendar month we form an equally weighted τ-month portfolios set up to include any firm which has an IPO during the

[7] We are grateful to an anonymous referee for suggesting this regression.

previous τ months, for τ = 12, 36, 60. We examine the performance of these monthly portfolios, by calculating the subsequent excess return and running the following calendar time regression:

$$(R_{pt} - R_{ft})_{\tau} = \alpha + \beta\left(R_{mt} - R_{ft}\right) + \gamma\, SMB_t + \delta\, HML_t \; + \varepsilon_t \qquad (6)$$

where $(R_{pt} - R_{ft})$ is the excess return in month t on an equally weighted (τ=12, 36, or 60 month) portfolio of IPOs that were issued during the past τ months. This calendar time approach has the added advantage that it provides a direct measure of the opportunities available to investors attempting to exploit any abnormal performance. The independent variables in (6) are the same as in equation (4), so that the basic regression is a time-series Fama-French three factor model.

We also report the results of regression models with the parameter restrictions $\gamma=\delta=0$ (the CAPM), and with $\delta=0$ and the variable SML_t being replaced by the excess return of the Hoare-Govett Smaller Companies index over the market index (the HG model). In addition, the results of the following regression, equivalent to equation (6) for the size-decile (SD) portfolio, are reported:

$$(R_{pt} - R_{ft})_{\tau} = \alpha + \beta\left(R_{Pst} - R_{ft}\right) + \varepsilon_t \qquad (7)$$

where, as in equation (6), the dependent variable $(R_{pt} - R_{ft})$ is the excess return on an equally weighted (τ=12, 36, or 60 month) portfolio of IPOs that were issued up to month *t*, and R_{Pst} is a portfolio of size-decile matched firms, one for each of the firms making a new issue up to month *t* and in the previous months, *t-12*, *t-36*, and *t-60*.[8] If firms undertaking an IPO underperform, then the intercepts in the time-series regressions of equations (6) and (7) should be statistically significantly less than zero (based on t-tests).

IV. DATA

The sample consists of all 588 IPOs issued by non-financial UK companies during the period from 1985 to 1992 and reported by KPMG Peat Marwick's New Issues Statistics. IPOs of investment companies, building societies, privatisation issues and foreign-incorporated

[8] We are grateful to an anonymous referee for suggesting the regression equation in (7).

companies, (including companies incorporated in the Republic of Ireland) were excluded.[9] Long-term total returns, including both capital gains and dividend payments, were computed from monthly returns data collected from the London Share Price Database (LSPD) 1985-97, for all IPOs on the London Stock Exchange during 1985-92. Similarly, the returns on the indices, the Financial Times Actuaries All Share Index and the Hoare Govett Smaller Companies Index, are measured as total returns including dividends. The cumulative abnormal return for a holding period of *m* months, is measured by the sum of the monthly average abnormal returns from the end of the first month of trading to the close of the *m*th month. If stocks drop out of the sample before the end of 60 months, final proceeds of those stocks are reallocated among the shares of surviving firms.

To construct the size decile control portfolios, all stocks on the London Stock Exchange are ranked by market capitalisation at the beginning of each year, and ten portfolios are formed with equal numbers of firms in each decile. Each IPO is then assigned a decile membership based upon its market capitalisation at the beginning of each year.

Data on book-to-market value (BMV) figures is collected from Datastream. A particular difficulty encountered when trying to apply the Fama-French three factor model to UK returns is the lack of BMV data for many firms on Datastream. For every company which has returns and market capitalisation data available from LSPD, the SEDOL number was extracted and used to search for BMV ratios on Datastream in each year from 1980 to 1994. Unfortunately, over 50% of the firms on LSPD for which market capitalisations were available for January 1980, did not have BMV ratios available on Datastream. This suggests that survivorship bias may be a problem when the three factor model is applied to UK data. Furthermore, the simple transposition of a US model based on BMV to the UK can be questioned given the very different accounting treatment of some balance sheet items in the UK compared to the US. Nevertheless, Strong and Xu (1997) find that book-to-market equity is a significant variable in explaining the cross-section of UK expected returns.[10] Given the prominence of the three-factor model in the recent US literature, it is used to estimate abnormal returns here, although the results should be treated with some caution.

[9]New issues which did not constitute true IPOs, such as share issues at the time of a relisting after a firm was temporarily suspended from trading on the stock market, were excluded.

V. RESULTS

For 588 IPO firms issued during 1985-92, cumulative average abnormal returns (CAARs) for the first to the 60th month of seasoning are shown in TABLE 1 for the four benchmark models, and these results are illustrated graphically in FIGURE 1. The results confirm the existence of statistically and economically significant long-term IPO underperformance in our sample irrespective of the benchmark employed. However, the degree of underperformance depends markedly on the benchmark. Specifically, while the CAAR estimates based on the CAPM and SD models (Models 1 and 2) are roughly comparable, the HG and FF models (Models 3 and 4) constitute polar cases in that they yield the lowest and highest estimates of underperformance, respectively.

Our sample shows under-performance over the first 36 months which is significantly worse than that reported by Levis (1993) for his sample of UK IPOs issued during 1980-88. Levis reports CAARs of -11% for the zero-one FTA benchmark. By contrast, the CAAR over 36 months ranges from -15.9% for the CAPM to -28.15% for the FF model. Although the 36-month CAAR of the HG model is smaller at -8.12%, this is in line with Levis' result of -8.31% based on a simple zero-one Hoare Govett benchmark model.

However, over the next two years, up to month 60, the rate of deterioration slows down for all the benchmarks, and in the case of one of the models, the HG benchmark (Model 3), there is even a reversal in reported cumulative performance. The cumulative average abnormal return after 60 months for the HG model is only -4.3%, and statistically this is not significantly different from zero. Comparing CAARs across different benchmarks in TABLE 1 and FIGURE 1, we can see that the initial CAPM returns are different from the others in that the excess returns up to the fifteenth month are positive. In all the other benchmarks the average excess returns are negative from the first month onwards. By the end of the first 30 months, the HG, CAPM and SD benchmarks yield roughly similar negative abnormal returns ranging from -7.62 percent to -13.54 percent. By contrast, the FF benchmark displays much larger underperformance of -25.08%. After the 30-month point, the abnormal returns diverge

[10] It is also questionable whether BMV has any real role in explaining the cross-section of US stock returns (Kothari et al, 1995, Jaganathan and Wang, 1996).

depending upon the benchmark used. The SD and CAPM results show a slow-down in the rate of performance decline during the latter half of the sample, but continue to decline up to 60 months. Abnormal performance measured according to the HG model even shows a slight improvement over the second 30 months. On the other hand, performance based on the Fama-French benchmark shows only a very slight slow-down in deterioration in the latter half of the sample period culminating in a substantial negative 60-month CAAR of 43%. Given our concerns mentioned in Section IV on the applicability of the Fama-French three-factor model to the UK stock market, we would hesitate to place too great a reliance on the exceptional size of the abnormal returns generated by the Fama-French benchmark. Furthermore, since IPOs are predominantly small firms and given the significance of size effects, we would not place too great an emphasis on the CAPM results.

TABLE 2 provides a more detailed breakdown of the average cumulative abnormal returns (ACARs) calculated using the size-decile (SD) benchmark (Model 2).[11] As illustrated in Panel A of TABLE 2, most of the sample firms went public during the earlier part of the period in particular during 1985-88. There is particularly little IPO activity during the last third of the sample period (1990-92).[12] Based on the SD ACARs, the worst underperformance occurs among IPOs issued in 1985 and 1992, followed by those in 1989 and in 1987.

PANEL B provides a breakdown of SD ACARs by issue method. Between the two groups of IPOs issued using the most common methods in the UK, placings and fixed-price offers, there is little variation in long-term performance.[13] By contrast, 13 tender offers display staggeringly bad performance. To some extent this can be explained by the timing of these

[11] Data in TABLE 2 refers to only 561 IPOs due to non-availability of returns and/or size-decile data for 27 firms.

[12] After the end of the sample period, market activity picked up again with 71 IPOs in 1993, 108 in 1994, and 48 in 1995 (Espenlaub, Garrett and Mun, 1998).

[13] Fixed-price offers are underwritten by an issuing bank and are marketed to the wider public. In a tender offer, applications are invited at or above a minimum price and shares are sold at a striking price based on the bids. During the sample period, larger issues were usually sold through offers for sale. In a placing, which is also technically underwritten, the majority of shares are usually placed (at a fixed price) by the issuing bank with larger and/or institutional investors. A more novel method, so-called ‘intermediaries offers’, introduced in 1992, normally involves the placing of a proportion of the shares; therefore they are grouped among placings. For further details on UK issue methods, see e.g. Levis (1993).

tender offers: all took place during 1985-86, and it is those issued in 1985 which have particularly dramatic underperformance (-76% over five years). A further explanation may be that, if IPO underperformance in general is due to faddish new issue markets, then it is likely to be particularly prevalent among issues sold to overoptimistic investors through tender. By implication, it would appear that issuers employing other issue methods are not exploiting the full extent of faddish investors' willingness to pay exaggerated prices.

PANELS C and D in TABLE 2 illustrate the distribution of stocks across market-size decile groups. PANEL C shows the distribution across decile groups for each sample year of all the IPOs having been issued during that year; the distribution of all sample stocks trading during that year is also shown separately. PANEL D focuses on decile-group membership of IPOs in the year of issuance. Not surprisingly, the number of observations in the two highest decile groups are very small. However, perhaps more unexpectedly, there are also only relatively few IPOs among the smallest 10% of the market (decile group ten). The typical (median) IPO is found to belong to decile group seven. Similar to Brav and Gompers' (1997) findings, underperformance seems more prevalent among the smaller rather than the larger half of the sample, where it is particularly high within the smallest 30% of the sample. However, amazingly, the worst underperformance occurs among the eight issues in the largest decile group, and although there is negative skewness in the ACARs in this group, the low average is not the results of outliers: in fact, the median 60-month ACAR for this group is -39.44.

Finally, PANEL E presents a breakdown of ACARs by industry indicating a concentration among some industries: worst of all, irrespective of the period of seasoning, are the nine oil and gas companies.[14] Persistent long-term underperformance is also found in the category "Other Capital Goods". Levis (1993) finds that companies in "Health & Household" perform worst over three years. In our sample, the 13 companies in that industry also performs badly over three years, but during the subsequently two years there is a stunning recovery.

Following Franks et al (1991), we report in TABLE 3 the cross-sectional averages of the event-time regression results of the 60-month long-run returns against the various benchmark returns. For each IPO we run a time series regression of the 60-month excess returns on the

[14] The result is not due to outliers, and the median CAARs are close to the average for most periods of seasoning.

various benchmarks and then average the coefficients across IPOs. The alpha coefficient is a measure of the average abnormal return, and under the null hypothesis of no abnormal returns, it should be equal to zero. These results confirm the earlier CAAR pictures: the CAPM, FF and SD benchmarks produce intercepts which are significantly negative implying long run underperformance. Again the HG benchmark demonstrates a different result from the others, and has an intercept term that is negative but insignificantly different from zero.

One explanation for the different findings in relation to the two size benchmarks (Models 2 and 3) is that the size decile approach implicitly assumes all firms in the same decile have the same beta. TABLE 4 shows that the betas on the decile portfolios for 1985-97 are almost monotonically increasing with size, which is exactly the opposite of the US results (Fama and French, 1992). In fact, the table shows that on average IPO firms have higher betas than those of the decile portfolios, so that IPO firms appear to be riskier than their size decile matches: while the median IPO falls into decile group seven (cf. TABLE 2) which has a beta of 0.7507, all four benchmarks in TABLE 3 have a beta coefficient which is greater than this.

The results of the RATS model which allows for a beta coefficient which is the same for firms in each size decile, but varies over time, also produces the same negative pattern of abnormal returns. In the final column of TABLE 5, the average alpha for the RATS model is around 0.35% per month, implying a 5 year excess negative return of 21%, which is very close to the size decile (SD) result (Model 2). The RATS event-time results are subdivided into consecutive twelve month periods, and we can see a pattern in the alpha coefficients which is similar to the SD CAARs in FIGURE 1. There is significant under-performance for the first three years, but insignificantly negative returns in years four and five.

Recently Kothari and Warner (1997) and Barber and Lyon (1997), have argued that long-horizon tests are mis-specified, and that there is significant over-rejection of the null hypothesis of no positive abnormal performance for CAAR methods. They find that there is a significant upward drift in abnormal returns over long-horizons (36 months). To investigate the extent of this bias in our sample we undertook the following experiment on a sample of seasoned (non-IPO) companies.[15]

We first identified the population of seasoned firms that were alive on the LSPD database at 30th December 1979, and were still in existence by 30th December 1984. There were 1574 companies that satisfied this criterion. By construction all of these firms had been in existence for at least 60 months, and therefore could be classified as seasoned firms rather than genuine IPOs. We then took a randomly selected sample of 100 of non-IPO companies from this seasoned population, which were representative in size (market capitalisation) of our actual IPO sample. For these 100 companies, a randomly selected event month was selected, using date weighting designed to mimic the actual distribution of IPO issue dates.

We then ran the regressions used to estimate the coefficients presented for the IPO sample in Table 3. The results are shown in a new Table 6. We note two substantive points. First, the ordering of performance from the random sample is identical to that presented for the IPO sample in Table 3.

Second, for the random sample, the alphas from both FF and CAPM models are not significantly different from zero. However, the HG model shows a significant positive alpha, suggesting that there may be some positive bias in model (3), which is similar to the findings of Kothari and Warner (1997) and Barber and Lyon (1997). Therefore we suggest that it may be possible that the insignificance of IPO performance using this benchmark may be attributable to some upward bias in the HG benchmark.

Having identified underperformance as a feature of these cross-section realised returns for all the benchmarks employed, we now go on to investigate the possible explanations for this phenomenon. One possibility is that comparatively short periods of severe underperformance of IPOs (and of comparable small, low book-to-market stocks) might distort the overall picture. Given the considerable clustering of events and the consequent overlap in calendar time of the post-IPO test periods of individual IPOs, periodic changes in general performance will give rise to cross-correlation in returns. The statistical significance of the cross-section abnormal returns in TABLES 1-3 will be overstated in the presence of cross-correlation (see Loughran and Ritter, 1995) as the t-tests assume that observations are independent. To control for this problem, we adopt the calendar-time approach outlined in Section III. TABLE 7 reports the time-series estimates of the Fama-French three factor model in equation (6), the

[15] This test was suggested by a referee

restricted versions of the model (corresponding to the CAPM and the HG model), and of the amended version of the SD model in equation (7).

As in the event-time regressions, the HG benchmark still produces statistically insignificant underperformance, but the negative excess returns are now also insignificant for the CAPM and only marginally significant for the SD case. In all cases, the intercept term is negative, with abnormal returns for the 60-month portfolio of -0.18% per month under the CAPM, -0.4% per month for the SD, and -0.07% per month under the HG model. But only in the case of the three-factor FF model is the under-performance of -0.67% per month statistically significant. Market effects are significant in all models in all portfolios, and there is a tendency for the beta coefficient to drift upwards over time in each of the models. Size effects are also strongly significant in both the HG, SD and three-factor models. The BMV effect is significantly different from zero for the 12- and 60-month portfolios but not for the 36-month portfolios.

The difference between the cross-section and time-series results in TABLE 7 compared with TABLES 1-3 arises due to cross correlation in returns which overstates the t-statistics in the event-time regressions. Moreover, the calendar-time regressions weight issuers in low-transactions periods more heavily than issuers in high-transactions periods, since (6) weights each of the 131 months equally, irrespective of the number of firms in the portfolio.[16] By contrast, the event-time approach weights each IPO equally.

The implication of the results in TABLE 7 is that much of the underperformance in TABLES 1-3 occurs because a large proportion of sample firms went public in periods (such as 1985 and in the following years 1986-87) which were subsequently associated with highly negative abnormal returns. Averaging the event-time returns across IPOs therefore produces apparently dramatic underperformance for the sample as a whole. However, in the calendar-time approach, which involves equal weighting of the IPO returns in each monthly rolling portfolio

[16] The portfolios are formed for each month from January 1985 to December 1997, although only new issues to the end of December 1992 are considered. Thus the total number of months is 156; however, there were no IPOs in January 1985 and therefore the number of observations used in the regressions is 155.

as well as of the average monthly returns of each rolling portfolio, this underperformance is much less spectacular.

VI. CONCLUSIONS

In this paper we have re-examined the evidence on the long-term returns of IPOs in the UK using a new data set of firms over the period 1985-97. We assess abnormal performance using a number of alternative benchmarks and approaches. The benchmarks employed allow for the standard CAPM, size effects, the Fama-French three-factor model and the modified RATS procedure. In addition to the more commonly used event-time regressions, we also use the calendar-time approach originally developed by Jaffe (1974) and Mandelker (1974). We find that, in line with Fama's (1998) conclusion, the results on long-run underperformance over 60-months after the IPO crucially depend on the choice of technique.

In the event-time regressions, four of the benchmarks: the CAPM, size-deciles (SD), Fama-French (FF) and RATS models, produce significant negative abnormal returns. By contrast, the Hoare-Govett (HG) model indicates only slightly negative and statistically insignificant performance over 60 months. However, up to 48 months there is underperformance in the HG model which is statistically significant although small in comparison with those of the other models. In comparing the relevance of each of these benchmarks, the CAPM would seem mis-specified given the empirical significance of size effects and the observation that IPOs are typically small stock; in our sample, the typical IPO belongs to decile group seven by market capitalisation (TABLE 2). The FF results may be contaminated by "backfill bias" due to the nature of the UK data available from Datastream. This leaves the two size control models, the SD and the HG models, which produce widely different results. Simulation results on a sample of seasoned companies suggest that all the benchmarks suffer from an upward drift, which is most apparent in the HG case, and might explain why the HG model for the IPO sample produces no significant underperformance in event-time.

We also examined abnormal performance based on calendar-time portfolios of IPOs, and found that across all benchmarks the statistical significance of underperformance was significantly weaker under this approach, and as in event-time, the two size-adjustment models yield very different results. Interestingly, this is analogous to Brav and Gompers' (1997) finding that apparently similar techniques produce surprisingly dissimilar results.[17] Based on these and other results, Fama (1998) concludes that *"consistent with the market efficiency prediction that apparent anomalies can be due to methodology"* and that *"most long-term return anomalies tend to disappear with reasonable changes in technique"*. Our findings for UK IPOs add some evidence to support this conclusion. The implication of the calendar-time results is that the finding of underperformance is driven by particular periods when large numbers of IPO are issued, and these tend to be the worst possible times - from outside investors' points of view - in terms of subsequent IPO performance.

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[17] Brav and Gompers find that the Fama-French three-factor model shows underperformance, which disappears when IPOs are matched to non-issuing firms by size and book-to-market value.

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TABLE 1

Cumulative Average Abnormal Returns For Alternative Benchmark Models.

Figures are percentages; models are the Capital Asset Pricing Model (1), the Dimson-Marsh (1986) simple size adjustment model (2), a multi-index model using the return on the HGSCI minus the return on the FTASI (3), the Fama and French (1996) three factor model (4), and the RATS model (5). The t-statistics are computed according to the Crude Dependence Adjustment method of Brown and Warner (1980).

Month	***CAPM Results***		***SD Results***		***HG Results***		***FF Results***	
	CAAR (%)	*t-stat*	*CAAR (%)*	*t-stat*	*CAAR (%)*	*t-stat*	*CAAR (%)*	*t-stat*
T1	-0.08	-(0.11)	-0.95	-(1.66)	-0.50	-(0.88)	-1.28	-(2.33)
T2	0.04	(0.04)	-1.55	-(1.91)	-0.85	-(1.06)	-2.11	-(2.71)
T3	0.82	(0.63)	-1.49	-(1.50)	-0.68	-(0.69)	-2.49	-(2.61)
T6	1.10	(0.60)	-2.69	-(1.91)	-0.97	-(0.70)	-4.60	-(3.41)
T12	1.21	(0.46)	-6.14	-(3.09)	-3.10	-(1.58)	-9.52	-(4.99)
T18	-1.83	-(0.57)	-9.23	-(3.80)	-5.14	-(2.14)	-15.38	-(6.58)
T24	-3.82	-(1.04)	-10.65	-(3.79)	-6.38	-(2.30)	-19.32	-(7.16)
T30	-10.13	-(2.46)	-13.54	-(4.31)	-7.62	-(2.46)	-25.08	-(8.31)
T36	-15.90	-(3.52)	-16.24	-(4.72)	-8.12	-(2.39)	-28.15	-(8.52)
T42	-22.02	-(4.51)	-19.62	-(5.28)	-8.46	-(2.31)	-33.28	-(9.32)
T48	-24.07	-(4.62)	-19.19	-(4.83)	-6.41	-(1.64)	-35.50	-(9.30)
T54	-28.11	-(5.08)	-20.61	-(4.89)	-5.31	-(1.28)	-39.48	-(9.76)
T60	-28.67	-(4.92)	-21.32	-(4.80)	-4.30	-(0.98)	-42.77	-(10.02)

FIGURE 1
Cumulative Average Abnormal Returns on UK IPOs (1985-92) for Alternative Benchmarks By Month of Seasoning

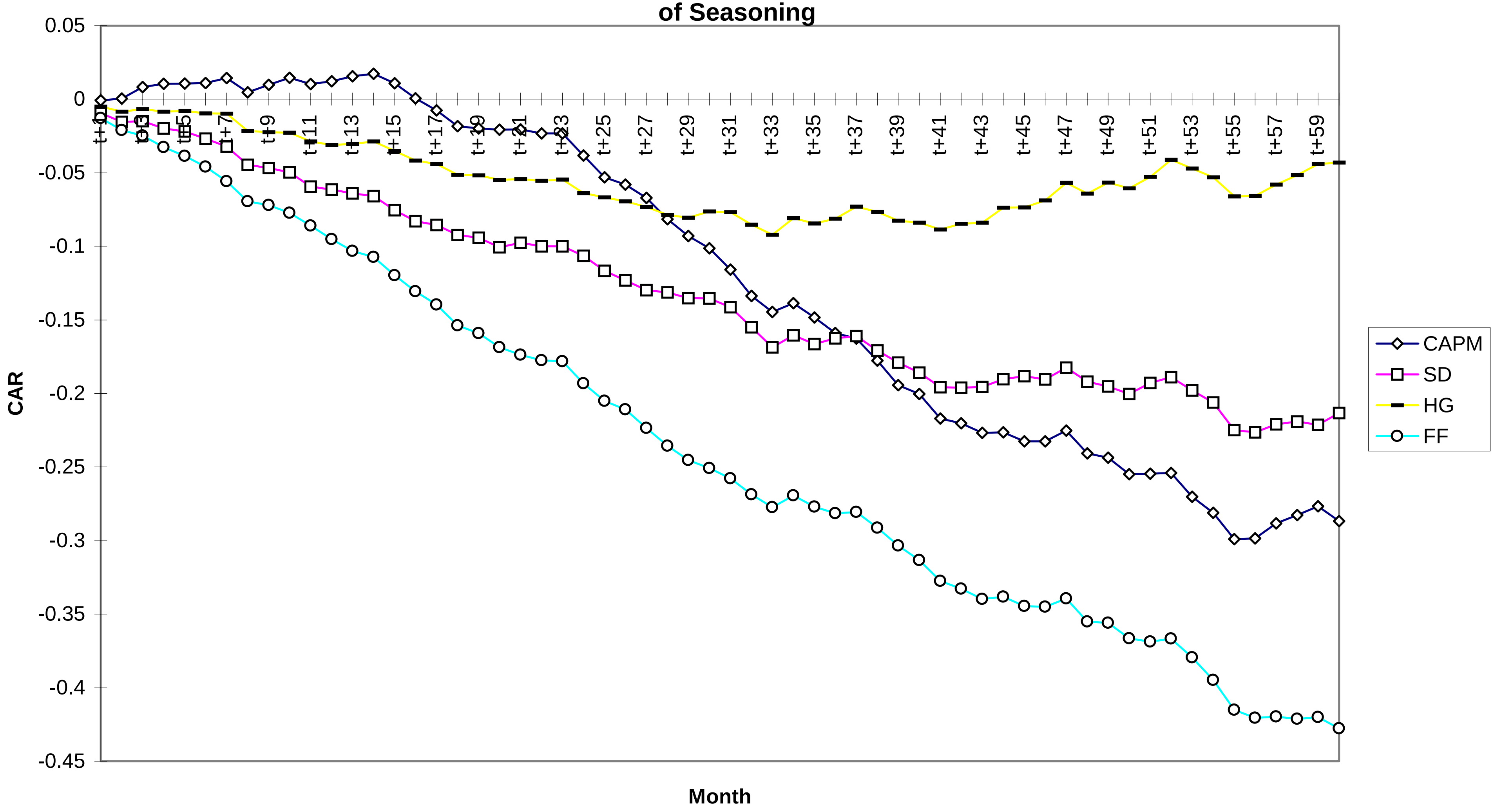

TABLE 2

Average Cumulative Abnormal Returns - Size-Decile Return Adjusted

In all of the panels in this table the reported figures are the average cumulative abnormal returns (ACARs) rather than the cumulative average abnormal returns (CAARs) reported in Table 1. All abnormal returns are size-decile return adjusted and calculated according to Model 2 (see Section III). PANEL A gives the average cumulative abnormal returns by month of seasoning and IPO year. PANEL B gives the average cumulative abnormal (size-decile return adjusted) returns by month of seasoning and issue method. 'Offers' comprise fixed-price offers for subscription and for sale. PANEL C shows the distribution of sample stocks across market size deciles; the 'IPOs' columns show the numbers of companies conducting an IPOs in a given year by market size deciles; the 'ALL' columns show the numbers of all stocks included in the sample that are trading in a given year, i.e. all stocks floated either in that year or previously during the IPO sample period (1985-92); stocks are allocated to decile categories based on their market capitalisation at the start of a given year. PANEL D shows the average cumulative abnormal (size-decile return adjusted) returns by month of seasoning and market-size decile; the second column gives the average market capitalisation of the sample stocks in a given decile group; IPOs are allocated to decile groups based on market capitalisation at the end of the year of issuance. PANEL E shows the average cumulative abnormal (size-decile return adjusted) returns by month of seasoning and industry; source of industry classification is KPMG Peat Marwick's New Issue Statistics.

PANEL A: Average cumulative abnormal returns by month of seasoning and IPO year

		Month								
		T3	*T4*	*T5*	*T6*	*T12*	*T24*	*T36*	*T48*	*T60*
Ipo Year	*Obs*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*
1985	112	-3.66	-5.65	-7.78	-8.93	-17.52	-28.65	-35.42	-43.54	-50.31
1986	121	-0.79	0.70	2.21	1.96	0.36	-2.54	-12.56	-13.25	-12.15
1987	108	-5.86	-7.52	-7.11	-8.38	-9.17	-13.61	-16.08	-20.09	-15.96
1988	112	0.76	0.36	-0.40	0.04	-1.04	2.15	5.26	9.00	6.62
1989	59	0.60	1.44	-0.22	1.06	-1.43	-6.74	-19.28	-26.44	-25.30
1990	15	5.75	5.20	4.17	0.06	-5.15	-3.24	12.80	14.76	17.36
1991	10	6.36	1.01	10.29	9.43	13.48	-3.82	-4.04	-9.21	-17.58
1992	24	3.45	3.29	3.75	2.44	-13.33	-21.16	-32.23	-25.51	-41.91
1985-92	561	-1.45	-1.94	-2.15	-2.64	-6.09	-10.23	-14.96	-17.26	-18.72

PANEL B: Average cumulative abnormal returns by month of seasoning and issue method

		Month								
		T3	*T4*	*T5*	*T6*	*T12*	*T24*	*T36*	*T48*	*T60*
	Obs	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*
Placings	422	-1.20	-1.65	-1.55	-2.32	-5.99	-10.12	-15.47	-17.34	-18.23
Offers	126	-2.00	-2.52	-3.60	-2.91	-4.71	-8.93	-10.38	-13.79	-16.74
Tender Offers	13	-3.94	-5.44	-7.70	-10.21	-22.31	-26.36	-42.90	-48.31	-53.74

PANEL C: Distribution of sample stocks across market size deciles																				
Year	*1985*	*1986*		*1987*		*1988*		*1989*		*1990*		*1991*		*1992*		*1993*	*1994*	*1995*	*1996*	*1997*
Decile	*IPOs*	*IPOs*	*ALL*	*IPOs*	*ALL*	*IPOs*	*ALL*	*IPOs*	*ALL*	*IPOs*	*ALL*	*IPOs*	*ALL*	*IPOs*	*ALL*	*ALL*	*ALL*	*ALL*	*ALL*	*ALL*
1 (Largest)	4	1	5	0	5	0	5	1	5	0	4	0	6	2	6	6	6	7	9	14
2	1	4	5	2	7	4	16	1	19	1	21	1	17	2	23	23	18	22	25	32
3	5	12	17	5	25	3	25	1	25	1	25	1	24	4	26	32	35	35	42	25
4	12	6	18	4	19	8	36	3	48	1	37	2	35	4	45	42	35	34	30	33
5	11	20	31	12	44	12	52	2	48	2	50	2	49	5	42	35	38	36	32	33
6	24	20	44	18	53	20	62	8	66	4	63	0	47	5	46	41	29	36	42	35
7	26	14	40	18	49	21	68	10	68	1	58	0	53	0	45	46	50	42	29	36
8	13	23	36	28	62	19	73	14	70	2	62	0	57	2	47	46	45	45	46	49
9	9	10	20	15	39	17	55	13	63	1	62	1	56	0	55	50	50	61	41	38
10 (Smallest)	3	8	11	6	15	5	18	5	26	1	31	1	42	0	42	45	38	37	42	26
Total	108	118	227	108	318	109	410	58	438	14	413	8	386	24	377	366	344	355	338	321

PANEL D: Average cumulative abnormal returns by month of seasoning and market-size decile											
	Average		*Month*								
	Market		*T3*	*T4*	*T5*	*T6*	*T12*	*T24*	*T36*	*T48*	*T60*
Decile	*Cap.*	*Obs*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*
1 (Largest)	795.84	8	-4.48	-6.71	-12.04	-9.18	-23.65	-33.33	-41.46	-48.09	-52.62
2	248.34	16	1.73	4.33	5.05	7.25	3.57	2.87	4.63	1.03	-5.83
3	92.99	32	3.19	4.15	5.95	8.87	6.08	6.45	-0.51	0.76	-3.35
4	54.92	40	4.45	5.45	7.32	8.68	13.49	5.02	-4.32	-7.09	-3.94
5	37.11	66	3.12	2.83	1.65	3.30	-1.03	-3.28	-6.10	-9.70	-5.38
6	24.83	99	1.34	0.23	-0.10	-1.63	-1.70	-4.68	-11.26	-15.66	-16.80
7	16.35	90	-1.20	-0.74	-2.24	-2.84	-3.84	-6.87	-8.10	-8.65	-10.82
8	13.37	101	-8.08	-8.46	-7.35	-9.06	-12.81	-16.61	-25.46	-25.01	-24.29
9	9.97	67	-3.20	-6.46	-6.71	-9.83	-17.25	-30.59	-42.20	-44.90	-49.78
10 (Smallest)	7.46	29	-9.16	-9.77	-12.20	-11.94	-31.32	-24.70	-16.38	-32.21	-39.46
ALL	44.14	561	-1.45	-1.94	-2.15	-2.64	-6.09	-10.23	-14.96	-17.26	-18.72

PANEL E: Average cumulative abnormal returns by month of seasoning and industry

		Month								
		T3	*T4*	*T5*	*T6*	*T12*	*T24*	*T36*	*T48*	*T60*
Industry	*Obs*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*	*ACAR (%)*
Construction	63	2.02	3.02	5.24	5.44	4.46	-2.62	-25.91	-39.73	-49.88
Electronics	50	-2.72	-6.13	-6.17	-8.43	-22.36	-16.84	-20.67	-11.16	0.41
Motors	15	1.18	-0.84	-1.64	-3.57	-2.44	-2.05	1.19	-1.80	6.40
Other Capital Goods	73	-2.78	-3.57	-5.25	-6.37	-7.97	-12.22	-12.96	-14.73	-17.77
Food Manufacturing & Retailing	19	-1.73	1.42	1.12	-0.36	-7.11	-14.58	-7.16	0.32	4.58
Health & Household	13	-7.50	-8.25	-2.87	-0.72	-18.39	-12.69	-23.47	7.39	39.77
Hotels & Leisure	27	5.26	2.46	0.86	3.81	-6.25	4.02	16.94	18.58	19.63
Publishing & Printing	24	2.85	1.29	1.26	0.47	3.58	-4.50	-8.74	-7.67	11.76
Stores	56	-2.15	-3.15	-3.97	-3.55	-11.67	-18.26	-16.69	-22.67	-29.67
Textiles	11	-8.53	-5.46	-7.44	-6.11	1.17	3.02	6.99	3.43	5.24
Other Consumer Goods	19	-1.32	1.05	-1.16	-4.99	-7.62	2.34	-0.18	7.95	11.03
Business Services, Agencies	96	-3.42	-3.61	-5.68	-5.31	-2.05	-9.55	-18.46	-23.79	-36.41
Chemicals	5	-4.91	-5.50	-3.80	-3.04	-36.31	-22.80	8.25	5.19	3.05
Conglomerates	8	2.32	-3.47	0.78	0.44	-1.39	-14.76	-5.78	-10.78	5.80
Oil & Gas	9	-10.82	-18.04	-27.89	-35.46	-66.14	-74.64	-65.80	-87.21	-81.48
Other Industrials	16	12.01	13.42	18.67	23.13	30.43	25.64	7.39	-5.27	-34.29
Property	36	-3.70	-1.47	1.96	-0.21	-0.84	-19.50	-38.32	-40.17	-40.22
Other Financials	21	-4.05	-4.27	-4.18	-7.05	-10.98	-14.78	-5.40	-9.55	-1.68

TABLE 3: Event-Time Regression Results For Alternative Benchmark Models.

The following regression was run in event time for each IPO, for the Fama and French (FF) three factor model (4), $(R_{it} - R_{ft})_{60} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + \gamma_i SMB_t + \delta_i HML_t + \varepsilon_{it}$ The same regression was run for the Capital Asset Pricing Model(CAPM) model (1), with the constraint $\gamma_t = \delta_t = 0$. Similarly for the multi-index model using the return on the HGSCI minus the return on the FTASI in model (3), the regression was $(R_{it} - R_{ft})_{60} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + \gamma_i(R_{ht}-R_{mt}) + \varepsilon_{it}$. Finally for the size control portfolio in model 2 the regression was $(R_{it} - R_{ft})_{60} = \alpha_i + \beta_I(R_{st}-R_{ft}) + \varepsilon_{it}$. The parameter values were averaged over all IPOs, and these averaged values are presented in the table below. Figures in brackets are the t-statistics.

	Benchmark			
	CAPM	HG	FF	SD
Alpha	-0.0045	-0.0016	-0.0077	-0.00473
t-stat	(-4.2166)	(0.4981)	(-8.3127)	-(2.8749)
Beta	0.7857	0.9310	0.8778	0.989337
t-stat	(65.5988)	(78.6735)	(71.1697)	(85.9678)
Gamma		1.2909	0.8645	
t-stat		(52.2269)	(39.6464)	
Delta			-0.0672	
t-stat			(-1.2422)	

TABLE 4: Betas of Decile Portfolios

	Decile 1 (Largest)	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10 (Smallest)*
Beta	1.0436	1.0034	0.9347	0.8636	0.8296	0.7739	0.7507	0.7241	0.7416	0.5856

TABLE 5: Event-Time Regression Results For RATS Model divided into consecutive 12 month periods

The *RATS* model was estimated as $(R_{it} - R_{st}) = \alpha_t + \beta_t (R_{mt} - R_{ft}) + \varepsilon_{it}$ and implicitly assumes that the difference between decile and firm betas captured by β_t is constant across firms in any time period. So Beta in the table is the difference between portfolio and decile beta

	Month Interval					
	T1-T12	*T13-T24*	*T24-T36*	*T37-T48*	*T49-T60*	*Average T1-T60*
Alpha	-0.0042	-0.0041	-0.0011	-0.00268	-0.00371	-0.00347
t-stat	-(3.7217)	-(2.2939)	-(2.8990)	-(1.3541)	-(1.0088)	-(3.9868)
Beta	-0.0350	-0.0148	0.0294	0.045205	0.001804	0.007763
t-stat	(0.3786)	-(0.3882)	-(1.1554)	(0.9296)	(0.9338)	-(0.5210)

TABLE 6: Event-Time Regression Results For Seasoned Sample with falsely designated IPO month.

The following regression was run in event time for a sample of 100 seasoned companies with falsely designated IPO months, for the Fama and French (FF) three factor model (4), $(R_{it} - R_{ft})_{60} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + \gamma_i SMB_t + \delta_i HML_t + \varepsilon_{it}$ The same regression was run for the Capital Asset Pricing Model (CAPM) model (1), with the constraint $\gamma_t = \delta_t = 0$. Similarly for the multi-index model using the return on the HGSCI minus the return on the FTASI in model (3), the regression was $(R_{it} - R_{ft})_{60} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + \gamma_i(R_{ht}- R_{mt}) + \varepsilon_{it}$. The parameter values were averaged over all IPOs, and these averaged values are presented in the table below. Figures in brackets are the t-statistics.

	Benchmark		
	CAPM	HG	FF
Alpha	0.0021	0.0031	-0.0015
t-stat	(1.7013)	(3.460)	(0.8751)
Beta	0.8500	0.966	0.8951
t-stat	(43.985)	(51.490)	(43.3986)
Gamma		1.0018	0.4676
t-stat		(24.1390)	(14.2044)
Delta			0.254727
t-stat			(4.4738)

TABLE 7

Calendar Time Regression Results For Alternative Benchmark Models.

Time-series models are the Capital Asset Pricing Model , a multi-index model using the return on the HGSCI minus the return on the FTASI, and the Fama and French (1996) three factor model. Figures in brackets are the t-statistics. The regressions in each case are estimated using 155 monthly observations with the dependent variable being either the return on a 60, 36 or 12-month portfolio of IPOs minus the risk-free rate, and the independent variables being the benchmark factors implied by expressions (1), (3), and (4) in the text. Beta is the sensitivity of the excess returns on the company to the excess returns on the market (FTASI); Gamma is the sensitivity of the excess returns on the company to the 'small firms premium', which is taken as $(R_{ht}-R_{mt})$ for HG model (3) and *SML* for FF model (4) and Delta is the sensitivity to the BMV factor in the FF nodel. In the case of the SD model the dependent variable $(R_{pt} - R_{ft})$ is the excess return on an equally weighted (τ=12, 36, or 60 month) portfolio of IPOs that were issued up to month *t*, and the independent variable (R_{Pst} - R_{ft}) is a portfolio of size-decile matched firms, one for each of the firms making a new issue up to month *t* and in the previous months, *t-12*, *t-36*, and *t-60*; alpha is the intercept term.

PANEL A: 12-month portfolios				
	Benchmarks			
	CAPM	SD	HG	FF
Alpha	-0.0047	-0.0066	-0.0047	-0.0099
t-stat	(-1.064)	(-2.191)	(-1.468)	(-2.747)
Beta	0.72399		0.84807	0.80855
t-stat	(8.965)		(14.16)	(12.45)
Gamma		0.91746	1.1710	0.80608
t-stat		(17.21)	(9.790)	(7.784)
Delta				-0.38858
t-stat				(-1.973)
Adj R^2	0.4282	0.7358	0.6995	0.6401

PANEL B: 36-month portfolios				
	CAPM	SD	HG	FF
Alpha	-0.00325	-0.00469	-0.0028	-0.00804
t-stat	(-0.9410)	(-2.416)	(-1.303)	(-3.059)
Beta	0.75839		0.89298	0.83496
t-stat	(11.38)		(21.01)	(16.58)
Gamma		0.95966	1.1905	0.79247
t-stat		(26.26)	(14.33)	(9.535)
Delta				-0.22188
t-stat				(-1.423)
Adj R^2	0.4972	0.8412	0.8054	0.7195

PANEL C: 60-month portfolios				
	CAPM	SD	HG	FF
Alpha	-0.001839	-0.00406	-0.000762	-0.00673
t-stat	(-0.5090)	(-1.936)	(-0.3505)	(-2.506)
Beta	0.77391		0.96391	0.89677
t-stat	(10.53)		(21.08)	(16.39)
Gamma		1.0544	1.3959	0.95773
t-stat		(25.14)	(16.45)	(11.17)
Delta				-0.33899
t-stat				(-2.049)
Adj R^2	0.4163	0.8039	0.7886	0.6888