Leverage, Liquidity and Long-Run IPO Returns

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Abstract

It is well known that IPO stocks on average substantially underperform (over 3-5 years) non-IPO stocks matched on firm size. With a large sample of Nasdaq IPOs, this paper presents systematic evidence that IPO stocks are less risky than the size-matched firms and thus have lower *expected* return. We show that, in the years immediately following the issue, IPO stocks have lower leverage ratios and higher liquidity (turnover) than matched firms. A model with macroeconomic risk factors further reveals that IPO stocks have lower exposures than matched firms to leverage-related factors such as unexpected inflation and term-structure spreads. Moreover, when we introduce liquidity as a risk factor in a Fama-French type of model, we find that the liquidity factor also reduces expected returns to IPO stocks relative to matched firms. Controlling for risk using either factor model, we cannot reject the hypothesis of zero abnormal returns to IPO stocks.

1 Introduction

Ritter (1991) and Loughran and Ritter (1995) find that stocks of firms conducting initial public offerings (IPOs) subsequently underperform non-IPO stocks matched on equity size. Assuming that size-matching effectively controls for the systematic risk of IPO firms, the authors cast their evidence as a serious challenge to the notion of rational and efficient capital market pricing. Variants of the matched-firm technique, with some researchers matching on book-to-market and return momentum, have generated significant long-run performance estimates also following events such as seasoned equity offerings (SEOs), share repurchases, dividend omissions and initiations, mergers, stock splits, and exchange listings.[1] This empirical literature has inspired efforts to build behavioral models of asset pricing where the marginal investor is slow to assimilate publicly available information.[2]

More recently, researchers have been questioning whether the matched-firm procedure omits important and intuitively plausible risk factors which effectively lowers the risk of IPO stocks.[3] However, no study has yet identified such factors. While Brav, Geczy, and Gompers (1999), as well as this paper, show that matching on both size and book-to-market ratio tend to eliminate underperformance of the average IPO stock, the book-to-market ratio does not lend itself to an intuitive economic explanation of the underlying source and price of risk. In a sample exceeding 5,000 Nasdaq IPOs, we find that, in the years immediately following the IPO date, IPO stocks have significantly lower leverage ratios and higher liquidity (turnover) than control firms matched on size. Using a macro-factor model, we confirm that the lower leverage lowers expected return. Specifically, IPO stocks exhibit lower exposures to leverage-related risk factors such as unanticipated inflation and return spreads at both the short and long end of the term structure. Furthermore, we build a Fama-French-type factor model with a liquidity risk factor computed as the return differential between low-liquidity and high-liquidity stocks.[4] The liquidity factor is statistically significant and

[1]See, e.g., Loughran and Ritter (1995), Spiess and Affleck-Graves (1995), Ikenberry, Lakonishok, and Vermaelen (1995), Mitchell and Stafford (1997), Michaely, Thaler, and Womack (1995), Agrawal, Jaffe, and Mandelker (1992), Desai and Jain (1997), and Dharan and Ikenberry (1995).

[2]See, e.g., Daniel, Hirshleifer, and Subrahmanyam (1998), Barberis, Shleifer, and Vishny (1998), and Hong and Stein (1999).

[3]Alternative factor-model specifications are examined by Brav, Geczy, and Gompers (1999) and Eckbo, Masulis, and Norli (1999) in the context of SEOs. Statistical issues (power and bias) are also discussed in Barber and Lyon (1997), Kothari and Warner (1997), Lyon, Barber, and Tsai (1999), Fama (1998), and Loughran and Ritter (1999).

[4]The empirical work by Brennan and Subrahmanyam (1996), Datar, Naik, and Radcliffe (1998), and Brennan, Chordia, and Subrahmanyam (1998) suggests that stock expected returns are cross-sectionally related to stock liquidity measures and that higher stock liquidity lowers expected returns. These studies do not, however, explicitly analyze a liquidity risk factor.

lowers the expected return to IPO stocks both in absolute terms and relative to size-based matched firms. Using either factor model, we cannot reject the hypothesis of zero abnormal return to a portfolio long in matched stocks and short in IPO firms.

In addition to identifying economically intuitive sources of differential risk between IPO stocks and size-matched firms, our macro-factor model approach provides a useful input to the ongoing debate over market rationality. Macroeconomic factors such as change in aggregate per capita consumption, unexpected inflation and term premiums are arguably exogenous to the firm and not easily influenced by market sentiment. This is true even if we use factor-mimicking stock portfolios since the portfolio weights are formed to track the underlying exogenous factor. Thus, the macro-factor model has greater power to detect true abnormal performance than a model where the risk factors are constructed using market prices (such as size and book-to-market ratios).

Moreover, in a world where managers have private information about their own firm's future earnings prospects, the timing of voluntary corporate events will reflect that information.[5] The matched-firm technique designates as a match a firm that, based on *its* private information, has decided *not* to issue. Given the self selection of both the issuer and the matching firm, the (implicit) Loughran-Ritter assumption that the two firms have similar cash-flow and risk characteristics is questionable. For example, if firms issue equity in response to private information about favorable future investment opportunities, then these firms may very well develop lower leverage over the post-issue period which in turn lowers expected stock returns relative to non-issuing firms.[6] Our macro-factor-model approach is advantageous here because it specifies risk in terms of covariances of issuer returns and macroeconomic risks that are not subject to private firm-specific information. It also follows from this argument that, contrary to the conjecture of Loughran and Ritter (1999), purging the factor mimicking portfolios of issuing firms is *not* desirable because it biases the estimates towards finding differences between the average issuer stock and the average factor risk premium.[7]

The paper is organized as follows. Section 2 contains a description of the data and sample characteristics. Section 3 estimates abnormal IPO performance using the matched-firm technique.

[5]See, e.g., Acharya (1988), Eckbo, Maksimovic, and Williams (1990) and Prabhala (1997) for discussions of the effects of managerial timing on the econometric specification of event studies.

[6]As the firm undertakes these favorable investment projects, leverage is reduced unless the firm issues debt to offset the equity-increase caused by the net present value of the new projects.

[7]The non-random sampling of event firms also creates statistical problems which lead Lyon, Barber, and Tsai (1999) to conclude that: "...misspecification [of the matching firm technique] in nonrandom samples is pervasive."

This serves as a benchmark comparison for the factor-analysis used throughout the remainder of the paper. We then proceed, in Section 4, to estimate our macro-factor model using portfolios of IPO stocks as well as the a zero-investment portfolio long in size-matched firms and short in the IPO stocks. Since the zero-investment portfolio represents the difference between IPOs and their matches, our tests are relatively robust to biases caused by omitted risk factors. Our examination of the role of liquidity as a price factor is contained in Section 5 along with estimation of the Fama-French three-factor model and the momentum factor used by Carhart (1997). Section 6 summarizes the various factor model estimates in terms of the total contribution of each factor to overall portfolio returns. Section 7 concludes the paper.

2 Data and sample characteristics

2.1 Selection of IPO stocks and matched firms

The sample of IPOs used in this study is drawn primarily from Securities Data Corporation's (SDC's) New Issues database over the 1973 to 1996 period. The sample also includes IPOs from the dataset compiled by Ritter (1991), covering the period 1975–1984, that is not present in the SDC database.[8] These sources generate a total sample of 5,173 IPOs satisfying the following sample restrictions: The issuer is domiciled in the U.S., the IPO is on the Nasdaq Stock Exchange and it involves common stocks only (excludes unit offerings), and the issuer must appear on the CRSP tapes withing two years of the offering.

Our sample selection criteria differ somewhat from those used by Loughran and Ritter (1995) and Brav, Geczy, and Gompers (1999) in that we sample Nasdaq IPOs only, and by our exclusion of unit offerings. Moreover, while our sample period starts in 1973 (the first year in which CRSP includes Nasdaq firms) and ends in 1996, Loughran and Ritter (1995) draws their sample of 4,753 IPOs from the period 1970–1990, and the total sample of 4,622 IPOs in Brav, Geczy, and Gompers (1999) is from the 1975–1992 period.

Figure 1 shows the annual distribution of the 5,173 IPOs in our total sample. Each column represents the number of sample offerings in a given year, with the lower (darkened) part representing the number of sample offerings for which we have Compustat information on book-to-market

[8]The IPOs compiled by Ritter (1991) is publicly available on the IPO resource page http://www.iporesources.org.

ratios. As seen from the figure, book-to-market ratios is available for nearly all sample issues in the 1990s, while this information is missing for a substantial number of issues in the 1980s. Overall, requiring information on book-to-market ratios reduces the total sample size from 5,173 to 4,315. Figure 1 also reveals a clustering of IPOs ("hot issue" period) in the early to mid 1980s. Moreover, the figure shows a steady growth in the number of IPOs from a low in 1990 through a high in 1996 when the sample period ends.

Since the basic motivation for this study is the anomalous abnormal return evidence produced by the matched-firm technique of Ritter (1991) and Loughran and Ritter (1995), we systematically compare the returns on IPO stocks to a set of matched firms. Moreover, to make the results comparable to Loughran and Ritter, we use size-matching. Size-matched firms are selected from all companies listed on the Nasdaq stock exchange at the end of the year prior to the IPO. The size-matched firm is the firm closest in market capitalization to the issuer, where the issuer's market capitalization is the first available market capitalization on the CRSP monthly tapes after the offering date. When matching on size and book-to-market ratios, we use a procedure analogous to the one employed by Fama and French when constructing their size- and book-to-market-ranked portfolios. Specifically, using the same set of Nasdaq firms as above, the subset of firms that have equity market values within 30% of the equity market value of the issuer are ranked according to book-to-market ratios. The size and book-to-market matched firm is the firm with the book-to-market ratio that is closest to the issuer's.

The book value of equity is measured in one of two periods: for offer dates in the first six months of the year, the book value is for the fiscal year-end two years earlier, and for offer dates in the second half of the year, the book value is for the prior fiscal year-end. Book value is defined as "the COMPUSTAT book value of stockholders equity, plus balance sheet deferred taxes and investment tax credits (if available), minus the book value of preferred stock. Depending on availability, we use the redemption, liquidation, or par value (in that order) to estimate the value of preferred stock"(Fama and French, 1993, p.8). If the issuer's book value is not available on COMPUSTAT for the year prior to the offering, we use the book value for the offering year. Matched firms are included for the full five-year holding period or until they are delisted, whichever occurs sooner. If a match delists, a new match is drawn from the *original* list of candidates described above.

2.2 Average leverage and liquidity

Table 1 shows average leverage ratios and measures of stock liquidity for the issue year and each of the five years following the issue. Panel (A) documents that IPO stocks have significantly lower leverage than the size-matched firms in year 0 (the year of the IPO) as well as in the two following years. This is true whether we measure leverage as the ratio of long-term debt to total assets, long-term debt to market value of equity, or total debt (current liabilities plus long-term debt) to total assets. We do not have data on actual leverage changes (i.e., equity issues and/or debt repurchases) other than the IPO itself. Of course, the IPO causes a substantial firm-reduction in leverage. Moreover, since IPO-companies are younger than the matched firms, they tend to have less collateral and may therefore have lower optimal leverage ratios. The lower debt policy may also be reinforced by the significant growth opportunities often found in private companies selecting to go public. As these growth opportunities are exercised and the firm builds collateral, the leverage ratios of IPO fiurms and the matched companies tend to converge, much as shown in Panel (A) over the five-year post-IPO period.

Panel (B) of Table 1 shows the average annual values of two alternative measures of liquidity. The first is the natural logarithm of stock price times the monthly volume of trade (in million shares), measured as 12-month averages. The second is the monthly turnover (trading volume divided by the number of shares outstanding). Each measure leads to the conclusion that IPO stocks are more liquid than the matched firms in each of the five years starting in year 1. In the case of the turnover variable, the difference in liquidity is statistically significant in every one of the five years. However, for IPOs the average monthly turnover is greatest immediately following the issue.

We now turn to an analysis of the return difference between IPO stocks and size-based matched firms, first using the standard matched-firm technique, and subsequently using factor models that are explicitly designed to capture potential risk-differences emanating from the differences in leverage and liquidity shown in Table 1.

3 IPO performance using the matched-firm technique

The matched-firm technique defines abnormal return simply as the difference in average holding-period (buy-and-hold) returns of issuing and non-issuing matched firms. Let R_{it} denote the return to stock i over month t, and let ω_i denote stock i's weight in forming the average holding-period return. The effective holding period for stock i is T_i which in this paper is either five years or the time until delisting, whichever comes first.[9] The percent weighted average holding-period return (BHR) across a sample of N stocks is given by

$$BHR \equiv \sum_{i=1}^{N} \omega_i \left[\prod_{t=\tau_i}^{T_i} (1 + R_{it}) - 1 \right] \times 100. \tag{1}$$

The five-year abnormal return (AR) following IPOs is then computed as the difference in BHR for issuers and their matched firms:

$$AR_{IPOs} \equiv BHR_{IPOs} - BHR_{matches}. \tag{2}$$

Table 2 shows performance estimates using size matching only and using size and book-to-market matching. Panel (A) shows that for the full sample of 5,173 IPOs the equally weighted average five-year buy-and-hold return for issuers is 35.6%. This average buy-and-hold return is very close to the average return reported by Brav, Geczy, and Gompers (1999), but about twice as high as the return reported by Loughran and Ritter (1995). The discrepancy between our result and the result of Loughran and Ritter (1995) is due to the extremely low returns earned by companies that went public during the period 1970–1972. The equal-weighted average five-year buy-and-hold return for size-matched firms is 72.3%, resulting in an average IPO underperformance of -36.7%. Again, this is somewhat smaller than the -50.7% average IPO underperformance reported by Loughran and Ritter (1995).

Interestingly, as shown in the right half of Table 2, the underperformance resulting from size matching disappears completely when matched firms are selected using both size and book-to-market ratio. The difference in average five-year buy-and-hold return between issuers and the size

[9] Our focus on a five-year holding period simplifies exposition and preserves the main findings of the literature using the matched-firm technique. While not shown here, using shorter holding periods (1-year, 2-year, .. 4-year) does not alter the main conclusions of this paper.

and book-to-market matched firms is now +10.7%. While the average return for issuers in this subsample of 4,315 IPOs is approximately the same as in the total sample (38%), adding book-to-market matching reduces the average holding-period return for the matched firms to 27.3%.

Restricting the analysis to the sample of 4,315 IPOs with available information on book-to-market ratio (Panel (B) of Table 2), does not alter this conclusion. In Panel (B), average buy-and-hold returns are 38.0% and 74.4% for issuers and matched firms, respectively, which is almost identical to the corresponding results for the full sample of 5,173 IPOs in Panel (A). In other words, the lack of underperformance when matching on size and book-to-market ratio is not driven by the loss of issuers from the sample due to non-availability of book value of equity.

Turning to Panel (C) of Table 2, and focusing first on the results for size matching, we see that IPO underperformance is greater (-73.7%) during the "hot issue" period 1980–1984. Greater underperformance following periods with greater issue activity is consistent with the "window-of-opportunity" hypothesis which holds that issuer time the IPO to periods where the market is more likely to overprice new issues (Ritter, 1991; Loughran and Ritter, 1995, 1999). However, Panel (C) also shows that IPO underperformance following the "hot issue" period is eliminated when matching on both size and book-to-market ratio. The average buy-and-hold return for matching firms is reduced from 79.5% using size-matching only, to 5.3% using both size and book-to-market ratio as the matching criteria. Again the elimination of IPO underperformance is not driven by the reduction in number of issuers (from 1,541 to 1,160) as the average buy-and-hold return for issuers only drop from 5.9% to 2.4%. In sum, using the matched-firm technique with both size and book-to-market matching, one cannot reject the hypothesis of zero average five-year abnormal performance following IPOs over the sample period.

Although the total sample shows evidence of zero average abnormal return using the size and book-to-market matching technique, Table 3 shows that this technique generates significant abnormal returns to the smallest Nasdaq issuers. The table reports five-year holding-period abnormal returns (issuer minus size and book-to-market matched firms) broken down by size and book-to-market quintiles. Panel (A) of the table contains the number of observations in each quintile, while Panel (B) shows percent abnormal return. Since our sample is restricted to Nasdaq issuers, the quintiles are defined using breakpoints for Nasdaq-listed stocks only. As a result, the distribution of issuers across the 25 quintile cells shown in Table 3 is very different from the distribution that occurs when breakpoints are determined using using NYSE firms only (as is commonly done in the literature). For example, Brav, Geczy, and Gompers (1999) find that 50% of IPOs are placed in the cell with the smallest size and the lowest book-to-market ratio. Panel (A) in Table 3 shows that with Nasdaq-generated breakpoints, only about 0.2% ($10/4315 \times 100$) of the IPOs are in this category. When looking at the size distribution in Panel (A), issuers are highly skewed towards low book-to-market ratios ("glamour" stocks), and slightly skewed towards big firms.

Turning to Panel (B) of Table 3, small issuers and issuers with high book-to-market ratio show underperformance relative to size and book-to-market matched firms, while large issuers and issuers with low book-to-market ratio show overperformance. The finding that "glamour" issuers show overperformance is a reflection of the result for the whole sample (these stocks represent 81% of the sample). Weighting the IPO underperformance in the two smallest size quintiles by the number of issuers in each quintile, the average five-year IPO underperformance is about -35% for small firms. This inability of size and book-to-market to explain the low return on small issuers is consistent with the finding of Brav, Geczy, and Gompers (1999), who report that the Fama-French three factor model is unable to explain the return on a portfolio of the tercile of smallest firms.

In sum, we show that the matched-firm technique produces significant buy-and-hold abnormal returns for the overall sample when matching firms are chosen based on size only, and that this underperformance is eliminated when matching on both size and book-to-market ratio. Unlike Loughran and Ritter (1999), we do not find IPO underperformance for "hot-issue" periods when controlling for size and book-to-market ratio. However, when looking at the IPO performance by size quintiles, we do find IPO underperformance for the two quintiles of the smallest firms.

We now turn to a closer scrutiny of the long-run abnormal performance following IPOs using regression models based, in particular, on macroeconomic risk factors. The objective is twofold: First, the factor model approach allows us to examine more fundamentally the determinants of the returns to IPO firms and their matches. This is interesting even if the average difference between the buy-and-hold returns to these two groups of firms is insignificantly different from zero, as shown above. Second, the factor model approach allows us to examine whether the evidence of abnormal performance generated by the matched-firm technique for the smallest stocks is compensation for risk.

4 Leverage and expected returns to IPO stocks

In this section we report abnormal returns to portfolios of issuing and matched firms defined using a factor model with leverage-related risk factors. Since the matched-firm technique of the previous section indicates that small IPO stocks have lower returns that their matches, the regression results help answer the question of whether the lower returns is the result of "market mispricing" of IPO stocks or whether these stocks are simply "less risky". The most powerful answer to these questions comes from examining the abnormal return to a zero-investment portfolio strategy where you short the IPO stock and go long in the matched firm, with a holding period of five years. The matched-firm technique holds that the total return from this portfolio strategy should be zero unless the market misprices IPO stocks. The factor model approach is more agnostic in that it allows the data to determine the part of the average portfolio return that represents compensation for risk (as indicated by the model risk factors).

4.1 Model specification and factor mimicking

Let r_{pt} denote the return on portfolio p in excess of the risk-free rate, and assume that expected excess returns are generated by a K-factor model,

$$E(r_{pt}) = \beta_p' \lambda, \tag{3}$$

where β_p is a K-vector of risk factor sensitivities (systematic risks) and λ is a K-vector of expected risk premiums. This model is consistent with the APT model of Ross (1976) and Chamberlain (1988) as well as with the intertemporal (multifactor) asset pricing model of Merton (1973).[10] The excess-return generating process can be written as

$$r_{pt} = E(r_{pt}) + \beta_p' f_t + e_{pt}, \tag{4}$$

where f_t is a K-vector of risk factor shocks and e_{pt} is the portfolio's idiosyncratic risk with expectation zero. The factor shocks are deviations of the factor realizations from their expected values, i.e., $f_t \equiv F_t - E(F_t)$, where F_t is a K-vector of factor realizations and $E(F_t)$ is a K-vector of factor

[10] Connor and Korajczyk (1995) provide a review of APT models.

expected returns.

Regression equation (4) requires specification of $E(F_t)$, which is generally unobservable. However, consider the excess return r_{kt} on a "factor-mimicking" portfolio that has unit factor sensitivity to the kth factor and zero sensitivity to the remaining $K-1$ factors. Since this portfolio must also satisfy equation (3), it follows that $E(r_{kt}) = \lambda_k$. Thus, when substituting a K-vector r_{Ft} of the returns on factor-mimicking portfolios for the raw factors F, equations (3) and (4) imply the following regression equation in terms of observables:

$$r_{pt} = \beta_p' r_{Ft} + e_{pt}. \tag{5}$$

Equation (5) generates stock p's returns. Thus, inserting a constant term α_p into a regression estimate of equation (5) yields a measure of abnormal return. We employ monthly returns, so this "Jensen's alpha," first introduced by Jensen (1968), measures the average monthly abnormal return to a portfolio over the estimation period.

As listed in Panel (a) of Table 4, the model contains a total of six factors: the value-weighted CRSP market index (RM), the seasonally adjusted percent change in real per capita consumption of nondurable goods (RPC), the difference in the monthly yield change on BAA-rated and AAA-rated corporate bonds (BAA−AAA), unexpected inflation (UI), the return spread between Treasury bonds with 20-year and one-year maturities (20y−1y), and the return spread between 90-day and 30-day Treasury bills (TBILLspr). These are the same factors that are used in Eckbo, Masulis, and Norli (1999) in their study of the performance after seasoned security offerings, and similar factors also appear in, Ferson and Harvey (1991), Evans (1994), Ferson and Korajczyk (1995), and Ferson and Schadt (1996).[11]

Of the six factors, three are themselves security returns, and we create factor-mimicking portfolios for the remaining three, RPC, BAA−AAA, and UI. Factor-mimicking portfolio are constructed by first regressing the return of each of the 25 size and book-to-market sorted portfolios of Fama and French on the set of six factors. These 25 time-series regressions produce a (25×6) matrix B

[11] The returns on T-bills, and T-bonds as well as the consumer price index used to compute unexpected inflation are from the CRSP bond file. Consumption data are from the U.S. Department of Commerce, Bureau of Economic Analysis (FRED database). Corporate bond yields are from Moody's Bond Record. Expected inflation is modeled by running a regression of real T-bill returns (returns on 30-day Treasury bills less inflation) on a constant and 12 of its lagged values.

of slope coefficients against the six factors. If V is the (25×25) covariance matrix of error terms for these regressions (assumed to be diagonal), then the weights used to construct mimicking portfolios from the 25 Fama-French portfolios are formed as

$$w = (B'V^{-1}B)^{-1}B'V^{-1}. \tag{6}$$

For each factor k, the return in month t on the corresponding mimicking portfolio is determined by multiplying the kth row of factor weights with the vector of month t returns for the 25 Fama-French portfolios. Mimicking portfolios are distinguished from the underlying macro factors ΔRPC, BAA−AAA, and UI using the notation $\widehat{\Delta\text{RPC}}$, $\widehat{\text{BAA} - \text{AAA}}$, and $\widehat{\text{UI}}$.

As shown in Panel (B) of Table 4, the factor-mimicking portfolios are reasonable: they have significant pairwise correlation with the raw factors they mimic, and they are uncorrelated with the other mimicking portfolios and the other raw factors. Moreover, Panel (C) of Table 4 shows that when we regress the mimicking portfolios on the set of six raw factors, it is only the own-factor slope coefficient that is significant.[12] Turning to Panel (D) of Table 4, the pairwise correlation coefficient between the six macroeconomic factors ranges from a minimum of −0.090 between TBILLspr and $\widehat{\text{UI}}$, and a maximum of 0.403 between TBILLspr and 20y−1y.

We now turn to the estimation of this macro-factor model using portfolios of IPO stocks and their control firms matched on size only. Size-matching allows us to directly examine whether the long-run IPO underperformance estimates reported by Ritter (1991) and others are robust when adjusting for risk using our factor model. Moreover, size-sorting allows us to examine whether our macro-factor model succeeds in pricing IPO stocks where the size-and-book-to-market matching technique shown in Table 3 does not.

[12]Let b_k be the kth row of B. The weighted least squares estimators in (6) are equivalent to choosing the 25 portfolio weights w_k for the kth mimicked factor in w so that they minimize $w_k'Vw_k$ subject to $w_kb_i = 0$, $\forall k \neq i$, and $w_k'b_k = 1$, and then normalizing the weights so that they sum to one. Lehmann and Modest (1988) review alternative factor mimicking procedures. As they point out, the normalization of the weights will generally produce own-factor loadings, as those listed in Panel (C) of Table 4, that differ from one.

4.2 Performance estimates with constant factor loadings

We estimate the parameters in the following macro-factor model:

$$r_{pt} = \alpha_p + \beta_1 \mathrm{RM}_t + \beta_2 \widehat{\Delta \mathrm{RPC}}_t + \beta_3 (\mathrm{BA}\widehat{\mathrm{A} - \mathrm{A}}\mathrm{AA})_t + \beta_4 \widehat{\mathrm{UI}}_t + \beta_5 (20\mathrm{y} - 1\mathrm{y})_t + \beta_6 \mathrm{TBILLspr}_t + e_t, \tag{7}$$

where e_t is a mean zero error term in month t, and the constant term (Jensen's alpha) is the average monthly abnormal return to portfolio p. The model is estimated using OLS with standard errors computed using the heteroscedasticity-consistent estimator of White (1980).

Table 5 reports total sample estimates of Jensen's alpha and factor loadings for six portfolios: equal-weighted (EW) and value-weighted (VW) portfolios consisting of IPO-stocks only ("Issuer"), size-matched firms only ("Match"), and the zero investment portfolio short in IPO stocks and long in the matched firms ("Zero"). Thus, for IPO stocks to underperform the size-matched firms (which would be consistent with the evidence presented earlier in Table 2) the estimate of alpha for the zero investment portfolio must be positive.

Notice first that four of the six alpha estimates in Table 5 are negative and all are insignificant at the five percent level. In the last row, where the dependent variable is the excess return to the value-weighted zero-investment portfolio, the estimate of Jensen's alpha is negative and marginally significant with a p-value of 5.3% indicating that, if anything, IPO stocks tend to *outperform* the size-based matched firms. However, the overall inference from the alpha estimates in Table 5 is that the monthly abnormal performance of IPO stocks is statistically indistinguishable from the average monthly abnormal performance of the corresponding size-matched firms. In other words, the underperformance of IPO stocks generated by the matched firm technique and reported earlier in Table 2 is eliminated once we take into account the differential exposures (factor loadings) of IPO stocks and matched firms to the macroeconomic risk factors in our regression model.

Turning to the individual factor loadings reported in Table 5, IPO stocks have a significantly greater exposure to the market return (RM). For both equal-weighted and value-weighted portfolios, the market beta for IPO stocks is 1.4 versus 1.0 for the matched firms. In other words, this risk factor *reduces* the expected return to our zero-investment portfolio (since this portfolio is short in issuer stocks). Thus, the contribution of the market risk factor itself is to make the evidence of IPO underperformance shown in Table 2 even more puzzling. For this underperformance to be explained in terms of compensation for differential risk exposure, there must exist other, non-market risk factors that reduces the expected return to IPO stocks relative to size-matched firms.

Table 5 shows that, of the other non-market risk factors, the percent change in real per capita consumption of non-durable goods (ΔRPC) is statistically significant and positive for each of the issuer- and match portfolios. Thus, expected portfolio returns are increasing in this factor. However, since the factor loadings are equal across the two portfolios (with a value of 0.03 for EW-Issuer and EW-Match), this particular risk factor does not contribute to our understanding of the the *differential* risk exposure of IPO stocks versus size-matched firms.

The third risk factor in Table 5, the credit spread (BAA–AAA) is statistically insignificant with the exception of the value-weighted issuer portfolio where the factor loading equals 0.01 and is significant at the 1% level. Again, this factor does not contribute much to the differential return on the issuer- and matched-firm stocks.

Interestingly, the remaining three risk factors combine to more than offset the strong impact of the market index on issuer expected returns. First, while unexpected inflation (UI) increases the expected return to the equal-weighted portfolio of issuers, it does so only marginally and by a smaller amount than the matched firms (the factor loadings are .03 and .04 for EW-issuer and EW-Match, respectively). Moreover, with value-weighting, the factor loading for the issuer portfolio is significantly negative. Overall, although the magnitude is small, there is a tendency for shocks to unexpected inflation to lower issuer returns relative to matched-firm returns.

Second, most of the offsetting effect comes from the long-term spread (20y–1y) and the short T-bill spread (TBILLspr). Both factors produce relatively large factor loadings and they invariably reduce the expected returns to issuer firms. Equal-weighted portfolios have significant loadings on the term spread factor, while value-weighted portfolios tend to have significant loadings on the T-bill-spread factor. These two factors lead to an increase in the expected return on the zero-investment portfolio (reflecting lower expected returns on IPO stocks than on matched-firm stocks) which is economically and statistically significant.[13]

Overall, the evidence in Table 5 indicate that while issuing firms have higher exposure to market

[13] A discussion of each factor's percentage contribution to the portfolio's expected return is given in Section 6 (and Table 11), below.

risk, the effect of the market factor is more than offset by lower post-issue exposure to unanticipated inflation and the spreads at both the short- and the long ends of the term structure. A consistent explanation is that, since the IPO lowers leverage, issuers' exposures to unexpected inflation and term premium risks decrease, thus decreasing their stocks' expected returns relative to matched firms. The result is a value of Jensen's alpha for the zero-investment portfolio that is insignificantly different from zero.

Recall from Table 3 that, while matching on both size and book-to-market ratio tends to eliminate abnormal performance in the overall sample, it leaves significant IPO underperformance in the subsample of smaller issuers and significant overperformance in the subsample of larger issuers. To examine the effect of size on our estimates of Jensen's alpha, Table 6 shows estimates of alphas and factor loadings for portfolios classified by size-quintile membership. Again, keep in mind that a positive alpha for the zero-investment portfolio indicates IPO overperformance while a negative alpha follows from IPO overperformance. Of the eight values of Jensen's alpha for the zero-investment portfolios, three are significant at the 5% level and, of these, two have a positive sign. The significantly positive alphas occur in size-quintile 3, with estimated values of 0.89 (p-value of 0.001) for the EW portfolio and 0.76 (p-value of .009) for the VW portfolio. The remaining alpha estimates across the quintiles are either insignificant or indicating IPO overperformance (quintile 5, VW portfolio). As shown in Section 5 below, the significant abnormal return to the zero-difference portfolio in size-quintile 3 is robust also to using alternative factor models.

In sum, the results of our macro-factor model estimation for the overall sample fail to reject the hypothesis of zero abnormal performance following IPOs. The estimated factor loadings indicate that during the post-issue period, IPO stocks are on average less risky—and thus require lower expected returns—than stocks of size-matched firms. As a corollary, the "underperformance" of IPO stocks produced by the matched-firm technique and listed in Table 2 and Table 3 arises as a result of rational market pricing in a multi-factor setting. There is, however, some residual evidence of underpricing of IPOs in the third size quintile. In the remainder of this section we examine alternative factor model specifications in order to check for the robustness of these results.

4.3 Conditional performance estimation

The above estimation of model (7) assumes that the factor loadings (β) are constant through time. In light of the growing evidence that expected returns are predictable using publicly available information (see, e.g., Ferson (1995) for a review), it is instructive to reexamine the null hypothesis of zero abnormal performance when Jensen's alpha is estimated in a conditional factor model framework.

We follow Ferson and Schadt (1996) and assume that factor loadings are linearly related to a set of L known information variables Z_{t-1}:

$$\beta_{1pt-1} = b_{p0} + B_{p1} Z_{t-1}. \tag{8}$$

Here, b_{p0} is a K-vector of "average" factor loadings that are time-invariant, B_{p1} is a $(K \times L)$ coefficient matrix, and Z_{t-1} is an L-vector of information variables (observables) at time $t-1$. The product $B_{p1}Z_{t-1}$ captures the predictable time variation in the factor loadings. After substituting Eq. (8) into Eq. (5), the return-generating process becomes

$$r_{pt} = b'_{p0} r_{Ft} + b'_{p1}(Z_{t-1} \otimes r_{Ft}) + e_{pt}, \tag{9}$$

where the KL-vector b_{p1} is $\text{vec}(B_{p1})$ and the symbol $\otimes$ denotes the Kronecker product.[14] Again, we estimate this factor model adding a constant term, α_p, that equals zero under the null hypothesis of zero abnormal returns.

The information variables in Z_{t-1} include the lagged dividend yield on the CRSP value-weighted market index, the lagged 30-day Treasury bill rate, and the lagged values of the credit and yield curve spreads, BAA$-$AAA and TBILLspr, respectively. The resulting estimates of Jensen's alpha are given in Panel (A) of Table 7. Since the factor loadings change over time they are not reported in the table. However, the effect of predictability is relatively small. In fact, for the overall sample and for most size-quintiles, we cannot reject the hypothesis that the estimates of α with time-varying factor loadings in Panel A of Table 7 equal the estimates of α with constant betas in Table 5 and Table 6.

[14]The operator vec($\cdot$) vectorizes the matrix argument by stacking each column starting with the first column of the matrix.

As shown in Panel A of Table 7, the conditional estimation yields an insignificant alpha for the equal-weighted zero-investment portfolio. For value-weighted portfolios, the estimated value of alpha is significant at the 5% level (p-value of 0.024) but has a negative sign, indicating overperformance of IPO stocks. Overall, the conditional estimation does not support the hypothesis that IPO stocks underperform non-issuing firms matched on firm size.

4.4 Principal components as factors

In this section, we replace our macro-factor model with a model using factors extracted from the covariance matrix of returns using the principal components approach of Connor and Korajczyk (1988).[15] While these factors do not have intuitive economic interpretations, they are by construction consistent with APT theory and thus provide an alternative view of the pricing structure. The resulting alpha estimates are reported in Panel B of Table 7. This model produces a significantly positive alpha of 0.47 (p-value 0.002) for the equal-weighted zero-investment portfolio. The value-weighted portfolio now has a statistically insignificant alpha. The significant underperformance for the equal-weighted portfolio is largely a result of the large and negative alpha this model produces for the equal-weighted issuer portfolio itself. We return in Section 6 below to a discussion of the relative economic importance of this factor model when compared to alternative model specifications.

5 Liquidity and expected returns to IPO stocks

5.1 Liquidity factor construction

Brennan and Subrahmanyam (1996), Datar, Naik, and Radcliffe (1998), and Brennan, Chordia, and Subrahmanyam (1998) find that stock expected returns are cross-sectionally related to stock liquidity measures. In particular, share turnover appears to be a priced asset characteristic that lowers a stock's expected return. This suggests that, since IPO firms have significantly higher liquidity than matched firms (Table 1), they are also less risky and should command lower expected returns than the matched firms over the post-issue period.

We examine this proposition using a factor model that includes liquidity as a risk factor. This

[15]We thank Robert Korajczyk for providing us with the return series on these factors.

serves to link our IPO performance analysis to the asset pricing literature more generally, and it provides new information on the role of liquidity as a determinant of expected returns. Absent a theoretically "best" definition of liquidity, our approach is agnostic, and we use both monthly turnover (TO, defined as the number of shares traded over the month divided by number of shares outstanding) and the monthly dollar value of trades (PVOL, defined as stock price times number of shares traded).

We construct the two liquidity factors using an algorithm similar to the one used by Fama and French (1993) when constructing their size (SMB) and book-to-market ratio (HML) factors. To construct TO, we we start in September 1972 and form two portfolios based on a ranking of the end-of-month market value of equity and three portfolios formed using stocks ranked on TO. Next, six portfolios are constructed from the intersection of the two market value and the three turnover portfolios. Monthly value-weighted returns on these six portfolios are calculated starting in October 1972. Portfolios are reformed in January, April, July, and October, using firm rankings from the previous month. The TO portfolio is the difference between the equal-weighted average return on the two portfolios with low turnover and the equal-weighted average return on the two portfolios with high turnover. The PVOL portfolio is constructed the same way, using PVOL instead of TO to construct the liquidity rankings.[16] When Fama and French constructed their SMB and HML factors, the idea was to "mimic the underlying risk factors in returns related to size and book-to-market equity." Their procedure tries to accomplish this goal by making sure that the average size for the firms in the three book-to-market portfolios is the same, while also maintaining the same average book-to-market ratio for the two size portfolios. The idea behind PVOL and TO is similar, but we try to capture the risk factor in return related to liquidity.

5.2 Model estimates

Having constructed the two liquidity factors, we place these in a six-factor model that in addition includes the three Fama-French factors (the market index RM, SMB and HML)[17] as well as a momentum mimicking portfolio labeled PR1YR. This momentum factor is constructed in a similar way as the momentum factor used by Carhart (1997). In particular, each month we form a high-

[16]Comparing this procedure with the one used by Fama and French to create SMB and HML, TO and PVOL "plays the role" of the book-to-market ratio.

[17]We thank Ken French for providing us with the return series on these factors.

performance portfolio ("winners") and a low-performance portfolio ("losers") based on buy-and-hold returns over the previous 12 months. The portfolio of winners contains the third of the firms which have the highest buy-and-hold return, while the portfolio of losers contains the third of the firms with the lowest buy-and-hold return. The portfolio returns are value-weighted, and PR1YR is the return on the portfolio long in the winner-portfolio and short in the loser-portfolio.

Table 8 shows the mean, standard deviation and pairwise correlations for the six risk factors. In Panel A, notice that the mean return on the two liquidity factors are positive. Recall that both factors are portfolios long in low-liquidity stocks and short in high-liquidity stocks. Thus, to the extent that illiquid stocks are more "risky" than liquid stocks, they have higher average returns and thus the factor portfolios have positive returns on average.

As shown in Panel B, the correlation between the two liquidity factors is 0.64, reflecting the fact that they are constructed to capture the same underlying risk factor. The two liquidity portfolios also have a relatively low correlation with the SMB portfolios. This is not surprising since the portfolio of high liquidity stocks and the portfolio of low liquidity stocks are constructed to have the same average size. However, the HML portfolio is positively related to both PVOL and TO. This is likely a reflection of the fact that they are constructed in the same way as HML relative to size sorted portfolios. The momentum mimicking portfolio (PR1YR) does not show any strong correlation with the other characteristic-based mimicking factors, suggesting that these portfolios mimic underlying risk factors not captured by the other factor portfolios.

The results of the estimation are shown in Table 9. Starting with the original Fama-French model in the top half of the table, there is little evidence of significant IPO underpricing. Jensen's alpha for the equal-weighted zero-investment portfolio is an insignificant 0.22 (p-value of 0.153), while value-weighting causes the IPO stocks to weakly *over*perform the size-matched firms (alpha of -0.44, p-value of 0.07). Moreover, moving to the expanded model in the second half of Table 9, the alphas of the zero-investment portfolios are uniformly insignificantly different from zero.

As seen in Table 9, adding the momentum and liquidity factors tends to improve the fit of the original Fama-French regression. For example, for the equal-weighted IPO portfolio, the R^2 increases from 0.870 in the Fama-French model to 0.885 in our expanded model. With value-weighted portfolios, the increase in R^2 is from 0.807 to 0.832. Notice also that for value-weighted portfolios, adding the three factors appears to reduce the significance of the original book-to-market

(HML) factor.

The momentum factor is significant at a 5% level or higher only for value-weighted portfolios, while the liquidity factors have the greatest level of significance for the equal-weighted portfolios. Both the EW and the VW issuer portfolios have negative factor loadings with the turnover factor TO, as expected. Thus, greater liquidity lowers expected return, and the reduction is greater for issuer stocks than for the matched firms. The liquidity factor TO produces the strongest evidence of a differential effect on issuer and matching firms for equal-weighted portfolios: The loading on this factor is -0.36 (p-value of 0.003) for the EW-zero portfolio. The expected zero-investment portfolio return is increasing in the liquidity premium because matched firms have lower liquidity than IPO stocks.

Table 10 presents the results of the expanded Fama-French regressions performed on portfolios of stocks sorted by size quintiles. Again, the main purpose is to test for significant abnormal returns (alphas) to the zero-investment portfolios, and to examine the impact of the liquidity risk factors. The results for the alphas closely mimic the results for the macro-factor model in Table 6: monthly abnormal returns are generally insignificantly different from zero (on a 5% level) except for in the third size quintile. In size quintile 3, the alphas are positive and significant, indicating significant underperformance of IPO stocks. In this size quintile, the estimate of alpha equals 0.81% per month for the equal-weighted zero-investment portfolio (p-value of 0.000), and 0.85% for the value-weighted zero-investment portfolio (p-value of 0.001). The corresponding values of alpha when using the macro-factor model in Table 6 are similar: 0.89% for EW-zero (p-value 0.001) and 0.76% for VW-zero (p-value 0.009). In sum, while the two factor models generate zero average abnormal performance for the overall sample as well as for four of the five size-quintiles, the hypothesis of zero abnormal performance is rejected for size-quintile 3.

In the next section, we present a direct comparison of the contribution of each factor to total portfolio returns, using each of the four factor models estimated in the paper. This provides a unique perspective on the role played by the various risk factors in relation to the others, and it provides our final illustration of why IPO stocks are on average less risky than the matched firms.

6 Individual factor contributions to expected portfolio returns

In this section, we compute the product of the mean monthly factor returns over the sample period and the portfolio factor loadings reported throughout the paper. Since all the factors are in the form of returns (either directly, or via factor-mimicking portfolios), the product of the factor loading and the average factor realization equals the total monthly portfolio return premium generated by the risk factor.[18] These return premiums are shown in Table 11 for each of the four factor models discussed throughout the paper. Moreover, the table shows the average monthly portfolio excess return in the first column followed by the average monthly model return (i.e., the portfolio expected return given by the model). Since the main purpose of this section is expository, the earlier information on significance levels is left out.[19]

The most noticeable feature of Table 11 is the predominant impact of the market risk factor RM in each of the three models where this factor appears. This factor generates 94% (.78/.81) of the total return generated by the macro-factor model, 77% of the Fama-French three-factor model, and approximately all of the total model return under the six-factor, extended Fama-French model. The monthly total market risk premium for the equal-weighted issuer portfolio ranges from 0.52% in the extended Fama-French model to 0.78% in the macro-factor model. The difference between the total model (expected) return and the market risk premium is 0.03% (0.81-0.78) for the macro-factor model, 0.16% (0.73-0.57) for the Fama-French model, and 0.21% (0.73-0.52) in the expanded Fama-French model. Of course, while these magnitudes are small, they reflect much greater differences in the total monthly risk premiums of each of the remaining risk factors.

It is apparent from panel A of Table 11 that the portfolio of matched firms receives a greater return contribution from the three leverage-related risk factors UI, 20y–1y, and TBILLspr than does

[18] This, of course, is just a restatement of Eq. (5). The sample factor means are given in Table 4 and Table 8 and are not repeated here.

[19] It is useful to establish the link between the five-year (60-month) average buy-and-hold returns (BHR) in Table 2 and the average monthly (excess) portfolio return in Table 11. Recall that BHR is computed by first compounding the individual returns and then calculating the average. Alternatively, one could compound the average monthly portfolio return shown in the first column of Table 11 (after adding back the average risk-free return). Depending on the diversification effect of forming portfolios, the two compounded returns can be substantially different. To illustrate, the equal-weighted BHR for the matched firms in Table 2 is 72.3%. If we compound the equal-weighted average monthly return to matched firms in Table 11 we get only 58.8% ($(1+.0072+.00054)^{60}-1$). The corresponding compounded values for the equal-weighted issuer portfolio are 35.6% (BHR) and 40.1% ($(1+.0051+.00054)^{60}-1$), respectively. Thus, if we were to compound the portfolio average return, the matched-firm technique generates an IPO underpricing of only -18.7% (40.1% - 58.8%) compared to the -36.7% (35.6% - 72.3%) resulting from the BHR method in Table 2. Thus, as also pointed out by Mitchell and Stafford (1997), a simple change in compounding cuts the magnitude of the original IPO underpricing by almost 50%.

the portfolio of issuers. For example, for equal-weighted portfolios, the short spread (TBILLspr) adds 0.101% per month to the matched-firm portfolio, while it subtracts 0.045% from the issuer portfolio return. Similarly, unexpected inflation (UI) adds a monthly return of 0.093% to the matched firms and 0.078% to the issuer portfolio. Again, as argued earlier, the lower leverage of issuing firms (Table 1) reduces the portion of the issuers' expected return generated by leverage-related risk factors. Specifically, these three factors adds a monthly expected return of 0.237% (0.093-0.036+0.101) for the equally weighted portfolio of matched firms and subtracts -0.28% (0.078-0.061-0.045) per month for the corresponding portfolio of IPO stocks.

Turning to the liquidity factor, the net contribution of PVOL and TO in Panel D of Table 11 is to reduce the expected return to the equal-weighted issuer portfolio by 0.017% (0.045 - 0.062) per month, and 0.093% (-0.056 - 0.037) for value-weighted issuers. The reduction in expected return to the portfolios of IPO stocks coming from the liquidity factors is a direct manifestation of the greater liquidity (and therefore lower risk) of IPO stocks relative to the size-based matched firms.

7 Conclusion

This paper examines, using a factor-pricing framework, the contention of Ritter (1991) and Loughran and Ritter (1995) that IPO stocks underperform non-IPO stocks matched on equity size over a three-to-five year period following the IPO date. To the extent that the matched-firm technique provide unbiased measures of true abnormal performance, the Loughran-Ritter evidence challenges the classical market efficiency hypothesis and instead suggests that the marginal investor is slow to assimilate publicly available information.

The starting point of this paper is the distinct possibility that the matched-firm procedure omits important risk factors. Using a sample exceeding 5,000 Nasdaq IPOs from 01/73–12/96, we first document that IPO stocks have significantly lower leverage and higher liquidity in each of the three years immediately following the IPO date. There is theoretical reason to suspect that both factors are priced, and that lower leverage and greater liquidity reduces risk and, therefore, expected stock return. If so, the Loughran-Ritter "underperformance" may be driven entirely by omitted risk factors.

We examine the omitted-risk-factor hypothesis through the lens of alternative factor models. The primary target of our factor model analysis is the zero-investment portfolio long in size-based matched firms and short in IPO stocks, i.e., the portfolio return which the Loughran-Ritter matched-firm technique equates with abnormal performance. Since this portfolio return represents the return *difference* between the matched and issuer stocks, it is less susceptible to omitted-factor bias (beyond those factors included in the model) than, say, a portfolio long in IPO stocks alone.

We examine the effect of the lower leverage of IPO stocks through the factor model also studied by Eckbo, Masulis, and Norli (1999) in the context of SEOs. This model uses a set of macroeconomic risks, including leverage-related factors such as unexpected inflation and terms spreads. The return to the zero-investment portfolio exhibits significant factor loadings, and we confirm that the portfolio of IPO stocks have significantly lower exposures to the leverage-related risk factors. After adjusting for the impact of the risk premiums on expected portfolio returns, we cannot reject the hypothesis of zero abnormal return to the zero-investment portfolio. This conclusion is shown to be robust to alternative model specifications, including the use of conditioning information (for time-varying factor loadings) and a factor model that uses as factors the asymptotic principal components of Connor and Korajczyk (1988).

We then examine the effect of the higher liquidity of IPO stocks by constructing a Fama-French type factor model that includes momentum and liquidity as additional risk factors. The liquidity factors are highly significant, and the contribution of the liquidity factors is to lower the expected return to IPO stocks relative to the size-matched firms. Again, the hypothesis of zero average monthly abnormal return to the zero-investment portfolio (long in matched firms and short in issuers) cannot be rejected on the total sample using this liquidity-based factor model either.

Finally, the paper provides a perspective on the magnitude of the contribution to portfolio expected return provided by each risk factor studied throughout the paper. Not surprisingly, the market factor alone accounts for more than three-quarters of the total expected portfolio return for both issuers and matched firms, with a monthly risk premium ranging from 0.55% to 0.75%. The remaining portfolio return is generated by the various additional risk factors, with each factor typically contributing less than 0.10% per month. However, a factor contribution of 0.10% is economically significant: the monthly risk-free rate represents approximately 0.05%, and the total IPO "underpricing" generated by the matched-firm technique itself (and which is eliminated using our factor models) translates into approximately -0.18% per month.

In their study of seasoned equity and debt offerings, Eckbo, Masulis, and Norli (1999) conclude that the factor model approach to expected return resolves what Loughran and Ritter (1995) label the "new issues puzzle", i.e., the puzzling underperformance of issuing firms relative to theire size-based matches. The results of this paper resolves the "new issues puzzle" also for IPO stocks. IPO stocks have lower expected return than size-matched companies because they are less risky in terms of factors related to both leverage and liquidity.

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Figure 1
Annual Distribution of the 5,173 Nasdaq-IPOs in the Sample, 01/73–12/96.

The columns represent the sample total, and the bottom (dark) part of the columns is the number of sample IPOs for which we also have Compustat information on book-to-market ratios (totaling 4,315 cases).

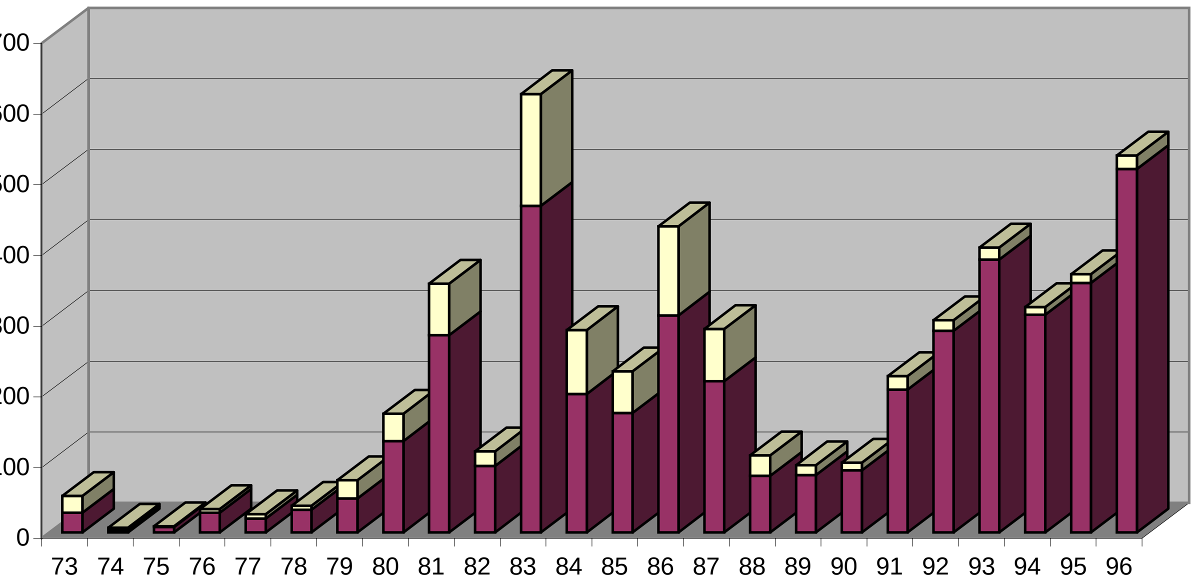

Table 1

Average annual leverage ratios and liquidity for firms going public on Nasdaq and their non-issuing control firms matched on size, over the 1973–1996 sample period.

The leverage variables are computed using long-term debt, total debt (long-term debt plus total current liabilities), and total assets at the end of the fiscal year (as reported by COMPUSTAT). Market values are measured at the end of the calendar year. Observations whith long-term debt or total debt is larger than total assets are excluded (0.24% and 1.54% of the observations respectively). The liquidity measure price-times-volume is measured in ln(million dollar), while turnover is volume divided by number of shares outstanding. The liquidity variables are measured from the first January after the offer date, and are measured as 12 month averages, except for the last year in the holding period, where averages are computed only for the months until the five-year anniversary (or the delisting month if the issuer is delisted before the five-year anniversary).

(A) Leverage

	Long-term debt divided by total assets				Long-term debt divided by market value of equity				Total debt divided by total assets			
Year	N	Issuer	Match	p-diff	N	Issuer	Match	p-diff	N	Issuer	Match	p-diff
0	4118	0.108	0.151	0.000	4110	0.171	0.478	0.000	3880	0.342	0.422	0.000
1	3995	0.126	0.154	0.000	3947	0.296	0.506	0.000	3728	0.370	0.422	0.000
2	3217	0.145	0.152	0.142	3151	0.408	0.501	0.009	2963	0.399	0.424	0.000
3	2699	0.153	0.152	0.698	2634	0.498	0.555	0.244	2463	0.415	0.421	0.330
4	2186	0.154	0.152	0.778	2133	0.603	0.607	0.951	1984	0.416	0.422	0.435
5	1735	0.152	0.151	0.872	1687	0.623	0.596	0.735	1564	0.418	0.422	0.551

(B) Liquidity

	Monthly average price-times-volume				Monthly average turnover			
Year	N	Issuer	Match	p-diff	N	Issuer	Match	p-diff
1	4995	14.546	14.393	0.000	4995	0.118	0.099	0.000
2	4252	14.437	14.331	0.025	4252	0.111	0.082	0.000
3	3580	14.368	14.359	0.858	3580	0.106	0.071	0.000
4	2937	14.282	14.411	0.041	2937	0.101	0.066	0.000
5	2091	14.224	14.421	0.012	2091	0.094	0.062	0.000

Table 2

Five-year buy-and-hold stock percent returns (BHR) to firms going public on Nasdaq and their matched control firms, classified by type of matching procedure (size/size-and-book-to-market), sample period, and portfolio weights (equal-/value-weighted), 01/73–12/96.

Buy-and-hold percent returns are defined as:

$$BHR \equiv \omega_i \sum_{i=1}^{N} \left[\prod_{t=\tau_i}^{T_i} (1 + R_{it}) - 1 \right] \times 100.$$

When equal-weighting (EW), $\omega_i \equiv 1/N$, and when value-weighting (VW), $\omega_i = MV_i/MV$, where MV_i is the firm's common stock market value (in 1995 dollars) of the issuer at the start of the holding period and $MV = \sum_i MV_i$. The abnormal buy-and-hold returns shown in the column marked "Diff" represent the difference between the average BHR in the "Issuer" and "Match" columns. The rows marked "N" contain number of issues. The p-values for equal-weighted abnormal returns are p-values of the t-statistic using a two-sided test of no difference in average five-year buy-and-hold returns for issuer and matching firms. The p-values for the value-weighted abnormal returns are computed using $U \equiv \omega' x/(\sigma\sqrt{\omega'\omega})$, where ω is a vector of value weights and x is the corresponding vector of differences in buy-and-hold returns for issuer and match. Assuming that x is distributed normal $N(\mu, \sigma^2)$ and that σ^2 can be consistently estimated using $\sum_i \omega_i (x_i - \bar{x})^2$, where $\bar{x} = \sum_i \omega_i x_i$, U is distributed $N(0, 1)$.

	Size matching					Size/book-to-market matching				
	N	Issuer	Match	Diff	$p(t)$	N	Issuer	Match	Diff	$p(t)$
(A) Total sample										
EW	5173	35.6	72.3	−36.7	0.000	4315	38.0	27.3	10.7	0.023
VW	5173	144.4	79.7	64.7	0.001	4315	143.7	34.2	109.5	0.000
(B) Subsample with book-to-market ratios on Compustat										
EW	4315	38.0	74.4	−36.4	0.000					
VW	4315	144.2	80.4	63.8	0.003					
(C) "Hot-issue" sample 1980–1984										
EW	1541	5.9	79.5	−73.7	0.000	1160	2.4	5.3	−2.9	0.686
VW	1541	152.2	95.5	56.7	0.242	1160	166.8	15.7	151.1	0.010

Table 3

Equal-weighted average differences in five-year buy-and-hold stock returns (%) between firms going public on Nasdaq and non-issuing control firms matched on size and book-to-market ratio, grouped by size (market value of equity) and book-to-market quintiles, 01/73–12/96 period.

Buy-and-hold percent returns are defined as:

$$BHR \equiv \frac{1}{N}\sum_{i=1}^{N}\left[\prod_{t=\tau_i}^{T_i}(1+R_{it})-1\right]\times 100.$$

The average abnormal buy-and-hold returns reported in Panel (B) are computed as the average BHR for issuers minus the average BHR for firms matched on size and book-to-market ratio. firms. The quintile breakpoints are created using Nasdaq listed firms only. The size quintiles are ordered from Small to Big, and the book-to-market quintiles are ordered from Low to High. The parentheses contain p-values computed using the t-statistic for the return difference between issuer and matching firm.

	Small	2	3	4	Big	All
(A) Number of observations						
Low	66	348	481	635	700	2230
2	59	227	326	444	206	1262
3	30	96	181	205	58	570
4	9	29	63	51	18	170
High	10	18	25	16	14	83
All	174	718	1076	1351	996	4315
(B) Size/book-to-market matched control firms						
Low	−125.1 (0.024)	−5.6 (0.713)	15.4 (0.115)	46.3 (0.000)	89.0 (0.000)	39.9 (0.000)
2	−41.9 (0.064)	−35.1 (0.003)	12.7 (0.629)	5.0 (0.622)	2.1 (0.921)	−2.9 (0.743)
3	−33.8 (0.418)	−34.9 (0.129)	−10.8 (0.464)	−75.5 (0.008)	−16.8 (0.460)	−39.9 (0.001)
4	−169.5 (0.205)	−97.4 (0.057)	−10.7 (0.515)	−69.6 (0.032)	−50.6 (0.232)	−55.8 (0.001)
High	−244.0 (0.218)	25.9 (0.593)	−160.6 (0.373)	−4.5 (0.916)	−67.4 (0.139)	−84.4 (0.159)
All	−90.3 (0.001)	−21.8 (0.018)	4.5 (0.659)	9.3 (0.198)	60.2 (0.000)	10.7 (0.023)

Table 4
Factor mimicking portfolios and macroeconomic variables used as risk factors, 01/73–12/96 sample period.

A factor mimicking portfolio is constructed by first regressing the returns on each of the 25 size and book-to-market sorted portfolios of Fama and French (1993) on the total set of six factors, i.e., 25 time-series regressions producing a (25×6) matrix B of slope coefficients against the factors. If V is the (25×25) covariance matrix of the error terms in these regressions (assumed to be diagonal), then the weights on the mimicking portfolios are: $w = (B'V^{-1}B)^{-1}B'V^{-1}$ (see Lehmann and Modest (1988)). For each factor k, the return in month t for the corresponding mimicking portfolio is calculated from the cross-product of row k in w and the vector of month t returns on the 25 Fama-French portfolios.

(A) Raw macroeconomic variables

	N	Mean	Std Dev
Excess return on the market index (RM)	300	0.532	4.542
Change in real per capita consumption of nondurable goods (ΔRPC)[a]	300	0.077	0.691
Difference in BAA and AAA yield change (BAA−AAA)	300	-0.011	1.160
Unanticipated inflation (UI)[b]	300	-0.025	0.256
Return difference on Treasury bonds (20y−1y)[c]	300	0.102	2.730
Return difference on Treasury bills (TBILLspr)[d]	300	0.054	0.121

(B) Correlation between raw macroeconomic factor and the factor mimicking portfolio

Mimicking factor	ΔRPC	BAA−AAA	UI
$\widehat{\Delta RPC}$	0.186 (0.000)	0.039 (0.499)	−0.013 (0.826)
$\widehat{BAA-AAA}$	0.064 (0.269)	0.194 (0.001)	−0.032 (0.581)
$\widehat{UI}$	0.051 (0.380)	−0.049 (0.396)	0.265 (0.000)

(C) Mimicking factor portfolios regressed on economic variables

	Independent variables						
Mimicking factor	Intercept	RM	ΔRPC	BAA−AAA	UI	20y−1y	TBILLspr
$\widehat{\Delta RPC}$	0.014	−0.765	$\boxed{14.122}$	1.116	5.540	0.260	9.208
	(0.664)	(0.254)	$\boxed{(0.001)}$	(0.683)	(0.630)	(0.836)	(0.725)
$\widehat{BAA-AAA}$	−0.010	1.454	5.914	$\boxed{17.688}$	3.341	−2.301	−8.047
	(0.870)	(0.268)	(0.472)	$\boxed{(0.001)}$	(0.882)	(0.349)	(0.875)
$\widehat{UI}$	0.036	0.015	2.028	0.132	$\boxed{14.353}$	−0.023	−5.235
	(0.000)	(0.933)	(0.066)	(0.854)	$\boxed{(0.000)}$	(0.945)	(0.446)

(D) Correlation between macroeconomic factors

	RM	$\widehat{\Delta RPC}$	$\widehat{BAA-AAA}$	$\widehat{UI}$	20y−1y	TBILLspr
RM	1.000					
$\widehat{\Delta RPC}$	-0.040	1.000				
$\widehat{BAA-AAA}$	0.073	0.187	1.000			
$\widehat{UI}$	-0.025	-0.085	0.114	1.000		
20y−1y	0.362	-0.005	0.036	-0.071	1.000	
TBILLspr	0.124	0.028	0.052	-0.090	0.403	1.000

[a] Seasonally adjusted real per capita consumption of nondurable goods are from the FRED database.

[b] Unanticipated inflation (UI) is generated using a model for expected inflation that involves running a regression of real returns (returns on 30-day Treasury bills less inflation) on a constant and 12 of it's lagged values.

[c] This is the return spread between Treasury bonds with 20-year and 1-year maturities.

[d] The short end of the term structure (TBILLspr) is measured as the return difference between 90-day and 30-day Treasury bills.

Table 5
Jensen's alphas and constant factor loadings for stock portfolios of firms going public on Nasdaq and non-issuing matching firms, classified by portfolio weights, 01/73–12/96 sample period.

The model is:

$$r_{pt} = \alpha_p + \beta_1 \mathrm{RM}_t + \beta_2 \widehat{\Delta\mathrm{RPC}}_t + \beta_3 (\widehat{\mathrm{BAA}-\mathrm{AAA}})_t + \beta_4 \widehat{\mathrm{UI}}_t + \beta_5 (20\mathrm{y}-1\mathrm{y})_t + \beta_6 \mathrm{TBILLspr}_t + e_t$$

where r_{pt} is either a portfolio excess return or a return on a zero investment portfolio that is long the stock of the matching firm and short the stock of the issuer, RM is the excess return on the market index, RPC is the percent change in the real per capita consumption of nondurable goods, BAA−AAA is the difference in the monthly yield changes on bonds rated BAA and AAA by Moody's, UI is unanticipated inflation, 20y−1y is the return difference between Treasury bonds with 20 years to maturity and 1 year to maturity, and TBILLspr is the return difference between 90-day and 30-day Treasury bills. T is the number of months in the time series regression, N is the average number of firms in the portfolio, and I is the number of issues used to construct the portfolio. The coefficients are estimated using OLS. Standard errors are computed using the heteroskedasticity consistent estimator of White (1980). The numbers in parentheses are p-values.

		Factor betas (T=299, N=763, I=5173)						
Portfolio	$\hat{\alpha}$	RM	$\widehat{\Delta\mathrm{RPC}}$	$\widehat{\mathrm{BAA}-\mathrm{AAA}}$	$\widehat{\mathrm{UI}}$	20y−1y	TBILLspr	Rsq
EW-Issuer	−0.30 (.220)	1.43 (.000)	0.03 (.000)	0.00 (.303)	0.03 (.146)	−0.52 (.000)	−0.83 (.655)	0.724
EW-Match	−0.07 (.673)	1.05 (.000)	0.03 (.000)	−0.00 (.892)	0.04 (.013)	−0.31 (.000)	1.88 (.157)	0.792
EW-zero	0.23 (.212)	−0.38 (.000)	−0.00 (.352)	−0.00 (.144)	0.01 (.710)	0.21 (.018)	2.71 (.116)	0.275
VW-Issuer	0.46 (.117)	1.44 (.000)	0.00 (.660)	0.01 (.008)	−0.08 (.000)	−0.17 (.106)	−5.37 (.046)	0.675
VW-Match	−0.16 (.342)	1.02 (.000)	−0.00 (.714)	−0.00 (.891)	−0.04 (.003)	−0.01 (.853)	1.41 (.317)	0.763
VW-zero	−0.63 (.053)	−0.43 (.000)	−0.01 (.494)	−0.01 (.021)	0.04 (.058)	0.16 (.133)	6.77 (.016)	0.169

Table 6

Jensen's alphas and constant factor loadings for stock portfolios of firms going public on Nasdaq and non-issuing control firms matched on size, classified by size-quintile portfolio membership and portfolio weights, 01/73-12/96.

The model is:

$$r_{pt} = \alpha_p + \beta_1 \mathrm{RM}_t + \beta_2 \widehat{\Delta\mathrm{RPC}}_t + \beta_3 (\widehat{\mathrm{BAA}-\mathrm{AAA}})_t + \beta_4 \widehat{\mathrm{UI}}_t + \beta_5 (20\mathrm{y}-1\mathrm{y})_t + \beta_6 \mathrm{TBILLspr}_t + e_t$$

where r_{pt} is either a portfolio excess return or a return on a zero investment portfolio that is long the stock of the matching firm and short the stock of the issuer, RM is the excess return on the market index, RPC is the percent change in the real per capita consumption of nondurable goods, BAA−AAA is the difference in the monthly yield changes on bonds rated BAA and AAA by Moody's, UI is unanticipated inflation, 20y−1y is the return difference between Treasury bonds with 20 years to maturity and 1 year to maturity, and TBILLspr is the return difference between 90-day and 30-day Treasury bills. In the panel headings, T is the number of months in the time series regression, N is the average number of firms in the portfolio, and I is the number of issues used to construct the portfolio. The coefficients are estimated using OLS. Standard errors are computed using the heteroskedasticity consistent estimator of White (1980). The numbers in parentheses are p-values.

		Factor betas						
Portfolio	$\hat{\alpha}$	RM	$\widehat{\Delta\mathrm{RPC}}$	$\widehat{\mathrm{BAA}-\mathrm{AAA}}$	$\widehat{\mathrm{UI}}$	20y−1y	TBILLspr	Rsq
(A) Size quintile 1 and 2 (T=299, N=162, I=1218)								
EW-Issuer	−0.55 (.158)	1.28 (.000)	0.05 (.000)	0.00 (.543)	0.14 (.000)	−0.66 (.001)	−0.51 (.885)	0.509
EW-Match	−0.09 (.758)	1.06 (.000)	0.04 (.000)	−0.01 (.035)	0.08 (.002)	−0.43 (.000)	1.56 (.451)	0.592
EW-zero	0.47 (.194)	−0.22 (.019)	−0.01 (.400)	−0.01 (.009)	−0.06 (.095)	0.23 (.301)	2.07 (.568)	0.069
VW-Issuer	−1.02 (.010)	1.38 (.000)	0.04 (.000)	0.00 (.547)	0.08 (.022)	−0.60 (.006)	−0.56 (.887)	0.520
VW-Match	−0.28 (.380)	1.18 (.000)	0.04 (.000)	−0.01 (.019)	0.03 (.252)	−0.33 (.000)	0.38 (.865)	0.567
VW-zero	0.74 (.075)	−0.21 (.035)	−0.00 (.907)	−0.01 (.008)	−0.06 (.120)	0.27 (.227)	0.93 (.836)	0.045
(B) Size quintile 3 (T=299, N=190, I=1313)								
EW-Issuer	−0.84 (.007)	1.42 (.000)	0.04 (.000)	0.00 (.783)	0.07 (.010)	−0.49 (.000)	−0.00 (.999)	0.629
EW-Match	0.05 (.802)	1.04 (.000)	0.04 (.000)	−0.00 (.609)	0.06 (.003)	−0.39 (.000)	3.10 (.071)	0.656
EW-zero	0.89 (.001)	−0.38 (.000)	0.00 (.589)	−0.00 (.470)	−0.01 (.662)	0.10 (.289)	3.10 (.140)	0.153
VW-Issuer	−0.66 (.039)	1.43 (.000)	0.02 (.006)	0.00 (.121)	0.01 (.547)	−0.27 (.021)	−3.99 (.171)	0.626
VW-Match	0.09 (.667)	1.03 (.000)	0.04 (.000)	0.00 (.300)	0.02 (.232)	−0.30 (.000)	2.29 (.217)	0.651
VW-zero	0.76 (.009)	−0.40 (.000)	0.01 (.196)	−0.00 (.469)	0.01 (.807)	−0.02 (.842)	6.28 (.028)	0.156
(C) Size quintile 4 (T=299, N=231, I=1543)								
EW-Issuer	−0.31 (.260)	1.48 (.000)	0.03 (.000)	0.00 (.314)	0.00 (.991)	−0.58 (.000)	1.03 (.657)	0.689
EW-Match	−0.21 (.204)	1.05 (.000)	0.03 (.000)	0.00 (.698)	0.03 (.022)	−0.30 (.000)	3.34 (.050)	0.769
EW-zero	0.10 (.642)	−0.42 (.000)	0.00 (.963)	−0.00 (.319)	0.03 (.142)	0.28 (.003)	2.30 (.231)	0.228
VW-Issuer	−0.12 (.675)	1.51 (.000)	0.02 (.001)	0.01 (.004)	−0.08 (.001)	−0.47 (.000)	0.22 (.928)	0.716
VW-Match	−0.07 (.713)	1.09 (.000)	0.02 (.000)	0.00 (.121)	−0.01 (.411)	−0.21 (.001)	1.47 (.390)	0.716
VW-zero	0.04 (.885)	−0.41 (.000)	0.00 (.947)	−0.00 (.351)	0.06 (.008)	0.26 (.013)	1.25 (.633)	0.164
(D) Size quintile 5 (T=299, N=179, I=1099)								
EW-Issuer	0.37 (.149)	1.52 (.000)	0.02 (.003)	0.00 (.049)	−0.06 (.003)	−0.30 (.001)	−2.66 (.186)	0.742
EW-Match	−0.02 (.889)	1.05 (.000)	0.01 (.006)	0.00 (.012)	−0.00 (.719)	−0.15 (.005)	1.08 (.442)	0.808
EW-zero	−0.39 (.134)	−0.47 (.000)	−0.01 (.063)	−0.00 (.763)	0.06 (.002)	0.15 (.073)	3.74 (.067)	0.258
VW-Issuer	0.73 (.022)	1.46 (.000)	−0.00 (.871)	0.01 (.006)	−0.11 (.000)	−0.14 (.228)	−5.71 (.044)	0.657
VW-Match	−0.12 (.499)	1.01 (.000)	−0.01 (.071)	−0.00 (.936)	−0.04 (.002)	0.04 (.567)	1.43 (.344)	0.751
VW-zero	−0.85 (.017)	−0.45 (.000)	−0.01 (.550)	−0.01 (.018)	0.06 (.012)	0.17 (.137)	7.14 (.016)	0.163

Table 7
Jensen's alphas for firms going public on Nasdaq and non-issuing control firms matched on size, estimated using (A) conditional factor model with time-varying factor loadings, and (B) principal component factors, 01/73–12/96.

The conditional factor model in panel (A) is:

$$r_{pt} = b'_{p0} r_{Ft} + b'_{p1}(Z_{t-1} \otimes r_{Ft}) + e_{pt},$$

where the information variables in Z_{t-1} include the lagged dividend yield on the CRSP value-weighted market index, the lagged 30-day Treasury bill rate, and the lagged values of BAA$-$AAA and TBILLspr. The model used in panel (b) is the five-factor model of Connor and Korajczyk (1988) where factors are extracted from the covariance matrix of asset returns. The last column labeled 'N' contains the average number of firms in the portfolio. The coefficients are estimated using OLS. Standard errors are computed using the heteroskedasticity consistent estimator of White (1980). The numbers in parentheses are p-values.

	Equal-weighted portfolios			Value weighted portfolios			
	Issuer	Match	EW-zero	Issuer	Match	VW-zero	N
(A)	**Alpha estimates with conditional factor model**						
	−0.20 (.464)	−0.03 (.862)	0.17 (.348)	0.73 (.024)	−0.19 (.308)	−0.92 (.005)	763
(B)	**Alpha estimates with Connor and Korajczyk (1988) principal component factors**						
	−0.52 (.006)	−0.04 (.710)	0.47 (.002)	−0.21 (.424)	−0.25 (.167)	−0.04 (.874)	763

Table 8
Descriptive statistics for characteristic based risk factors, 01/73–12/96 sample period.

The size factor (SMB) is the return on a portfolio of small firms minus the return on a portfolio of large firms (?, See)]FamaFren93. The momentum factor (PR1YR) is constructed using a procedure similar to Carhart (1997): It is the return on a portfolio of the one-third of the CRSP stocks with the highest buy-and-hold return over the previous 12 months minus the return on a portfolio of the one-third of the CRSP stocks with the lowest buy-and-hold return over the previous 12 months. The liquidity factors PVOL and TO are constructed using an algorithm similar to the one used by Fama and French (1993) when constructing the SMB and HML factors. To construct TO, we we start in September 1972 and form two portfolios based on a ranking of the end-of-month market value of equity and three portfolios formed using stocks ranked on TO. Next, six portfolios are constructed from the intersection of the two market value and the three turnover portfolios. Monthly value-weighted returns on these six portfolios are calculated starting in October 1972. Portfolios are reformed in January, April, July, and October, using firm rankings from the previous month. The TO portfolio is the difference between the equal-weighted average return on the two portfolios with low turnover and the equal-weighted average return on the two portfolios with high turnover. The PVOL portfolio is constructed the same way, using PVOL instead of TO to construct the liquidity rankings.

(A) Characteristic based factors

	N	Mean	Std Dev
Difference in returns between small firms and big firms (SMB)	299	0.164	2.792
Difference in return between firms with high and low book-to-market (HML)	299	0.490	2.675
Difference in return between winners and losers (PR1YR)	299	0.679	4.219
Difference in return between firms with high and low price times volume (PVOL)	299	0.204	2.847
Difference in return between firms with high and low turnover (TO)	299	0.103	2.617

(B) Correlation between characteristic based factors

	RM	SMB	HML	PR1YR	PVOL	TO
RM	1.000					
SMB	0.277	1.000				
HML	-0.427	-0.108	1.000			
PR1YR	-0.112	-0.262	-0.000	1.000		
PVOL	-0.398	0.068	0.584	-0.032	1.000	
TO	-0.608	-0.484	0.511	0.117	0.640	1.000

Table 9

Jensen's alphas, Fama and French (1993) factor loadings, and factor loadings for momentum and liquidity factors for stock portfolios of firms going public on Nasdaq and non-issuing matching firms, classified by portfolio weights and matching technique, 01/73–12/96.

The model is:

$$r_{pt} = \alpha_p + \beta_1 \text{RM}_t + \beta_2 \text{SMB}_t + \beta_3 \text{HML}_t + \beta_4 \text{PR1YR}_t + \beta_5 \text{PVOL}_t + \beta_6 \text{TO}_t + e_t$$

where r_{pt} is either a portfolio excess return or a return on a zero investment portfolio that is long the stock of the matching firm and short the stock of the issuer. RM is the excess return on a value weighted market index, SMB and HML are the Fama and French (1993) size and book-to-market factors, PR1YR is a momentum factor and is constructed as the return difference between the one-third highest and one-third lowest CRSP performers over the past 12 months, PVOL (price times monthly trade volume) and TO (monthly volume divided by number of shares outstanding) are liquidity factors that are constructed using the same algorithm used to construct HML. Thus, TO is the difference between the equal-weighted average return on two size sorted portfolios with low turnover and the equal-weighted average return on two size sorted portfolios with high turnover. The PVOL portfolio is constructed the same way, using PVOL instead of TO to construct the liquidity rankings. In the panel headings, T is the number of months in the time series regression, N is the average number of firms in the portfolio, and I is the number of issues used to construct the portfolio. In panel (b), matching firms are drawn from the population of NYSE/Amex-listed firms only, while in Panel (c), matches are drawn exclusively from the population of Nasdaq firms. The coefficients are estimated using OLS. Standard errors are computed using the heteroscedasticity consistent estimator of White (1980). The numbers in parentheses are p-values.

		Factor betas (T=299, N=763, I=5173)						
Portfolio	$\hat{\alpha}$	RM	SMB	HML	PR1YR	PVOL	TO	Rsq
EW-Issuer	−0.22 (.193)	1.05 (.000)	1.33 (.000)	−0.12 (.127)				0.870
EW-Match	0.00 (.995)	0.87 (.000)	0.93 (.000)	0.19 (.000)				0.919
EW-zero	0.22 (.153)	−0.18 (.000)	−0.40 (.000)	0.31 (.000)				0.395
VW-Issuer	0.33 (.088)	1.05 (.000)	1.02 (.000)	−0.69 (.000)				0.807
VW-Match	−0.11 (.457)	0.93 (.000)	0.27 (.000)	−0.16 (.020)				0.777
VW-zero	−0.44 (.070)	−0.12 (.144)	−0.74 (.000)	0.53 (.000)				0.325
EW-Issuer	−0.21 (.179)	0.96 (.000)	1.13 (.000)	−0.05 (.593)	0.09 (.079)	0.22 (.019)	−0.60 (.000)	0.885
EW-Match	0.07 (.472)	0.84 (.000)	0.80 (.000)	0.17 (.001)	−0.04 (.071)	0.18 (.000)	−0.24 (.001)	0.923
EW-zero	0.28 (.051)	−0.12 (.006)	−0.33 (.000)	0.21 (.011)	−0.13 (.008)	−0.04 (.645)	0.36 (.003)	0.454
VW-Issuer	0.24 (.184)	0.94 (.000)	1.01 (.000)	−0.42 (.000)	0.16 (.006)	−0.27 (.028)	−0.36 (.014)	0.832
VW-Match	−0.08 (.639)	0.91 (.000)	0.22 (.003)	−0.14 (.100)	−0.02 (.688)	0.02 (.859)	−0.12 (.254)	0.777
VW-zero	−0.32 (.175)	−0.04 (.666)	−0.79 (.000)	0.28 (.025)	−0.19 (.004)	0.29 (.032)	0.24 (.169)	0.379

Table 10

Jensen's alphas, Fama and French (1993) factor loadings, and factor loadings for momentum and liquidity factors for stock portfolios of firms going public on Nasdaq and non-issuing control firms matched on size, classified by size-quintile portfolio membership, 01/73–12/96.

The model is:

$$r_{pt} = \alpha_p + \beta_1 \text{RM}_t + \beta_2 \text{SMB}_t + \beta_3 \text{HML}_t + \beta_4 \text{PR1YR}_t + \beta_5 \text{PVOL}_t + \beta_6 \text{TO}_t + e_t$$

where r_{pt} is either a portfolio excess return or a return on a zero investment portfolio that is long the stock of the matching firm and short the stock of the issuer. RM is the excess return on a value weighted market index, SMB and HML are the Fama and French (1993) size and book-to-market factors, PR1YR is a momentum factor and is constructed as the return difference between the one-third highest and one-third lowest CRSP performers over the past 12 months, PVOL (price times monthly trade volume) and TO (monthly volume divided by number of shares outstanding) are liquidity factors that are constructed using the same algorithm used to construct HML. Thus, TO is the difference between the equal-weighted average return on two size sorted portfolios with low turnover and the equal-weighted average return on two size sorted portfolios with high turnover. The PVOL portfolio is constructed the same way, using PVOL instead of TO to construct the liquidity rankings. In the panel headings, T is the number of months in the time series regression, N is the average number of firms in the portfolio, and I is the number of issues used to construct the portfolio. In panel (b), matching firms are drawn from the population of NYSE/Amex-listed firms only, while in Panel (c), matches are drawn exclusively from the population of Nasdaq firms. The coefficients are estimated using OLS. Standard errors are computed using the heteroscedasticity consistent estimator of White (1980). The numbers in parentheses are p-values.

		Factor betas						
Portfolio	$\hat{\alpha}$	RM	SMB	HML	PR1YR	PVOL	TO	Rsq
(A) Size quintile 1 and 2 (T=299, N=162, I=1218)								
EW-Issuer	−0.53 (.095)	0.91 (.000)	1.19 (.000)	0.21 (.208)	0.24 (.060)	0.54 (.010)	−0.63 (.018)	0.582
EW-Match	0.10 (.625)	0.76 (.000)	1.00 (.000)	0.18 (.148)	0.03 (.494)	0.38 (.001)	−0.46 (.002)	0.727
EW-zero	0.62 (.040)	−0.15 (.094)	−0.19 (.283)	−0.03 (.823)	−0.21 (.096)	−0.16 (.403)	0.17 (.533)	0.039
VW-Issuer	−1.09 (.000)	1.00 (.000)	1.18 (.000)	0.11 (.483)	0.28 (.026)	0.37 (.093)	−0.52 (.048)	0.620
VW-Match	−0.29 (.203)	0.89 (.000)	0.97 (.000)	0.06 (.668)	0.14 (.010)	0.17 (.163)	−0.27 (.070)	0.654
VW-zero	0.80 (.018)	−0.10 (.305)	−0.21 (.280)	−0.05 (.803)	−0.14 (.291)	−0.20 (.396)	0.26 (.382)	0.018
(B) Size quintile 3 (T=299, N=190, I=1313)								
EW-Issuer	−0.61 (.008)	0.96 (.000)	1.14 (.000)	−0.06 (.657)	0.04 (.517)	0.33 (.018)	−0.59 (.001)	0.770
EW-Match	0.20 (.233)	0.81 (.000)	1.01 (.000)	0.22 (.042)	0.02 (.576)	0.28 (.000)	−0.27 (.085)	0.801
EW-zero	0.81 (.000)	−0.16 (.014)	−0.13 (.246)	0.29 (.055)	−0.02 (.751)	−0.05 (.719)	0.32 (.082)	0.216
VW-Issuer	−0.74 (.002)	1.00 (.000)	1.19 (.000)	−0.21 (.185)	0.13 (.074)	−0.11 (.447)	−0.22 (.167)	0.768
VW-Match	0.11 (.531)	0.81 (.000)	1.01 (.000)	0.20 (.062)	0.07 (.113)	0.13 (.239)	−0.21 (.105)	0.787
VW-zero	0.85 (.001)	−0.20 (.096)	−0.18 (.130)	0.41 (.036)	−0.06 (.500)	0.24 (.208)	0.01 (.950)	0.208
(C) Size quintile 4 (T=299, N=231, I=1543)								
EW-Issuer	−0.06 (.733)	0.93 (.000)	1.08 (.000)	−0.02 (.841)	−0.05 (.275)	0.20 (.052)	−0.78 (.000)	0.861
EW-Match	−0.01 (.909)	0.86 (.000)	0.68 (.000)	0.28 (.000)	−0.10 (.019)	0.19 (.025)	−0.31 (.001)	0.864
EW-zero	0.05 (.793)	−0.07 (.223)	−0.40 (.000)	0.30 (.000)	−0.05 (.304)	−0.01 (.874)	0.46 (.000)	0.431
VW-Issuer	−0.02 (.934)	0.95 (.000)	1.01 (.000)	−0.24 (.052)	0.01 (.853)	0.04 (.788)	−0.69 (.000)	0.869
VW-Match	−0.01 (.931)	0.90 (.000)	0.66 (.000)	0.08 (.443)	−0.05 (.307)	−0.00 (.983)	−0.17 (.073)	0.788
VW-zero	0.00 (.991)	−0.05 (.588)	−0.35 (.023)	0.32 (.085)	−0.06 (.420)	−0.04 (.812)	0.53 (.009)	0.295
(D) Size quintile 5 (T=299, N=179, I=1099)								
EW-Issuer	0.33 (.054)	1.02 (.000)	1.02 (.000)	−0.26 (.006)	0.06 (.298)	−0.07 (.387)	−0.49 (.000)	0.887
EW-Match	0.06 (.555)	0.90 (.000)	0.57 (.000)	0.04 (.531)	−0.09 (.006)	−0.06 (.383)	−0.01 (.935)	0.888
EW-zero	−0.26 (.198)	−0.12 (.053)	−0.44 (.000)	0.30 (.007)	−0.15 (.007)	0.02 (.857)	0.49 (.000)	0.439
VW-Issuer	0.49 (.022)	0.96 (.000)	0.96 (.000)	−0.48 (.000)	0.15 (.021)	−0.35 (.011)	−0.34 (.044)	0.795
VW-Match	−0.04 (.831)	0.93 (.000)	0.12 (.118)	−0.14 (.124)	−0.03 (.660)	−0.01 (.915)	−0.11 (.359)	0.749
VW-zero	−0.53 (.047)	−0.03 (.771)	−0.84 (.000)	0.34 (.014)	−0.18 (.008)	0.34 (.025)	0.24 (.232)	0.359

Table 11
Average portfolio return, and individual factor contribution to portfolio expected return, for stock portfolios of firms going public on Nasdaq and non-issuing matching firms, 01/73–12/96.

The returns on the issuer and match portfolios are reported in excess of the one month Treasury bill. For the model in panel (a), RM is the excess return on the market index, RPC is the percent change in the real per capita consumption of nondurable goods, BAA−AAA is the difference in the monthly yield changes on bonds rated BAA and AAA by Moody's, UI is unanticipated inflation, 20y−1y is the return difference between Treasury bonds with 20 years to maturity and 1 year to maturity, and TBILLspr is the return difference between 90-day and 30-day Treasury bills. The model used in panel (b) is the five-factor model of Connor and Korajczyk (1988) where factors are extracted from the covariance matrix of asset returns. For the models in panel (c) and (d) RM is the excess return on a value weighted market index, SMB and HML are the Fama and French (1993) size and book-to-market factors, PR1YR is a momentum factor and is constructed as the return difference between "winners" and "losers", PVOL (price times monthly trade volume) and TO (monthly volume divided by number of shares outstanding) are liquidity factors that are constructed using the same algorithm used to construct HML. Thus, TO is the difference between the equal-weighted average return on two size sorted portfolios with low turnover and the equal-weighted average return on two size sorted portfolios with high turnover. The PVOL portfolio is constructed the same way, using PVOL instead of TO to construct the liquidity rankings.

Portfolio	Average portfolio excess return	Average model return	R-sq	Factor contribution to expected return (Mean return on factor mimicking portfolio times factor-beta)					
(A) Macroeconomic risk factors									
				RM	$\widehat{\Delta RPC}$	$\widehat{BAA-AAA}$	$\widehat{UI}$	20y−1y	TBILLspr
EW-Issuer	0.51	0.81	0.724	0.780	0.062	-0.002	0.078	-0.061	-0.045
EW-Match	0.72	0.79	0.792	0.574	0.056	0.000	0.093	-0.036	0.101
VW-Issuer	0.73	0.27	0.675	0.784	0.007	-0.005	-0.209	-0.021	-0.289
VW-Match	0.36	0.52	0.763	0.553	-0.002	0.000	-0.103	-0.001	0.076
(B) Principal component factors									
				F1	F2	F3	F4	F5	
EW-Issuer	0.51	1.03	0.810	1.034	-0.371	0.037	0.467	-0.407	
EW-Match	0.72	0.76	0.855	0.773	-0.277	0.027	0.349	-0.304	
VW-Issuer	0.73	0.94	0.633	0.988	-0.354	0.035	0.446	-0.389	
VW-Match	0.36	0.61	0.630	0.666	-0.239	0.024	0.301	-0.262	
(C) Fama-French Model									
				RM	SMB	HML			
EW-Issuer	0.51	0.73	0.873	0.574	0.218	-0.059			
EW-Match	0.72	0.72	0.933	0.474	0.152	0.094			
VW-Issuer	0.73	0.40	0.810	0.574	0.167	-0.340			
VW-Match	0.36	0.47	0.822	0.508	0.045	-0.081			
(D) Extended Fama-French Model									
				RM	SMB	HML	PR1YR	PVOL	TO
EW-Issuer	0.51	0.73	0.885	0.523	0.185	-0.024	0.063	0.045	-0.062
EW-Match	0.72	0.66	0.923	0.458	0.131	0.081	-0.027	0.037	-0.025
VW-Issuer	0.73	0.49	0.832	0.514	0.166	-0.207	0.111	-0.056	-0.037
VW-Match	0.36	0.44	0.777	0.495	0.037	-0.069	-0.015	0.003	-0.012