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Why does IPO volume fluctuate so much? ☆

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Abstract

IPO volume fluctuates substantially over time. This paper compares the extent to which the aggregate capital demands of private firms, the adverse-selection costs of issuing equity, and the level of investor optimism can explain these fluctuations. Empirical tests include both aggregate and industry-level time-series regressions using proxies for the above factors and an analysis of the relation between post-IPO stock returns and IPO volume. Results indicate that firms' demands for capital and investor sentiment are important determinants of IPO volume, in both statistical and economic terms. Adverse-selection costs are also statistically significant, but their economic effect appears small.

JEL classification: G32

Keywords: IPO; Capital demands; Information asymmetry; Investor sentiment

1. Introduction

Both the number of initial public offerings (IPOs) and the total proceeds raised in these offerings vary substantially over time. Fig. 1 illustrates the extreme fluctuations in IPO volume over 37 years. For example, between 1973 and 1979 only 329 firms

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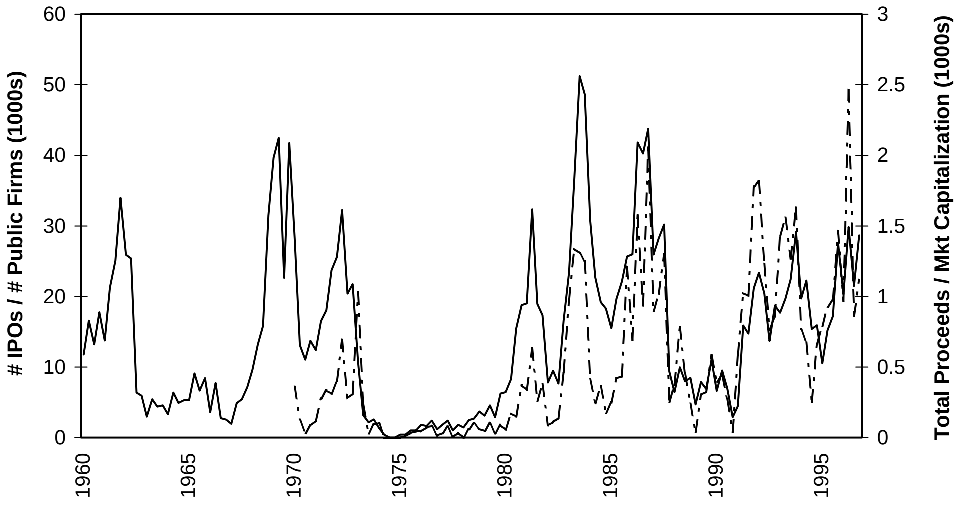

Fig. 1. Time series of IPO volume, 1960–1996. The number of IPOs each quarter deflated by the estimated number of public firms at the end of the prior quarter (in thousands) is depicted with the solid line, and total proceeds deflated by estimated total market capitalization (in thousands) at the end of the prior quarter are shown with the dotted line. Section 3.2 of the paper describes the procedure used to estimate the total number and value of CRSP firms, which accounts for the discrete changes when CRSP adds the Amex and Nasdaq. Data on the number of IPOs were provided by Jay Ritter (http://bear.cba.ufl.edu/ritter/ipodata.html), and data on proceeds raised are from SDC. The proceeds sample excludes IPOs in which 75% or more of the shares are secondary shares, ADRs, units, REITS, issues in which the offer price is less than $5, closed-end funds, and mutual-to-stock conversions.

went public. In comparison, 2,644 firms went public in the seven years preceding 1973, and 3,805 firms went public during the seven years after 1979. Notably, this variation is far in excess of the variation in capital expenditures, suggesting that factors other than financing requirements have a substantial effect on the timing of a firm's IPO. The objective of this paper is to explore the underlying causes of this time-series variation in IPO volume and to determine whether the observed fluctuations are consistent with efficient markets.

While there exists a considerable body of literature on IPOs, the variation in IPO volume has received relatively little attention, and our understanding of these fluctuations is limited. Ibbotson and Jaffe (1975) and Ibbotson et al. (1988, 1994) show the substantial fluctuations in IPO volume, but these studies do not examine the underlying cause of this variation. Lowry and Schwert (2002) note that IPO volume tends to be higher following periods of especially high initial returns, and their findings suggest that this relation is driven by information learned during the registration period. Specifically, more positive information leads to higher initial returns for those offerings and more companies filing to go public soon thereafter. The findings of Rajan and Servaes (1997, 2003), Lee et al. (1991), Lerner (1994), and Pagano et al. (1998) suggest that IPO volume is related to various forms of market irrationality. Consistent with this finding, Lerner et al.'s (2003) results suggest that periods of low IPO volume represent times when private firms "can not" access the equity markets on favorable terms, thus forcing them to enter into less favorable financing arrangements. Specifically, they find that during periods of low equity issuance the agreements signed between small biotechnology firms and major corporations are less successful and more likely to be renegotiated, compared to those agreements signed during periods of higher equity issuance.

Notably, only Pagano et al. (1998) systematically test the relative power of several potential determinants of IPO volume, and their study focuses on the Italian market over an 11-year period, during which only 139 firms went public on the Milan Stock Exchange. They find that companies are more likely to have IPOs when the average market-to-book (MB) ratio of public firms in their industry is higher. Further, they note that the high MB ratio does not seem to reflect investment opportunities, as companies tend to go public following (rather than prior to) periods of high investment. They interpret their findings as indicating that companies time their IPOs to take advantage of industry-wide overvaluations, rather than to finance future growth.

The current study fills a gap in the literature by employing a 37-year time series of U.S. IPO volume and investigating the extent to which efficient- versus inefficient-market factors can explain the observed fluctuations. My primary objective is to explore three potential explanations for the variation in IPO volume. One common perception regarding IPO volume is that it simply varies with the business cycle. During economic expansions, economy-wide demand for capital is higher and more firms therefore go public. A second widely held viewpoint is that the variation in IPO volume is primarily driven by changes in investor optimism. The popular press contains many examples of this viewpoint. For example, "The [current] rule in the IPO market seems to be: Buy it at any price" (Wall Street Journal, May 20, 1996, p. C2), and "When [investors] get bearish, you can't go public. But when they go bullish, just about anyone can go public." (Wall Street Journal, April 19, 1999, p. C1.) Finally, the lower numbers of IPOs during periods of high uncertainty potentially reflect a lemons problem, and this is a third explanation of the observed fluctuations in IPO volume. Variation in investors' uncertainty regarding the true value of firms may cause the adverse-selection costs and therefore IPO volume to fluctuate over time. It is possible that more than one of these factors are important determinants of IPO volume, and I examine all three factors in my analysis.

The investigation of these factors is formalized into three hypotheses, which are developed in more detail in the following section. An examination of the time-series as well as cross-sectional patterns in the data indicates that industry dynamics play an important role in firms' decisions to go public. Consequently, empirical tests are conducted at both the aggregate level and at the industry level. The specific tests used to discriminate between the importance of capital demands, adverse selection costs, and investor sentiment are described below.

As a first test of the three proposed explanations, I develop proxies for private firms' aggregate capital demands, the adverse-selection costs of issuing equity, and the level of investor optimism. I then investigate the ability of these proxies to explain IPO volume. Results indicate that all three factors contribute to the observed fluctuations in the number of firms going public over time, with capital demands and investor sentiment being the most important.

It is possible that the importance of adverse selection is camouflaged in the aggregate analysis. More generally, any of the above factors may play a larger role at the industry level. However, inferences from the industry analysis are similar to those from the aggregate-level data. Empirical tests again provide some support for all three factors, but firms' demands for capital and investor sentiment are the most highly significant.

The final set of tests focuses on post-IPO stock returns. This analysis has the advantage of not relying on proxies. If the number of IPOs is affected by changes in the level of investor sentiment, then post-IPO returns will be lowest following the high optimism, high IPO volume periods, when investors overpay the most. While I do not find a significant relation between *abnormal* IPO returns and IPO volume, results do show that IPO volume is significantly negatively related to both *raw* IPO post-issue returns and to post-issue *market* returns. Firms seem to successfully go public when a broad class of firms, often the entire market, is valued especially highly.

In summary, results indicate that changes in firms' demands for capital and changes in the level of investor optimism explain a substantial portion of the variation in IPO volume. Adverse selection costs are marginally significant and appear to be of secondary importance. Notably, the prior literature has focused on only one potential determinant of IPO volume, investor sentiment. While sentiment does appear to affect the timing of IPOs, evidence indicates that it is not the only relevant factor.

Section 2 develops the hypotheses in more detail. Section 3 describes the data and analyzes the time-series properties of IPO volume. Section 4 examines the relation between the observed fluctuations in IPO volume and time-series variation in private firms' demands for capital, the adverse-selection costs of issuing public equity, and the level of investor optimism. Section 5 investigates the relation between IPO volume and post-issue stock returns. Finally, Section 6 concludes.

2. Hypotheses

This section discusses in more detail the three proposed explanations for variation in aggregate IPO volume: the *capital demands hypothesis*, the *information asymmetry hypothesis*, and the *investor sentiment hypothesis*.

The capital demands hypothesis says that variation in IPO volume is caused by changes in private firms' aggregate demand for capital. General economic conditions vary over time. When conditions are better and expected growth in the economy is higher, companies tend to have higher demands for capital. This higher economy-wide demand for capital translates into more companies seeking financing. Private firms can obtain financing through bank loans, public debt, venture capital, or public equity. Assuming that managers maximize firm value, they will evaluate their current demand for capital, the costs of raising that capital, and their demand for and expected costs of obtaining future capital to choose the appropriate financing vehicle. A firm has an IPO when public equity provides the greatest net benefits. On average, the number of companies having IPOs increases when private firms' aggregate demand for capital increases. Consistent with this hypothesis, Choe et al.'s (1993) findings suggest that more companies have seasoned equity offerings when economic conditions are better.

The information asymmetry hypothesis asserts that the adverse-selection costs of issuing public equity change over time. Information asymmetry represents the difference between managers' information and the market's information about firm value. Because managers have an incentive to issue equity when the firm is overvalued, the market lowers its estimate of firm value when a firm announces an equity offering. Assuming that markets are semi-strong form efficient, this devaluation ensures that firms that do issue are correctly priced, on average. However, Myers (1977), Myers and Majluf (1984), and Korajczyk et al. (1992) show that these adverse-selection costs prevent many firms with positive net present value (NPV) projects from raising the equity necessary to finance their projects. A firm only issues equity if the benefits of obtaining this financing exceed the direct issue costs plus any adverse-selection costs. When information asymmetry is especially high, companies are more likely to find it optimal to obtain alternative types of financing. They will postpone an IPO until decreases in the costs of issuing equity and/or increases in companies' demands for capital make issuing equity the optimal choice to maximize firm value. Lucas and McDonald's (1990) model predicts that such information asymmetries will lead to the clustering of seasoned equity offerings, and similar logic should also apply to IPOs. Consistent with this model, prior research by Bayless and Chaplinsky (1996) and Choe et al. (1993) suggests that periods of high information asymmetry are associated with lower seasoned equity issue volume.[1] Similarly, the information asymmetry hypothesis predicts that IPO volume is negatively correlated with information asymmetry.

Finally, the investor sentiment hypothesis posits that variation in the level of investor optimism causes the costs of issuing equity and therefore IPO volume to fluctuate over time. During some periods, investors are overly optimistic and are willing to pay more for firms than they are worth. During these periods, the costs of going public are especially low. Consequently, a large number of firms find it optimal to go public. In contrast, during periods of low sentiment, investors may undervalue firms, causing IPO volume to be low. Lee et al. (1991) and Rajan and Servaes (1997, 2003) conclude that changes in investor sentiment significantly affect IPO volume over time. Similarly, Pagano et al. (1998) conclude that the clustering of IPOs in Italy reflects mispricing in the market. Also consistent with the idea that investors are

[1] As an example of a high information asymmetry period, consider the recent Asian currency crisis. Investors had less information than managers regarding how this event would affect firm value. For example, investors did not know whether the company had been planning to move some of its production facilities to Asia, or whether specific products were being developed for the Asian market. Because insiders were less certain of the true value of firms, the adverse-selection costs of issuing equity were higher.

especially optimistic during certain periods, Purnanandam and Swaminathan (2001) find that IPOs that are more *overvalued* at the offer price earn especially *high* first-day returns and especially low returns over the next five years. In addition, Jindra's (2001) results suggest that firms are significantly more likely to have seasoned equity offerings when they are overvalued.

The three hypotheses differ on two dimensions: their assumptions on the efficiency of the market, and their focus on companies' demand for equity versus the market supply of equity. First, both the capital demands hypothesis and the information asymmetry hypothesis maintain that the market is semi-strong form efficient. These hypotheses assert that issue costs are always positive, and companies only go public if they have positive NPV projects. In contrast, the investor sentiment hypothesis asserts that the market is inefficient. During certain periods, investors are overly optimistic and they are willing to pay more for IPOs than they are worth. Second, the capital demands hypothesis focuses on changes in issuing firms' demands for equity, while the information asymmetry hypothesis and the investor sentiment hypothesis concentrate on shifts in the market supply of equity (i.e., shifts in how receptive investors are to new issues). Note that these three hypotheses are not mutually exclusive. Capital demands, information asymmetry, and investor sentiment may all contribute to the variation in IPO volume.

3. Data and test specification

Between 1960 and 1996, 12,821 companies went public.[2] Fig. 1 shows the variation in the number of IPOs over this period, as a fraction of the total number of public firms (in thousands) at the end of the previous quarter. This 37-year time series enables me to examine the intertemporal relation between the number of companies going public and variation in market conditions. Ending the sample in 1996 enables me to examine three years of post-IPO stock returns, in addition to pre-IPO market conditions. Because this dataset does not include any offer-specific or company-specific information, I rely on the Securities Data Company (SDC) database for more detailed analysis. This database includes 9,163 firm-commitment IPOs between 1970 and 1996. From this set, I exclude closed-end funds, ADRs, REITs, units, mutual-to-stock conversions, issues in which the offer price is less than \$5, and issues in which 75% or more of the shares sold represent secondary shares, yielding a sample of 5,349 IPOs. This database includes proceeds raised, the offer price, and the issuer's SIC code. Fig. 1 also shows the aggregate proceeds raised in IPOs, deflated by total market capitalization (in thousands) at the end of the previous quarter, between 1970 and 1996. The correlation between the two datasets of the number of IPOs each quarter between 1970 and 1996 equals 0.90.

[2] I would like to thank Jay Ritter for making these data available: http://bear.cba.ufl.edu/ritter/ipodata.html.

3.1. Descriptive statistics

Table 1 provides descriptive statistics on all sample firms with SDC data. These 5,349 firms raised a total of \$196 billion, in 1990 dollars. The average proceeds per IPO (in 1990 dollars) was \$36.6 million (median = \$18.3 million) and the average offer price was \$12.06 (median = \$11.50).

Rajan and Servaes (1997), Pagano et al. (1998), Ritter (1984), and many practitioners suggest that industry effects have a substantial effect on IPO volume. This suggests that a thorough analysis of aggregate IPO volume must consider dynamics at the industry level. An examination of industry effects obviously requires defining industry groups. Typically, SIC codes are used for this purpose. For each IPO firm, I try to obtain the SIC code from the Center for Research in Securities Prices (CRSP), or otherwise from SDC. I then attempt to group firms that would be most sensitive to the same factors into the same industry. For example, the transportation industry includes companies manufacturing transportation equipment as well as companies providing transportation services. Firms are classified into a total of 16 industries.[3] The bottom portion of Table 1 lists the 16 industry groups.

The remainder of the bottom portion of Table 1 shows that industry dynamics substantially affect aggregate IPO volume. The third column shows the total number of IPOs in each industry between 1970 and 1996. The fourth through sixth columns list the total number of IPOs in the industry in each decade (1970s, 1980s, and 1990–1996), as a percentage of the total number of public firms in that industry at the beginning of the decade. These descriptive statistics highlight the importance of controlling for differences in industry size. For example, although the healthcare industry had fewer IPOs than the manufacturing industry (379 vs. 555), healthcare IPO volume seems substantially higher when measured as a fraction of existing firms. The number of healthcare IPOs during the 1980s measured as a percentage of the number of public healthcare firms at the beginning of the decade equals 123%. The comparable measure for the manufacturing industry is only 28%.

3.2. Time-series properties of IPO volume

IPO volume is highly persistent over time, and well-specified tests must consider this persistence. The first-order autocorrelation of quarterly IPO volume between 1960 and 1996 equals 0.87, and the augmented Dickey-Fuller test (Dickey and Fuller, 1979) provides some evidence that IPO volume is nonstationary. Alternatively stated, there is no obvious tendency to revert towards some "normal" volume. The underlying economics further suggest that IPO volume is nonstationary. For example, suppose the number of companies going public is related to technological advancements in the economy. Technological change may be thought of as the accumulation of random shocks, i.e. valuable discoveries. As discussed by

[3] While the division into 16 industries is somewhat arbitrary, a finer division causes many industries to have zero IPOs for many time periods, and a coarser division results in less similar firms being grouped together or a large number of IPOs being classified into the 'other' group.

Table 1
Descriptive statistics on IPOs, 1970–1996

This table provides descriptive statistics for all firm-commitment IPOs between 1970 and 1996, as listed on SDC. IPOs in which 75% or more of the shares are secondary shares, ADRs, units, REITS, issues in which the offer price is less than $5, closed-end funds, and mutual-to-stock conversions are excluded. Total proceeds (in millions) for each IPO are in real 1990 dollars (adjusted using the CPI). The offer price statistics exclude one firm with an offer price of $5,000. Each quarter, the number of IPOs is divided by the total number of public firms (in thousands) at the end of the prior quarter, to form number of IPOs/number of public firms, as discussed in Section 3.2. There were 211 firms that did not fit into one of the specified industry groups.

	IPOs: 1970–1996	
	Number of IPOs	Proceeds (millions of 1990 dollars)
Total	5,349	$195,885
1970s	912	$15,288
1980s	1,922	$59,588
1990–1996	2,515	$121,008

	Mean	Median	Standard deviation
Total proceeds (millions)	36.63	18.30	84.64
Offer price	12.06	11.50	4.67
No. of IPOs/no. of public firms (thousands, each qtr.)	7.65	5.66	6.70

	SIC codes	No. of IPOs 1970–96	No. of IPOs during decade as a % of public firms in that industry at the beginning of the decade		
			1970s	1980s	1990s
Agriculture, Mining	100–1299, 1400–1499	36	7.2%	17.4%	5.8%
Apparel	2200–2399, 3100–3199	119	18.1	17.9	31.1
Communication, Computer, Electronics	3570–3579, 3600–3699, 4800–4899, 7370–7379	1390	26.6	92.1	72.5
Construction	1500–1799	84	26.4	39.4	36.1
Finance	6000–6499, 6700–6799	468	10.3	23.7	14.0

Food	2000–2099	82	14.3	16.1	20.3
Healthcare	2830–2839, 8000–8099	379	18.2	123.1	78.7
Manufacturing	2400–2499, 2600–2699, 2800–2829, 2840–2899, 3000–3099, 3200–3569, 3580–3599, 3900–3999	555	12.7	27.7	44.1
Oil, Gas	1300–1399, 2900–2999, 4600–4699, 4920–4929	159	8.8	18.2	18.8
Printing, Publishing	2700–2799	64	18.9	25.0	23.9
Recreation	7000–7099, 7800–7999	136	21.8	51.2	51.4
Scientific Instruments and Research	3800–3899, 8710–8719, 8730–8739	338	22.6	51.3	49.5
Services	6500–6599, 7200–7369, 7380–7399, 7600–7699, 8100–8399, 8720–8729, 8740–8749	245	25.7	24.7	52.3
Trade	5000–5999	805	24.8	54.7	57.8
Transportation	3700–3799, 4000–4299, 4400–4599, 4700–4799, 7510–7549	233	12.5	36.7	43.8
Utilities	4910–4919, 4930-4979	44	3.6	18.7	7.2

Schwert (1987), time aggregation of a random walk results in a nonstationary process. Also, when there exists some uncertainty over the stationarity of a series, Plosser and Schwert (1978) show that the more conservative approach is to assume the series is nonstationary.

There are two potential ways to account for this nonstationarity. One way is to use the first difference of IPO volume as the dependent variable. The second method is to deflate the number of IPOs by the total number of public firms at the end of the prior period. For my time-series regressions of aggregate IPO volume, either definition is feasible. However, for the industry time-series analysis the latter definition has the added advantage of controlling for differences in industry size, which Table 1 shows to be important. To enable the use of one definition of IPO volume throughout the paper, I employ the number of IPOs deflated by the number of public firms at the end of the prior period. However, the number of CRSP-listed firms exhibits large discrete jumps in 1963 and 1972 when Amex and Nasdaq firms are added (see, e.g., Jegadeesh, 2000). To mitigate the effects of these jumps and obtain a better estimate of the number of public firms throughout the sample period, I use the actual number of CRSP-listed firms after December 1972, but estimate the number of firms prior to that. Specifically, I use the compounded growth rate of 0.45% per year in the number of firms between December 1972 and December 1996, and then assume that the number of firms grew at this same rate prior to December 1972, when there were 5,690 CRSP-listed firms. This yields estimates of the number of public firms (a simple percentage trend) between January 1960 and November 1972. This procedure is carried out at both the market-wide and the industry level. In the remainder of the paper, the *number of public firms* refers to this adjusted number of CRSP-listed firms.

An additional characteristic of these time-series data is that quarterly IPO volume is highly seasonal. There are significantly fewer IPOs in the first quarter of the year. This is perhaps driven by Wall Street's practice of effectively shutting down between Christmas and New Year's each year, thus lowering the number of new IPO registrations. Therefore, each quarterly time-series regression includes a dummy variable, equal to one if it is the first calendar quarter and zero otherwise.

Finally, time-series models of the determinants of IPO volume also include an autoregressive parameter to account for residual serial correlation.

4. Time-series tests

This section investigates the timing of IPOs, using proxies for firms' demands for capital, information asymmetry, and investor sentiment. I first describe each set of proxies and then discuss the empirical results. Descriptive statistics on each of the proxies are shown in Table 2. Because the majority of quarterly regressions are based on 1972–1996 and annual regressions on 1961–1996, the quarterly and annual statistics in Table 2 are calculated over these two separate time periods.

Table 2
Descriptive statistics on proxy variables
This table provides descriptive statistics on the explanatory variables used in Tables 3–6. For each variable, the mean, median, and standard deviation are calculated. Quarterly (annual) data are based on 1972–1996 (1961–1996). The change in the number of new corporations equals the first difference of thousands of new corporations each quarter or year. GDP growth equals the percentage change in real GDP. Investment growth is the percentage change in real quarterly private, nonresidential, fixed investment. Quarterly (annual) sales growth equals the log of real sales in quarter t (year t) minus the log of real sales in quarter $t-1$ (year $t-1$), averaged across all public firms except firms that have gone public within the past three years. The dispersion of abnormal returns around earnings announcements equals the standard deviation across all firms with earnings announcements in a given quarter, of the AR (defined over days -1, $+1$) at this announcement. Analyst dispersion is the average, across companies that are in the last quarter of their fiscal year and have analyst forecasts listed on IBES during a given quarter, of the standard deviation of analyst forecasts for each company. The discount on closed-end funds is a value-weighted percent and is measured at the end of the given quarter. Quarterly (annual) future real market returns represent compounded monthly returns (in decimal form) on the equally weighted market index adjusted using the CPI over the four quarters (one year) subsequent to the IPO. MB is defined as the equally weighted average across all public firms of individual firm equity market value divided by book value (total shareholders equity − preferred stock + deferred taxes + investment tax credits) where book value is measured at the end of the fiscal year, market value is measured at the end of each quarter, and book value is lagged by at least four months relative to market value. Real market stock returns are measured as compounded monthly total returns in decimal form on the equally weighted index, adjusted using the CPI. Finally, the market interaction term equals market stock returns times a dummy variable, equal to one when the market MB is greater than or equal to 1.5 and zero otherwise. Initial returns equal the difference between the first closing price and the offer price, divided by the offer price, averaged across all firms that went public in the given quarter.

	Quarterly interval: 1972–1996			Annual interval: 1961–1996		
	Mean	Median	Std dev	Mean	Median	Std dev
Capital demands proxies						
Δ No. of new corp's	1.207	1.767	9.700	16.878	18.051	22.952
Sales growth	0.008	0.012	0.034	0.041	0.048	0.053
GDP growth	0.565	0.600	1.058	2.933	2.700	3.126
Inv't growth	0.634	0.900	2.331	3.406	3.650	7.196
NBER expansion	0.840	1.000	0.368	0.806	1.000	0.401
Information asymmetry proxies						
Δ Earn. AR dispersion	0.0003	0.0005	0.0123			
Δ Analyst dispersion	−0.0001	0.0020	0.0236			
Investor sentiment proxies						
Future EW mkt rets	0.103	0.112	0.206	0.102	0.159	0.247
Fund discount	11.429	11.091	6.519	9.379	11.440	7.923
Stock market variables						
EW returns	0.025	0.028	0.108	0.105	0.159	0.249
MB ratio	2.701	2.726	1.004	2.576	2.468	0.913
High MB*EW ret	0.022	0.003	0.079	0.084	0.101	0.224
Initial returns	0.148	0.129	0.140	0.154	0.130	0.126

4.1. Capital demands proxies

The capital demands hypothesis asserts that fluctuations in IPO volume are driven by changes in private firms' aggregate demand for capital. A survey of prospectuses by Mikkelson et al. (1997) shows that 85% of firms state that they have an IPO to raise working capital and 64% to raise money for new investments.[4] Because it is not possible to directly measure private firms' capital demands, I examine factors that are likely to be correlated with changes in firms' demand for working capital and new investment opportunities.

Proxies for private firms' capital demands include: percentage growth in the real gross domestic product (GDP); percentage growth in real private, fixed, nonresidential investment; the change in the number of new corporations; average real sales growth of public firms; and a business cycle dummy. Demand for working capital is likely to be higher when business conditions are more promising, meaning that it should be positively correlated with future growth in the GDP. Demand for money for new investments should be related to investment opportunities, suggesting that it will be positively correlated with future growth in investment and with the past and contemporaneous growth in new corporations.[5] Future sales growth should also be positively correlated with demand for capital. To generate increased sales, firms generally require more equipment, inventory, and working capital, meaning that periods of high sales growth should reflect times when firms' demands for capital are higher. To control for seasonality, future sales growth is defined as the log of firm sales in quarter $t+3$ minus the log of firm sales in quarter $t-1$ (i.e., one year earlier), averaged across all firms with sales data available on Compustat, excluding firms that have gone public within the past three years.[6] For annual regressions, it is defined as the log of firm sales in year t minus the log of firm sales in year $t-1$. Finally, a business cycle dummy equals one if the subsequent quarter is an NBER expansion and zero otherwise.

4.2. Information asymmetry proxies

The information asymmetry hypothesis asserts that the adverse-selection costs of issuing equity vary over time, which causes IPO volume to vary. When information asymmetry is especially high, the adverse-selection costs of issuing equity are greater, and fewer firms elect to go public. Because information asymmetry is unobservable, I use two proxies: the dispersion of abnormal returns around public firms' earnings announcements and the dispersion of analyst forecasts of public firms' earnings. Both of these proxies focus on earnings, and thus they should reflect uncertainty

[4] In addition, many firms state that they plan to use IPO proceeds to repay debt or provide liquidity to existing shareholders. However, such factors are unlikely to be highly correlated across firms.

[5] The number of new corporations each period is obtained from The Economic Report of the President.

[6] The other proxies do not exhibit similar seasonality, meaning that three quarter growth measures are appropriate. However, defining all proxies over one year (as opposed to three quarters) yields qualitatively similar results.

about assets in place, which Myers and Majluf (1984) show potentially prevents a firm from issuing equity.

Dierkins (1991) notes that a strong average market reaction to the earnings announcement of a given firm indicates that managers of that firm have substantial private information to release, i.e., information asymmetry is high. For each firm, she computes the abnormal return around each of its earnings announcements over the prior five years, and the standard deviation of these abnormal returns represents a measure of information asymmetry for that firm. Similarly, especially strong market reactions to earnings announcements in a given time period suggest that information asymmetry is high in that period, meaning that the standard deviation of earnings announcement abnormal returns across all firms in a given quarter should provide a measure of information asymmetry at that time. Each quarter I identify all firms with earnings announcements and measure the three-day abnormal return around each of these announcements, where the abnormal return is defined as the firm return minus the return on the value-weighted index. I then calculate the standard deviation of these abnormal returns. This dispersion of abnormal returns around earnings announcements should be positively correlated with information asymmetry and thus negatively related to IPO volume.

The dispersion of analysts' earnings forecasts represents a second proxy for information asymmetry. For each public firm in the IBES database, I obtain the standard deviation of all analysts' annual earnings forecasts made during the last quarter of that firm's fiscal year. While firm managers are likely to have relatively precise information about the firm's fiscal year earnings by the end of the year, the standard deviation of analyst forecasts represents a measure of the market's uncertainty. The average of these standard deviations across all observations in a given quarter results in a quarterly time series from 1977 to 1996. Analyst forecast dispersion should be positively related to information asymmetry, and thus negatively correlated with IPO volume.

4.3. *Investor sentiment proxies*

If individual investors are occasionally overoptimistic and willing to pay more for firms than they are worth, then value-maximizing managers will issue equity during these periods of high investor sentiment. I employ the discount on closed-end funds and post-IPO market returns as proxies for investor sentiment.

The choice of the discount on closed-end funds as a proxy is based on the findings of Lee et al., (LST, 1991). First, LST find that both closed-end funds and small stocks are mostly held by individual investors, suggesting that they are more likely than large stocks to be affected by investor sentiment. Second, although closed-end funds mostly invest in large stocks, their returns are significantly more highly correlated with returns on small stocks than with returns on large stocks. LST find that almost a quarter of the variation in monthly returns on the smallest decile of firms is explained by discount changes, even after controlling for general market movements. Their findings suggest that when investor sentiment is higher, investors pay relatively more for closed-end funds, and the discount is smaller. Following

LST, I measure the discount for a given quarter or year as the value-weighted discount across all domestic equity closed-end funds at the end of the period, where fund discounts are weighted by fund net asset value times shares outstanding.[7] The investor sentiment hypothesis predicts that IPO volume will be negatively related to this discount.

Baker and Wurgler (2000) show that firms issue relatively more equity around market peaks, just prior to periods of low market returns. They examine several potential explanations for this phenomenon and conclude that it reflects market timing. If investor optimism does affect market-wide returns and firms can successfully go public during high optimism periods, then IPO volume should be negatively correlated with future market returns. Returns are measured as compounded monthly returns on the equally weighted index over the four subsequent quarters in the quarterly regressions and the subsequent year in annual regressions, less the realized change in the consumer price index (CPI) during the year.

4.4. Control variables

Loughran et al. (1994) show that IPO volume tends to be higher when the level of the stock market is higher, i.e., following periods of high market returns. There exist several potential explanations for this observation. First, market returns may increase in response to increases in investment opportunities (and thus demands for capital). Second, market returns may increase as investor optimism increases. Either of these could cause more companies to go public. Third, changing market returns (or MB ratios) may reflect variation in the equity risk premium, i.e., variation in the difference between the expected returns on the market portfolio of common stocks and the risk-free rate. Fama and French (2000) estimate the equity risk premium conditional on ex ante information, and they find that this estimated premium has declined from 4.08% in the 1960s to 1.71% in the 1990s. While the cause of this decline is unknown (it could reflect rational responses to macroeconomic factors or irrational swings in investor sentiment), it is potentially associated with increases in contemporaneous realized market returns and in future IPO volume.

In summary, market returns variables potentially capture many different dynamics, and it is not clear whether they camouflage the true significance of the capital demands and/or investor sentiment proxies or whether they capture some other factor. Therefore, I run regressions both with and without these variables.

The market return measures include the average market-wide market-to-book ratio in the quarter prior to the IPO (MB_{t-1}), market returns during the three quarters prior to the IPO (EW market $return_{t-3 \text{ to } t-1}$), and a MB-returns

[7] Charles Lee graciously provided data on discounts between 1966 and 1985. For 1986–1996, net asset values were collected from *The Wall Street Journal*, and share and price data were obtained from CRSP. Finally, the annual regressions also include discounts from 1960 to 1965. The net asset value, price, and share data for this period were obtained from Wiesenberger's *Investment Companies* (Wiesenberger, 1960–1968).

interaction term (High MB_{t-1}*EW $returns_{t-3\text{ to }t-1}$), where High MB equals one when the MB ratio is above 1.5 and zero otherwise. MB is defined as the equally weighted average across public firms of individual firm equity market value divided by book value (total shareholders equity − preferred stock + deferred taxes + investment tax credits), where book value is measured at the end of the fiscal year, market value is measured at the end of each quarter, and book value is lagged by at least four months relative to market value. Firms with book values less than $100,000 (in 1990 dollars) and firms that have gone public within the past 36 months are excluded. Real stock returns are compounded monthly returns on the equally weighted index, adjusted by the CPI. For the industry analyses, MB and returns are averaged across public firms in each industry. The interaction term captures the possibility that stock returns have a larger effect on IPO volume when the market is above some threshold level. For example, the small stock rally of early 1975 did not result in any appreciable increase in the number of IPOs, while the rally of late 1982 generated many IPOs. Notably, the market MB in June 1975 was 1.1, compared to 2.0 in December 1982.

4.5. Aggregate time-series results

Table 3 shows time-series regressions at the quarterly interval, and Table 4 shows annual regressions. The first column of Table 3 shows quarterly IPO volume regressed on the market return variables. Both the MB ratio and the MB–returns interaction term are significantly positive, indicating that the number of companies going public varies significantly with the stock market. More firms go public when the average MB ratio is especially high. In addition, market returns have a significant effect when the market-wide MB ratio is also high.

The second through sixth columns investigate the importance of capital demands, information asymmetry, and investor sentiment. Rather than include several quarterly lags of each explanatory variable (or leads in the case of sales, GDP, and investment growth), I measure each variable over a three-quarter period. Because many of these explanatory variables are autocorrelated, multicollinearity can camouflage the significance of some factors if three separate lags (or leads) are included. For example, future GDP growth equals the percentage change in GDP between quarter t and quarter $t+3$. Because sales are highly seasonal, I measure sales growth as the change from quarter $t-1$ to $t+3$ (rather than quarter t to $t+3$). Also, because the discount is not a growth measure, one summary measure is less appropriate and individual quarterly lags are included in the regression.[8]

The second column of Table 3 shows quarterly IPO volume regressed on the capital demands proxies. Consistent with the importance of capital demands, future sales growth is positive and significant at the 1% level. The third column shows little

[8] Four lags of the discount (versus three of the other variables) are included in an attempt to reconcile the results at the quarterly and annual time intervals. As discussed later, the discount is strongly significant at the annual level, which seemed inconsistent with the insignificance of all three quarterly lags. This led me to add a fourth quarterly lag.

Table 3
Panel A: Quarterly time series analysis of aggregate IPO volume, 1972–1996

	(1) Mkt var's	(2) Cap. demands	(3) Info. asym.	(4) Investor sent.	(5) All proxies	(6) All proxies
Constant	6.66	7.51***	10.54	11.80***	12.06***	5.60
	(5.12)	(1.90)	(2.65)	(3.26)	(3.43)	(3.71)
Capital demands proxies						
Δ (No. of new corp's)$_{t-3 \text{ to } t}$		0.04			0.07***	0.09***
		(0.03)			(0.03)	(0.03)
Future sales growth$_{t-1 \text{ to } t+3}$		48.40***			15.27	20.50*
		(16.46)			(11.52)	(12.15)
Future GDP growth$_{t \text{ to } t+3}$		0.09			−0.03	−0.01
		(0.09)			(0.08)	(0.10)
Future inv't. growth$_{t \text{ to } t+3}$		−0.02			0.01	0.00
		(0.02)			(0.02)	(0.03)
NBER expansion$_{t+1}$		−1.43				
		(1.21)				
Information asymmetry proxies						
Δ(Earn. AR dispersion)$_{t-4 \text{ to } t-1}$			−39.53		−69.80***	−66.80***
			(29.57)		(19.51)	(21.42)
Δ(Analyst dispersion)$_{t-4 \text{ to } t-1}$			7.28			
			(20.30)			
Investor sentiment proxies						
Future EW mkt returns$_{t+1 \text{ to } t+4}$				−10.34***	−7.84***	−7.30***
				(2.94)	(2.55)	(2.69)
Fund discount$_{t-1}$				0.01	0.04	0.05
				(0.14)	(0.12)	(0.11)
Fund discount$_{t-2}$				0.19	0.26*	0.23
				(0.16)	(0.15)	(0.14)
Fund discount$_{t-3}$				0.03	−0.16	−0.06
				(0.16)	(0.14)	(0.12)
Fund discount$_{t-4}$				−0.38***	−0.44***	−0.47***
				(0.12)	(0.11)	(0.10)
Stock market variables						
MB$_{t-1}$	3.03*					1.62**
	(1.60)					(0.83)

Table 3 (*continued*)

	(1) Mkt var's	(2) Cap. demands	(3) Info. asym.	(4) Investor sent.	(5) All proxies	(6) All proxies
EW market return$_{t-3 \text{ to } t-1}$	−2.82					−0.91
	(3.04)					(1.89)
High MB$_{t-1}$ * EW ret$_{t-3 \text{ to } t-1}$	12.42**					4.33*
	(5.97)					(2.67)
Initial return$_{t-1}$						0.05**
						(0.02)
Quarter 1	−2.59***	−1.63***	−2.44**	−2.54***	−2.15***	−1.77***
	(0.77)	(0.57)	(1.15)	(0.48)	(0.50)	(0.57)
AR(1)	0.83***	0.78***	0.80***	0.84***	0.85***	0.79***
	(0.07)	(0.05)	(0.06)	(0.05)	(0.05)	(0.08)
Adjusted *R*-squared	76.2%	67.6%	61.2%	72.5%	77.0%	79.0%
Adj *R*-sqrd without AR(1)	54.8%	23.9%	1.6%	34.6%	42.3%	67.6%
No. of observations	100	100	76	100	97	94

This table shows quarterly regressions, in which the dependent variable is the number of IPOs, deflated by the number of public firms (in thousands) at the end of the prior quarter. The sample is 1972–1996. The change in the number of new corporations equals thousands of new corporations in quarter t minus thousands of new corporations in quarter $t-3$. Future sales growth equals the log of real sales in quarter $t+3$ minus the log of real sales in quarter $t-1$, averaged across all public firms except those firms that have gone public within the past three years. Future GDP growth equals the percentage change in real GDP between quarter t and quarter $t+3$. Investment growth is the percentage change in real quarterly private, nonresidential, fixed investment between quarter t and quarter $t+3$. The NBER dummy equals one if quarter $t+1$ was an expansion and zero otherwise. The dispersion of abnormal returns around earnings announcements equals the standard deviation across all firms with earnings announcements in a given quarter, of the AR (defined over days $-1,+1$) at this announcement. Analyst dispersion is the average, across companies that are in the last quarter of their fiscal year and have analyst forecasts listed on IBES during a given quarter, of the standard deviation of analyst forecasts for each company. The change in each of these dispersion measures (used in regressions) equals the dispersion in quarter $t-1$ minus the dispersion in quarter $t-4$. The discount on closed-end funds is a value-weighted percent and is measured at the end of the given quarter. Future real market returns (EW mkt returns$_{t+1,t+4}$) represent compounded monthly returns (in decimal form) on the equally weighted market index adjusted using the CPI over the four quarters subsequent to the IPO. The market-wide market-to-book ratio (MB), lagged real market returns, and MB-returns interaction terms are defined in Table 2. Subscripts (t, $t-1$, etc.) refer to quarters. Initial returns (IR) equal the difference between the first closing price and the offer price, divided by the offer price, averaged across all firms that went public in the given quarter. Newey-West standard errors are in parentheses. A quarter 1 dummy, equal to one in the first calendar quarter of each year and zero otherwise, is included to control for seasonality. Finally, an AR(1) term accounts for residual serial correlation.

Table 3 (*continued*)
Panel B: Chi-squared tests

	Primary and combination IPOs		Secondary IPOs	
	χ^2	p-Value	χ^2	p-Value
Capital demands proxies	2.37	(0.051)	4.92	(0.295)
Information asymmetry proxies	12.80	(0.000)	0.003	(0.954)
Investor sentiment proxies	23.95	(0.000)	15.14	(0.010)

This panel presents Chi-squared tests of the joint power of each set of proxies in Panel A. Capital demands proxies include the change in the number of new corporations, future sales growth, future GDP growth, and future investment growth. The dispersion of abnormal returns around earnings announcements proxies for information asymmetry. Real market returns over the four quarters subsequent to the IPO and the closed-end fund discount in each of the four quarters prior to the IPO proxy for investor sentiment. The first column is based on a regression of the number of primary and combination IPOs, deflated by the number of public firms (in thousands) at the end of the prior quarter on all of these proxies, i.e. the regression shown in column 5 of Panel A. The second column is based on a regression of secondary IPOs on these same proxies. Secondary IPOs are defined as IPOs in which at least 75% of the shares are secondary shares, excluding equity carve-outs. All other IPOs are included in primary and combination IPOs. Offerings in which the offer price is less than $5, ADRs, units, REITS, mutual-to-stock conversions, and closed-end funds are excluded from both series.

***, **, * Significance at the 1%, 5%, and 10% levels in two-sided significance tests.

support for information asymmetry as a determinant of IPO volume. The fourth column shows strong support for investor sentiment, as future market returns are significantly negative. While the fourth lag of the closed-end fund discount is also significantly negative, one must be cautious in interpreting this as supportive of the investor sentiment hypothesis because the first three lags of the discount have signs opposite from what was predicted. It is puzzling why investor sentiment would be so important four quarters prior to the IPO, but relatively unimportant closer to the IPO. Notably, this result is robust to excluding other independent variables, to including additional lags of these other variables, and to including dummies and interaction terms to control for seasonality. Further, when the sample is divided into two time periods (1972–1983 and 1984–1996), the fourth lag of the discount is negative and significant at the 10% level in both periods, indicating that outliers do not drive the results. The significance of the discount is re-examined in Table 4.

The fifth column of Table 3 combines the proxies for capital demands, information asymmetry, and investor sentiment into one regression to assess the relative power of each to predict IPO volume.[9] Consistent with the regressions in columns 1–3, strong support is provided for the importance of capital demands and investor sentiment. Notably, after controlling for variation in capital demands and investor sentiment, support is also provided for information asymmetry. Unfortunately, the total explanatory power of these variables is difficult to measure. While

[9] Because the analyst dispersion measure is only available beginning in 1978, this variable is excluded.

the adjusted R-squared for this regression equals 77%, the highly significant AR(1) term seems to contribute much of the explanatory power, suggesting that the economic model leaves a lot unexplained. The adjusted R-squared excluding the AR(1) term equals 42%, but this statistic must be interpreted with caution as the regression without the AR(1) term is not properly specified (Granger and Newbold, 1974). Chi-squared tests of the joint significance of certain explanatory variables and estimates of economic significance provide alternative measures of the importance of capital demands, information asymmetry, and investor sentiment.

Panel B of Table 3 shows Chi-squared tests of the joint power of each set of proxies (capital demands, information asymmetry, and investor sentiment). The first column is based on the regression shown in column 5 of Panel A. These tests support the conclusion that both aggregate capital demands and investor sentiment are important determinants of IPO volume (p-values of 0.051 and 0.000, respectively). Notably, information asymmetry is also significant (p-value $= 0.000$).

In addition to being statistically significant, capital demands are also significant in economic terms. An increase of 11,000 new corporations (one standard deviation) and a 5% increase in sales growth (one standard deviation) are each associated with a one-eighth standard deviation increase in IPO volume. Because IPO volume is measured as a fraction of existing public firms, this is associated with a different number of IPOs over time. A one-eighth standard deviation increase in IPO volume equates to approximately four IPOs per quarter in 1975, five in 1985, and seven in 1995. Notably, investor sentiment appears even more economically significant. A 21% decrease in future equal-weighted returns (one standard deviation) is associated with a one-quarter standard deviation increase in IPO volume, approximately ten IPOs per quarter in 1985. Finally, although information asymmetry is statistically significant, it is not significant in economic terms. The finding that information asymmetry is not an important determinant of the timing of IPOs may reflect the lack of uncertainty about the value of IPO firms' assets in place. As discussed by Myers and Majluf (1984), it is this uncertainty about assets in place that prevents firms from issuing equity. While there exists considerable uncertainty about IPO firms' growth opportunities, such uncertainty does not similarly deter equity issuance.

Finally, the sixth column of Panel A adds the market-wide MB ratio, market returns, the MB–returns interaction term, and average initial returns as additional independent variables. Evidence in column 1 shows that IPO volume is positively correlated with these stock market variables. Also, Lowry and Schwert (2002) show that IPO volume is significantly related to past initial returns. The significance of these variables potentially reflects the importance of aggregate capital demands or investor sentiment, in which case the significance of the other proxies may be attenuated. However, they may also capture time-varying risk premia or some other unknown determinant of IPO volume, which the previous regression did not control for. Notably, inferences from the column 6 regression are similar to those from previous regressions. Consistent with predictions, IPO volume is positively related to aggregate demand for capital and to investor sentiment and negatively related to information asymmetry. However, only capital demands and investor sentiment are significant in economic terms. Regarding the control variables, the MB ratio, the MB–returns interaction term, and initial returns are also significantly positive. MB is also significant in economic terms: a 0.9 increase in MB (approximately one standard deviation) is associated with approximately 10 more IPOs per quarter in 1985. None of the other control variables are economically significant.

One potential concern with any analysis that employs proxies is whether the proxies capture the intended factors. A comparison of the timing of primary and combination IPOs with that of secondary IPOs addresses this issue. Secondary offerings are defined as IPOs (excluding equity carve-outs) in which 75% or more of the total shares represent shares sold by pre-issue shareholders, and primary and combination offerings include all other IPOs. Fig. 2 shows that the time-series variation in primary and combination IPOs is significantly positively correlated with that of secondary IPOs (correlation = 0.53). This is consistent with the evidence in Table 3 that investor sentiment and possibly information asymmetry significantly

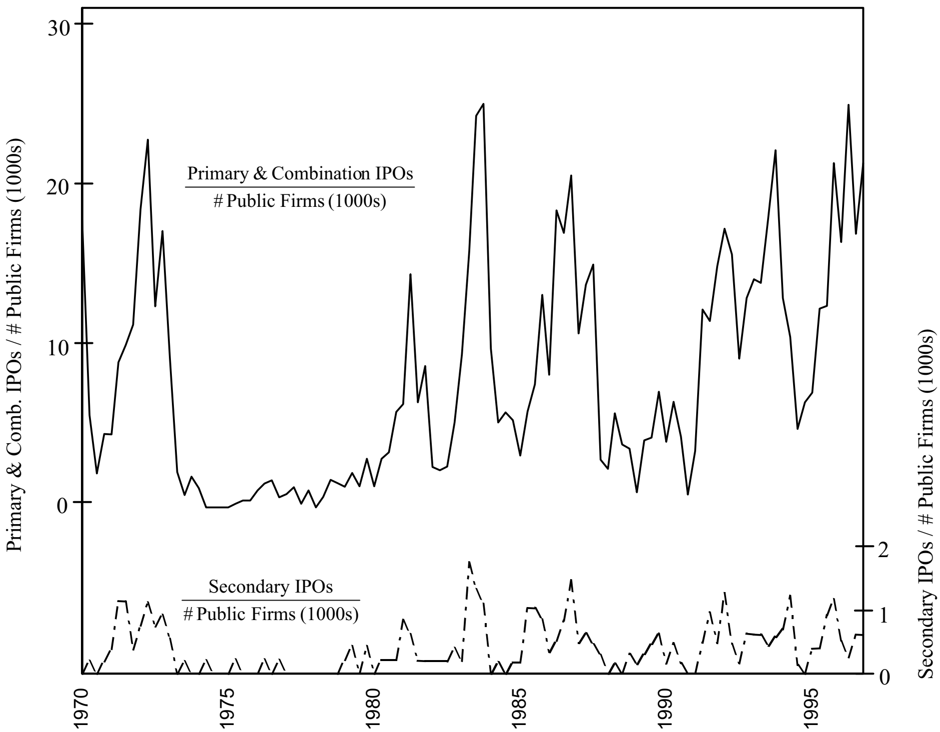

Fig. 2. Primary and combination IPOs versus secondary IPOs, 1970–1996. Primary and combination IPOs are depicted with the solid line, and secondary IPOs are shown with the dotted line. Both series are deflated by the total number of public firms (in thousands) at the end of the previous quarter. Secondary IPOs are defined as non-equity carve-outs in which at least 75% of the total shares represent secondary shares, i.e. shares sold by pre-issue shareholders. All other IPOs are included in primary and combination offerings. Offerings in which the offer price is less than $5, ADRs, units, REITS, closed-end funds, and mutual-to-stock conversions are excluded from both series. Data are from SDC.

affect IPO volume. If variation in IPO volume was entirely determined by changes in firms' demands for capital, then there should exist little relation between secondary and non-secondary IPO volume. Since secondary IPOs provide little new capital for firms, a firm's demand for capital should have little effect on the timing of its secondary IPO.

The second column of Panel B employs the time-series of secondary IPOs to test whether the proxies in the Table 3 regressions capture the intended factors. Similar to column 1, these Chi-squared tests are based on the Table 3, column 5 regression, but the dependent variable equals the number of secondary IPOs deflated by the number of public firms at the end of the prior quarter. Note that the capital demands proxies are not significant in explaining the timing of secondary IPOs (p-value $= 0.295$), but investor sentiment proxies are highly significant (p-value $= 0.010$). Finally, the Chi-squared test of the significance of the information asymmetry proxies has a p-value of 0.000 for the non-secondary IPOs, compared to 0.954 for the secondary IPOs. It is puzzling that information asymmetry is significant for non-secondary IPOs, but not for secondary IPOs. While many factors may contribute to this difference, it is possible that the larger average size of secondary IPO firms makes them less susceptible to adverse selection costs. More information tends to be available about larger firms, and secondary IPO firms are on average ten times larger than non-secondary IPOs, where size is measured as inflation-adjusted total assets prior to the IPO. In summary, the contrast between the Chi-squared tests of the capital demands and investor sentiment proxies supports the assertion that these proxies capture the intended factors. However, it is difficult to be as certain that the information asymmetry proxies accurately reflect variation in adverse selection costs.[10]

Table 4 further examines the relative importance of capital demands and investor sentiment in annual interval regressions. Because information asymmetry proxies are only available back to 1970, they are not included. The first column of Table 4 shows a regression of IPO volume on the lagged stock market variables. Results show that a higher market-wide MB ratio and higher market returns in conjunction with the higher MB ratio are both associated with higher IPO volume. The remaining columns investigate more specifically the importance of capital demands and investor sentiment. In column 2, the change in the number of new corporations is significantly positive, consistent with the importance of capital demands. In column 3, coefficients on both the closed-end fund discount and future returns are significantly negative, consistent with the investor sentiment hypothesis.

Column 4 of Table 4 includes selected capital demands and investor sentiment proxies. Similar to previous regressions, the change in the number of new corporations is significantly positive, and the closed-end fund discount and future

[10] Ex ante, one potential concern with these Chi-squared tests is that the small number of secondary IPOs may cause these regressions to have low power, thereby preventing meaningful inferences regarding the ability of these proxies to capture the intended factors. However, the finding that the investor sentiment proxies are significant for both groups while the significance of the capital demands proxies differs so dramatically mitigates this concern.

Table 4
Annual time-series analysis, 1961–1996
The dependent variable is the number of IPOs each year deflated by the number of public firms (in thousands) at end of the prior year. The sample is 1961–1996. The change in the number of new corporations equals the first difference of thousands of new corporations each year. Sales growth equals the log of real sales in year $t+1$ minus the log of real sales in year t, averaged across all public firms with Compustat data except firms that have gone public within the previous three years. GDP growth equals the percentage change in annual real GDP. Investment growth equals the percentage change in annual real private, nonresidential, fixed investment. The discount on closed-end funds is measured at the end of the given year. Future equally weighted real market returns represent returns (in decimal form) on the equally weighted index adjusted using the CPI over the one year subsequent to the IPO. The market-wide market-to-book ratio (MB), lagged real market returns, and MB-returns interaction terms are defined in Table 2. Newey-West standard errors are in parentheses. An autoregressive parameter [AR(1)] is also included in each regression to correct for residual serial correlation.

	(1) Market return variables	(2) Capital demands proxies	(3) Investor sentiment proxies	(4) All proxies	(5) All proxies
Constant	9.50	38.71*	95.19***	83.33***	58.09
	(30.45)	(19.63)	(11.62)	(10.73)	(34.26)
Δ(No. of new corp's)$_t$		0.81**		0.53**	0.58***
		(0.33)		(0.21)	(0.19)
Sales growth$_{t+1}$		42.18		13.77	
		(225.57)		(93.93)	
GDP growth$_{t+1}$		1.14			
		(3.42)			
Invest. growth$_{t+1}$		0.21			
		(1.80)			
Closed-end disc$_{t-1}$			−3.16***	−3.12***	−3.20***
			(0.67)	(0.73)	(0.96)
Future EW mkt returns$_{t+1}$			−61.55***	−47.33**	
			(18.07)	(19.22)	
MB$_{t-1}$	16.57*				7.30
	(9.11)				(8.56)
EW mkt returns$_{t-1}$	22.30				
	(17.34)				
High MB*EW ret$_{t-1}$	73.30**				39.62
	(27.14)				(31.76)
AR(1)	0.40***	0.64***	0.28***	0.37***	0.23*
	(0.10)	(0.12)	(0.09)	(0.13)	(0.11)
Adj R-sqrd	32.9%	33.7%	54.6%	58.5%	58.8%
Adj R-sqrd without AR(1)	23.7%	11.4%	52.7%	54.9%	57.2%
No. of observations	32	36	36	36	32

***, **, * Significance at the 1%, 5%, and 10% levels in two-sided significance tests.

market returns are significantly negative. In economic terms, an increase of 23,000 new corporations (one standard deviation) is associated with about 60 more IPOs in 1975, 75 in 1985, and 97 in 1995 (a 0.28 standard deviation increase). Regarding the investor sentiment proxies, a 25% decrease in future market returns (one standard deviation) similarly results in about 75 more IPOs in 1985. Notably, the closed-end fund discount has the highest economic significance; a 7.9% increase in the discount (one standard deviation) is associated with approximately 151 more IPOs in 1985 (a 0.57 standard deviation increase). These annual interval regressions indicate that the economic significance of both capital demands and investor sentiment is higher than the quarterly regressions suggested. This is perhaps because of the greater noise in the quarterly series. Notably, investor sentiment appears more economically significant than capital demands at both intervals.

Finally, column 5 includes the MB ratio and the MB–returns interaction term as control variables, the change in the number of new corporations to proxy for capital demands, and the closed-end fund discount to proxy for investor sentiment. (Because of degrees of freedom limitations, I only include the most significant variables from the columns 1–3 regressions.) Results again indicate that both capital demands and investor sentiment significantly affect IPO volume. Results are similar if future market returns are used to proxy for investor sentiment.

As mentioned earlier, the finding that only the fourth quarterly lag of the discount was significant (Table 3) is puzzling and casts some doubt on whether or not IPO volume is truly related to the discount. The finding that the first *annual* lag of the discount is negative as predicted and highly significant provides stronger evidence that such a relation exists. Notably, sensitivity tests indicate that outliers do not drive the different results across the two time intervals.[11] Perhaps the significance of future market returns across both time intervals provides the strongest evidence that IPO volume is truly related to investor sentiment.

In summary, results across the quarterly and annual intervals are relatively similar: capital demands and investor sentiment receive strong support in both sets of regressions. This similarity of results mitigates several potential concerns. For example, it seems that noise in the quarterly IPO volume series does not camouflage the statistical significance of certain explanatory variables. Also, although the annual interval contains fewer observations, these results do not seem to be driven by outliers. In addition, we learn that results hold over both a shorter and longer time period, i.e., 1973–1996 in the quarterly regressions and 1961–1996 in the annual regressions. Finally, the annual interval regressions have the advantage of explaining more of the variation in IPO volume. Although the adjusted R-squared is quite high at the quarterly interval, the highly significant AR(1) term seems to contribute much of this explanatory power. In contrast, at the annual interval, the AR(1) term is less significant but the adjusted R-squared remains over 50%, suggesting that capital

[11] To investigate whether outliers drive the strong significance at the annual level, I redefine the "year" in three alternative ways: beginning in the second quarter, beginning in the third quarter, and beginning in the fourth quarter. Results are qualitatively similar using these alternative definitions.

demands and investor sentiment do explain a substantial portion of the fluctuations in IPO volume.

4.6. Industry time-series analysis

Table 5 investigates the importance of capital demands, information asymmetry, and investor sentiment at the industry level. Proxies for these factors include those variables from the aggregate analysis that are available at the industry level: future industry sales, the standard deviation of abnormal returns around earnings announcements for publicly traded firms in the given industry, and future returns on a portfolio of publicly traded firms in that industry. I run a seemingly unrelated regression (SUR) on industry-level panel data, where the dependent variable equals IPO volume in each industry each quarter. The advantage of the SUR model as opposed to OLS for the industry analysis is that SUR accounts for both heteroskedasticity and contemporaneous correlation in the errors. The intercept, quarter 1 dummy, and AR(1) term (not shown) are allowed to vary across industries, while all other coefficients are constrained to be equal across industries.[12]

Several findings emerge from Table 5. First, industry-level dynamics in the stock market have a significant effect on the number of companies going public, as evidenced by the significance of the average industry MB ratio and industry returns. Second, capital demands and investor sentiment both contribute significantly to the observed fluctuations in IPO volume. Thus, results in Table 5 provide added support for the inferences drawn from Tables 3 and 4. Notably, information asymmetry is only marginally significant in these industry level regressions. Finally, industry factors have a substantial effect on IPO volume, incremental to market-wide dynamics.

4.7. Robustness checks

To verify that the three sets of proxies (capital demands, information asymmetry, and investor sentiment) do capture distinct factors, I calculate the fitted value of the change in the number of IPOs, based on each set of proxies individually, and then examine the correlation between the fitted values. For example, the fitted value based on the capital-demands proxies equals each of the capital-demands proxies multiplied by their respective coefficients from the regression in the fifth column of Table 3, Panel A. Conducting a similar exercise for the investor-sentiment proxies and then for the information-asymmetry proxies yields two additional fitted values. I find that the correlation between these fitted values is less than 0.25. This provides

[12] The constrained coefficients on the explanatory variables represent a weighted average of individual industry effects. Compared to letting all coefficients vary across industries, this approach minimizes the effects of noise at the industry level and eases interpretation of the 'average' effect of the hypothesized determinants of IPO volume (as proxied by the explanatory variables). Note that letting intercept terms vary allows the *level* of IPO volume to vary across industries.

Table 5

Quarterly time-series analysis of IPO volume at the industry level, 1973–1996

This table shows quarterly pooled time-series, cross-sectional regressions, in which the dependent variable is the number of nonsecondary IPOs in each industry, deflated by the number of public firms in that industry (in thousands) at the end of the prior quarter. There are a total of 16 industries, which are defined in Table 1. A seemingly unrelated regression (SUR) is estimated, which accounts for both heteroskedasticity and contemporaneous correlation in the errors across equations. The intercept, quarter 1 dummy, and AR(1) term (not shown) are allowed to vary across industries, while all other coefficients are constrained to be equal across industries. The sample is 1972–1996. Industry (aggregate) sales growth equals the log of sales in quarter $t+3$ minus the log of sales in quarter $t-1$, averaged across all public firms in each industry (in the market), except for firms that have had IPOs within the past 12 quarters. The industry (aggregate) dispersion of abnormal returns around earnings announcements equals the standard deviation across all firms in each industry (in the market) with earnings announcements in a given quarter, of the AR (defined over days $-1,+1$) at this announcement. Future industry (market) real returns represent average compounded monthly returns (in decimal form) on a portfolio of all public firms in the given industry (the equally weighted index) adjusted using the CPI over the four quarters subsequent to the IPO. The industry and aggregate market-to-book ratios (MB), real returns, and MB-returns interaction terms are defined in Table 2. Subscripts ($t, t-1$, etc.) refer to quarters. Newey-West standard errors are in parentheses. A quarter 1 dummy equals one in the first calendar quarter of each year and zero otherwise.

	(1) Mkt returns var's	(2) Capital demands	(3) Info. asymmetry	(4) Investor sentiment	(5) All proxies
Indus. future sales growth$_{t-1 \text{ to } t+3}$		4.98***			5.02***
		(1.75)			(1.80)
Agg. future sales growth$_{t-1 \text{ to } t+3}$		3.68			−2.85
		(5.25)			(5.34)
Indus Δ(Earn. AR dispersion)$_{t-4 \text{ to } t-1}$			−8.68*		−6.05
			(4.18)		(4.21)
Agg. Δ(Earn. AR dispersion)$_{t-4 \text{ to } t-1}$			16.94		11.49
			(12.20)		(11.84)
Indus. future EW mkt rets$_{t+1 \text{ to } t+4}$				−3.31***	−3.91***
				(0.95)	(0.97)
Agg. future EW mkt rets$_{t+1 \text{ to } t+4}$				−0.85	0.95
				(1.34)	(1.42)
Indus. MB$_{t-1}$	0.14*				0.14*
	(0.08)				(0.08)
Indus. EW return$_{t-3 \text{ to } t-1}$	2.91**				2.90**
	(1.32)				(1.34)
Indus: high MB$_{t-1}$ $*$ EW ret$_{t-3 \text{ to } t-1}$	1.86				1.25
	(1.47)				(1.36)
Time-series obs.	96	96	95	96	95
Total panel obs.	1536	1536	1513	1536	1513

***, **, * Significance at the 1%, 5%, and 10% levels in two-sided significance tests.

further evidence that capital demands, information asymmetry, and investor sentiment represent distinct factors.

Results are qualitatively similar under a variety of alternative specifications. For example, I include additional lags/leads of the explanatory variables, an equal-weighted (rather than value-weighted) measure of the closed-end fund discount, value-weighted (rather then equal-weighted) measures of sales growth, analyst forecast dispersion, and earnings abnormal returns dispersion, a business cycle dummy in the annual regressions, and, following Choe et al. (1993), market volatility as an additional measure of information asymmetry.[13] In addition, I rerun regressions using total proceeds raised/market capitalization. I also examine the relation between IPO volume and changes in the tax code, which potentially affect the supply of equity. However, tax-code changes do not seem to directly relate to IPO volume. Finally, while a limited number of degrees of freedom restricts my ability to examine information asymmetry at the annual interval, I nevertheless attempt to estimate its importance. However, results from a variety of univariate and multivariate regressions provide no evidence that annual IPO volume increases following decreases in adverse selection costs.

5. Post-IPO stock returns

This section investigates post-IPO stock returns as an additional means of gaining insight on the determinants of IPO volume. Unlike the time-series regressions, this analysis has the advantage of not relying on proxies. If the fluctuations in IPO volume are driven by changes in investor sentiment, then post-IPO returns will be lowest following the high optimism, high IPO volume periods, when investors overpay the most. While the level of post-IPO abnormal stock returns has received considerable attention in the literature (see, e.g., Ritter, 1991; Loughran and Ritter, 1995, 2000; Brav and Gompers, 1997; Brav et al., 2000), there exists relatively little evidence on the relation between IPO volume and post-IPO returns. Further, the existing evidence on this issue predates the recent literature on the measurement of long-run returns. Therefore, I first briefly discuss the prior literature in light of our recently gained knowledge of the specification of long-run abnormal returns tests. I then present my principal empirical tests on the relation between IPO volume and post-IPO returns.

5.1. Prior evidence

Ritter (1991) finds that IPO volume is negatively related to post-IPO stock returns. In a regression of three-year stock returns on the value-weighted market index, IPO volume at the time of each issue, initial returns, and several other control variables,

[13] Value-weighted measures of sales growth and the dispersion of abnormal returns around earnings announcements are slightly less significant than equal-weighted measures, perhaps because IPOs are more similar to smaller firms.

the coefficient on IPO volume is significantly negative. The top of Table 6 reviews this finding. Following Ritter (1991), I estimate a cross-sectional regression of 36 months of post-IPO returns (defined as compounded daily returns until the end of the first month and monthly returns over the next 35 months) on the IPO initial return, market returns over the same 36 month period (defined in the same manner), IPO volume, an oil dummy, and a bank dummy. IPO volume is defined as the number of IPOs during the year each firm went public divided by the total number of public firms at the end of the prior year. In the first row, the market is defined as the value-weighted index, and in the second row it is defined as the equal-weighted index. Consistent with Ritter's finding, row 1 shows a significant negative relation between long-run returns and IPO volume. However, as shown in the second row, when equal-weighted market returns are substituted for value-weighted returns, the coefficient on IPO volume is not significant at conventional levels. While neither market index completely captures expected returns, the equally weighted index is arguably a better proxy, as IPO firms tend to be small. These results suggest that the apparent negative relation between post-IPO returns and IPO volume is sensitive to the model of expected returns. Further empirical tests support this proposition.

Loughran and Ritter (1995, 2000) provide evidence on a closely related issue. They examine the relation between the returns on a portfolio and the number of firms in this portfolio, where the portfolio includes all firms that have gone public in the past three years. The portfolio composition is updated monthly, and average abnormal portfolio returns are calculated for each month. They then define high volume months as those months with the most number of firms in the portfolio (i.e., firms that have gone public within the previous three years), and compare the abnormal performance of the portfolio in high volume versus low volume months.

The bottom portion of Table 6 illustrates the Loughran and Ritter (1995) analysis. The sample consists of all firms between 1973 and 1996 with both total market capitalization and book-to-market equity (BM) available from CRSP and Compustat. For each firm month, an issue dummy equals one if the firm has completed an IPO within the previous 36 months and zero otherwise. Using a Fama and MacBeth (1973) type procedure, a cross-sectional regression of percent returns on the log of firm size, the log of firm BM, and a new issue dummy is estimated each month.[14] Reported coefficients and standard errors are based on the time-series of coefficient estimates. The first row is based on all months, and the second and third rows show the regressions for the high- and low-volume months, respectively. (Months in which the fraction of sample firms that have gone public during the past 36 months is above the median are considered high-volume periods, while those below the median represent low-volume periods.) Consistent with Loughran and Ritter's results, the new issues in the low-volume periods perform better than those in the high-volume periods.

Note that this definition of new-issue portfolio volume does not provide direct evidence on whether firms' post-IPO returns are related to IPO volume at the time

[14] BM is defined in the same manner as is described in Appendix A for the formation of the 25 size/BM portfolios.

Table 6

Regressions of post-IPO returns on IPO volume, 1973–1996

Panel A shows a cross-sectional regression of monthly compounded percentage returns over the 36 months following the IPO (defined as compounded daily returns until the end of the first month with 35 monthly returns,

$$\left[\prod_{t=\text{offer date}+1}^{T}(1+R_{i,\text{day } t})*\prod_{t=\text{offer month}+1}^{\min[\text{offer month}+35,\text{delisting date}]}(1+R_{i,\text{month } t})-1\right]*100,$$

where T is the last day of the first month the IPO trades) for firms that went public between 1973 and 1996. The initial return equals the percent difference between the first trading price and the offer price, where the first closing price must be within 14 days of the IPO. The equally weighted (EW) and value-weighted (VW) percentage returns are measured over the same period as the dependent variable. IPO volume equals the number of IPOs that went public during the same year divided by the total number of public firms at the end of the previous year. An oil dummy equals one if the firm is in SIC codes 131, 138, 291, or 679 and zero otherwise, and a bank dummy equals one if the firm is in SIC code 603, 612, 620, or 671 and zero otherwise. Panel B shows results from Fama-MacBeth regressions, where a cross-sectional regression is estimated each month. Reported coefficient estimates and standard errors are based on the monthly coefficient estimates. The sample includes monthly percentage returns for all firms with CRSP and Compustat data between 1973 and 1996. Independent variables include the natural log of firm market capitalization in month t (Firm size_{it}), the natural log of firm book-to-market in month t (Firm BM_{it}), a new issue dummy equal to one if the firm went public within the prior 36 months and zero otherwise, and this new issue dummy multiplied by volume at the time of the IPO. Volume is defined as the number of firms that went public during that quarter, divided by the total number of public firms (in thousands) at the end of the previous quarter. Regressions are estimated for all months, and separately over months in which the fraction of firms with the new issue dummy equal to one is above the median (high-volume months) and below the median (low-volume months).

Panel A: Cross-sectional regressions

Dependent variable	Intercept	Initial return_i	VW index	EW index	IPO volume_i	Oil dummy_i	Bank dummy_i	Obs	Adj R-sqrd
3 yr post-IPO returns	26.80*** (8.51)	0.16 (0.13)	0.86*** (0.10)		−843.74*** (139.89)	−40.12** (17.41)	−23.43 (15.74)	4147	2.15%
3 yr Post-IPO returns	1.51 (9.65)	0.14 (0.13)		1.02*** (0.11)	−200.49 (142.19)	−51.65*** (17.40)	−24.08 (15.69)	4147	2.73%

Panel B: Fama-MacBeth regressions

	Intercept	Firm size_{it}	Firm BM_{it}	New issue_{it}	New issue_{it} * Volume at time of IPO	No. of mths
All months	1.01* (0.55)	0.02 (0.06)	0.20*** (0.07)	−0.11 (0.17)		288
Low-volume months	1.77* (0.93)	−0.10 (0.09)	0.22** (0.10)	0.13 (0.29)		144
High-volume months	0.27 (0.61)	0.14** (0.06)	0.18** (0.08)	−0.37** (0.18)		144
All months	0.99* (0.56)	0.03 (0.06)	0.20*** (0.07)		0.07 (0.07)	288

***, **, * Significance at the 1%, 5%, and 10% levels in two-sided significance tests.

that they went public. Periods are classified as high- or low-volume based on the number of firms that went public within the previous three years rather than on IPO volume at one point in time, e.g., during a single quarter. For example, under Loughran and Ritter's (1995) classification, the fourth quarter of 1987 represents a high-volume period even though only 37 firms went public during that quarter, while the fourth quarter of 1983 is a low-volume period even though 236 firms went public then. The last row of Table 6 addresses the difference between my measure of IPO volume and their measure of portfolio volume. I estimate a similar Fama-MacBeth type regression, but instead of including the new issue dummy as a zero–one variable, I interact it with IPO volume at the time the firm went public ($\text{Issue}_{it} * \text{Volume}_i$). Volume is defined as the number of firms that went public in the same quarter as firm i, divided by the total number of public firms (in thousands) at the end of the previous quarter. As shown in the last row of Table 6, the coefficient on this variable is not significant. These results suggest that post-IPO *abnormal* returns are not significantly related to IPO volume at the exact time the firm went public. Further empirical tests in Tables 7 and 8 support this conclusion.

5.2. Relation between post-IPO abnormal stock returns and IPO volume

Table 7 classifies the IPOs into quartiles based on IPO volume during the quarter in which they went public and presents average post-IPO returns for each quartile. Raw returns represent compounded monthly returns over the three and five years after the IPO, on an equal-weighted and value-weighted basis, where the weight equals total market capitalization at the time of the IPO. Abnormal returns represent the compounded IPO firm returns minus the compounded benchmark return, over the three and five years after the IPO. If an IPO firm delists prior to the three or five years, abnormal returns are compounded up until the delisting date. The benchmark equals 25 size/BM portfolios. To form these portfolios, all firms on the CRSP tapes (excluding firms that have had an IPO or SEO within the past 36 months) are divided into five quintiles based on size and into five quintiles based on BM. The intersection of these groupings yields 25 size/BM portfolios.[15] IPO volume is defined as the number of IPOs divided by the total number of public firms at the end of the previous quarter. Quartile classifications are based on IPOs between 1973 and 1996 for the three-year post-IPO returns shown in the top panel, and between 1973 and 1994 for the five-year post-IPO returns shown in the bottom panel. Because no adjustment is made for the cross-correlation of IPO firm returns, no significance tests can be conducted. Nevertheless, the pattern of mean returns across the quartiles is enlightening.

As shown in Table 7, three-year equal-weighted raw returns and five-year value-weighted abnormal returns show monotonic relations across the quartiles, with the lowest IPO volume quartile having the highest post-IPO returns. However, evidence is mixed across the other return measures. It is generally the case that a monotonic

[15] Further details regarding the abnormal return tests are provided in Appendix A.

Table 7

Descriptive evidence on the relation between post-IPO stock returns and IPO volume

Panel A classifies firms that went public between 1973 and 1996 with both CRSP and Compustat data into quartiles based on IPO volume during the quarter in which they went public, with quartile 1 representing the lowest volume periods. IPO volume is defined as the number of firms that went public during the quarter divided by the total number of public firms at the end of the previous quarter. N equals the number of firms in the quartile. Raw IPO percentage returns over the 36 months after the IPO beginning with the first CRSP-listed closing price

$$\left[\sum_{i=1}^{N}\left(\prod_{t=1}^{\min[36\ \text{months,delisting date}]}(1+R_{i,t})-1\right)*100\right]/N$$

and the difference between these returns and returns on a matched size, BM portfolio over the same period

$$\left[\sum_{i=1}^{N}\left(\sum_{t=1}^{\min[36\ \text{months,delisting date}]}(1+R_{i,t}-R_{\text{benchmark},t})-1\right)*100\right]/N$$

are presented. For value-weighted returns, raw and abnormal returns are weighted by firm market capitalization after the IPO. Panel B presents similar statistics for five-year returns, with the exception that quartiles are based on firms that went public between 1973 and 1994.

Panel A: Three-year compounded post-IPO returns (%), 1973–1996

		Equal-weighted returns		Value-weighted returns	
IPO volume quartile	N	Raw IPO returns	Abnormal IPO returns	Raw IPO returns	Abnormal IPO returns
1 (low)	114	106.4%	33.2%	134.7%	55.3%
2	497	60.5	22.9	54.5	8.6
3	1277	32.1	−2.7	41.8	−7.1
4 (high)	2322	25.9	−0.1	66.1	19.4

Panel B: Five-year compounded post-IPO returns (%), 1973–1994

		Equal-weighted returns		Value-weighted returns	
IPO volume quartile	N	Raw IPO returns	Abnormal IPO returns	Raw IPO returns	Abnormal IPO returns
1 (low)	99	222.0%	70.6%	249.4%	102.2%
2	373	78.9	13.9	85.2	7.0
3	920	59.3	6.0	73.0	−2.0
4 (high)	1979	63.8	14.7	80.7	−13.0

relation exists among the first three quartiles. However, contrary to the investor sentiment hypothesis, the highest volume quartile rarely has the lowest returns.

Table 8 provides a more rigorous analysis of the relation between IPO volume and post-IPO returns. Thus, these results represent a more powerful test of the determinants of IPO volume. A well-specified test must account for the potentially

Table 8
Calendar portfolio regressions of post-IPO returns on IPO volume
This table shows regressions of post-IPO returns on IPO volume. The dependent variable equals returns on a monthly calendar time portfolio. Each month, the portfolio consists of firms that have gone public within the prior 36 months. All returns are in percentage form, but abnormal returns are standardized to account for heteroskedasticity. Abnormal monthly returns equal the difference between the average calendar time portfolio return and the portfolio expected return $[\sum_{i=1}^{N}(R_{i,t} - R_{\text{benchmark},t})]/N$, where N is the number of firms in the portfolio and $R_{\text{benchmark}}$ represents the expected return). Two models of expected returns are used: 25 size/BM portfolios and the three-factor model. Each month's abnormal return is standardized by the residual standard deviation, which is estimated using 36 months residuals, $\sqrt{\frac{1}{35}\sum_{j=1}^{36}(\hat{e}_{t,t-j+1} - \frac{1}{36}\sum_{i=1}^{36}\hat{e}_{t,t-i+1})^2}$. IPO volume equals the average across all component firms in the calendar month portfolio of number of IPOs/number of public firms (in thousands) during the quarter each component firm went public. An autoregressive ([AR(1)] term is included in each regression to correct for residual serial correlation. Newey-West standard errors are shown in parentheses.

Dependent variable	Intercept	IPO volume	AR(1) term	Obs
Equal-weighted regressions, 1973–1996				
Raw IPO returns	3.232***	−0.226**	0.207***	287
	(1.000)	(0.094)	(0.049)	
Abnormal IPO returns, using FF 3-factor model	0.097	−0.006	0.585***	287
	(0.234)	(0.024)	(0.056)	
Abnormal IPO returns, using matched size, BM portfolios	0.143	−0.017	0.152***	287
	(0.165)	(0.016)	(0.051)	
Value-weighted regressions, 1973–1996				
Raw IPO returns	2.169*	−0.137	0.164***	287
	(1.189)	(0.108)	(0.048)	
Abnormal IPO returns, using FF 3-factor model	−0.036	0.005	0.560***	287
	(0.217)	(0.024)	(0.063)	
Abnormal IPO returns, using matched size, BM portfolios	0.059	−9.131	0.097**	287
	(0.138)	(13.753)	(0.039)	

***, **, * Significance at the 1%, 5%, and 10% levels in two-sided significance tests.

high cross-correlations between IPO firm returns. Table 8 therefore employs the Jaffe (1974) and Mandelker (1974) calendar-time portfolio approach. Lyon et al. (1999) find that this approach provides the best-specified test of abnormal returns in nonrandom samples. Each month a portfolio is formed that includes all firms that have gone public in the previous three years. Monthly calendar-time abnormal returns (CTARs) represent the difference between the average portfolio returns and the portfolio expected return. Two models of expected returns are used: the 25 size/BM portfolios described above and the Fama-French three-factor model.

The time series of calendar portfolio returns (raw portfolio returns and CTARs) are regressed on the time series of IPO volume. Each month volume is calculated as the average (across all component firms in the calendar month portfolio) of the number of IPOs divided by the number of public firms (in thousands) during the quarter each component firm went public.[16] The numerator represents IPO volume in a given quarter, and the denominator is measured at the end of the previous quarter.

The results in Table 8 are generally consistent with the inferences drawn from Table 7. There exists a significant negative relation between post-IPO equal-weighted raw returns and IPO volume, but little evidence using abnormal returns or when returns are value-weighted. The coefficient on IPO volume is significantly negative in the equal-weighted raw returns regression, but insignificant at conventional levels in the other regressions.[17] Results are qualitatively similar using five years of post-IPO returns. Interestingly, additional calendar portfolio regressions (not reported) suggest that the Table 7 finding that firms in the lowest volume quartile have the highest abnormal returns is not statistically significant. Specifically, I add the proportion of issues in the lowest volume quartile as an additional independent variable in each of the four abnormal-return calendar-portfolio regressions. However, this variable is only significant in one of the regressions, and then only at the 10% level.

The contrast between raw and abnormal returns can be interpreted in one of two ways. If size and book-to-market accurately capture the risk characteristics of the firm, then the lack of a relation between abnormal returns and IPO volume provides evidence against the investor sentiment hypothesis. However, if certain sectors of the market tend to be overvalued at certain times (for example, small growth stocks), then the benchmark-adjusted returns could be controlling for the very factor I am trying to test. Given the inherent difficulties in measuring abnormal returns and thus distinguishing between these alternative viewpoints, I conduct one additional long-run return analysis.

As discussed earlier, Baker and Wurgler (2000) find a significant negative relation between future market returns and relative equity financing [equity/(equity + debt)]. They conduct a number of tests to determine if the source of this relation is consistent with efficient markets, but conclude that it reflects market timing on the part of firms issuing equity. In a similar spirit, Table 9 shows regressions of time $t+1$ market returns on time t # IPOs/total public firms (in thousands). Regressions are estimated at both the quarterly (rows 1 and 2) and annual (rows 3 and 4) interval. Market returns represent compounded monthly returns on the equal- or value-weighted market index during quarters $t+1$ to $t+4$ in quarterly regressions and year $t+1$ in annual regressions. Both of the equal-weighted regressions show a significant negative relation between future market returns and IPO volume. Notably, this relation is also economically significant. The quarterly equal-weighted regression indicates that a one standard deviation increase in IPO volume (equivalent to approximately 71 more IPOs in 1985) is associated with 2% lower

[16] Measuring IPO volume on a quarterly rather than a monthly basis increases the power of the regressions, as the monthly IPO series is extremely noisy.

[17] Many of the regressions in Table 8 exhibit strong autocorrelation, which suggest cycles in IPO underperformance, but these cycles are not necessarily related to IPO volume.

Table 9
Regressions of post-IPO market percentage returns on IPO volume
This table shows regressions of post-IPO market returns on IPO volume, over 1960–1996. The dependent variables are equal-weighted market-index percentage returns and value-weighted market-index percentage returns, both adjusted into real terms using the CPI. In the first two rows, quarterly market returns in quarter $t+1$ are regressed on the number of IPOs during quarter t divided by the number of public firms (in thousands) at the end of the prior quarter. In the last two rows, annual market percentage returns in year $t+1$ (i.e., in 1961–1997) are regressed on the number of IPOs during year t (i.e., 1960–1996), divided by the number of public firms (in thousands) at the end of the prior year. Newey-West standard errors are shown in parentheses.

Dependent variable	Intercept	IPO volume	Adj R-sqrd	Obs
Market returns regressions, 1960–1996				
Quarterly EW market returns	5.12***	−0.18**	3.4%	148
	(1.36)	(0.07)		
Quarterly VW market returns	3.17***	−0.09	0.1%	148
	(1.20)	(0.06)		
Annual EW market returns	26.62***	−0.27***	20.6%	37
	(4.25)	(0.06)		
Annual VW market returns	10.85***	−0.05	−0.1%	37
	(2.85)	(0.04)		

***, **, * Significance at the 1%, 5%, and 10% levels in two-sided significance tests.

returns in the subsequent quarter (a one-fifth standard deviation decrease). In the annual equal-weighted regression, a one standard deviation increase in IPO volume (approximately 269 more IPOs in 1985) is associated with 12% lower returns (nearly one-half a standard deviation decrease) the subsequent year. Consistent with Baker and Wurgler, these findings suggest that firms successfully time the market, having IPOs near market peaks. Higher numbers of firms successfully go public prior to periods of lower market returns.

In summary, the evidence in Tables 7–9 shows significant negative relations between post-IPO raw firm returns and IPO volume and between post-IPO market returns and IPO volume. However, I do not find any relation between abnormal IPO returns and IPO volume. Firms successfully go public when they and also other similar firms are valued especially highly by the market. In particular, the finding that periods of high IPO volume are followed by especially low market returns suggests a trading rule. Further, the magnitude of the effect seems to exceed plausible changes in the equilibrium equity risk premium, suggesting that the pattern is not consistent with efficient markets. Consistent with the evidence from the time-series regressions, the variation in the number of firms going public does not appear to solely reflect changes in private firms' demands for capital. Rather, the floods of IPOs during certain periods appear to at least partially reflect firms successfully raising capital when investors are valuing the equity of these firms especially highly.

6. Conclusions

Despite the large literature on IPOs, we still have relatively little understanding of why the number of IPOs fluctuates so substantially over time. This paper seeks to shed light on this issue. Specifically, I investigate the factors that lead so many companies to have IPOs during some periods, versus so few during other times. Results indicate that companies' demand for capital and the level of investor sentiment explain a significant amount of the variation in IPO volume. In economic terms, an increase of 23,000 new corporations and a 25% decrease in future market returns (i.e., a one standard deviation change in each variable) are each associated with about 75 more IPOs in 1985, and a decrease of 7.9 percentage points in the closed-end fund discount (one standard deviation) is associated with approximately 151 more IPOs in 1985. Adverse-selection costs are also statistically significant, but they are not significant in economic terms, suggesting that they are of secondary importance.

In addition to increasing our understanding of why firms go public, this paper also contributes to the broader literature on equity flows. Studies of venture capital funds by Gompers and Lerner (2000), mutual funds by Warther (1995) and Wermers (1999), and developing country markets by Clark and Berko (1996) and Stulz (1999) show that inflows into all of these investment vehicles vary substantially over time. Each of these studies attempts to discern whether high-volume periods represent times when investors are overpaying for these instruments. The studies of mutual funds and developing country markets show no evidence of such temporary misvaluations. However, Gompers and Lerner find that periods of high inflows into venture capital funds are associated with temporary increases in the valuation of these funds, suggesting that investors did overpay for the securities during these times. My findings indicate that temporary overvaluations also contribute to the periods of high IPO volume.

In summary, the results suggest that IPO volume is positively related to companies' demands for capital and the level of investor sentiment. Firms are also marginally more likely to have an IPO when adverse selection costs are lower. With respect to all of these factors, dynamics at both the economy-wide level and at the industry level significantly affect firms' decisions.

Appendix A

The appendix details the exact methods used to calculate the different measures of abnormal stock returns.

The first calculation of abnormal returns entails measuring three year cumulative average abnormal returns (CAARs) relative to a portfolio of firms matched on size and book-to-market, where

$$\text{CAAR}_i = \sum_{t=1}^{\min(T,\text{delisting date})} (R_{i,t} - R_{\text{benchark},t}). \tag{A.1}$$

Fama and French (1992, 1993) find that size and book-to-market are important determinants of the cross-section of expected stock returns. To compare IPO firms with firms of similar size and book-to-market, I form 25 size/book-to-market portfolios. Following Fama and French (1993), for each stock, size equals the market price times the number of shares outstanding, and book-to-market (BM) equals the book value of equity over total market capitalization, where book value equals total shareholders equity minus preferred stock plus deferred taxes (when available), plus investment tax credits (when available). Preferred stock is defined as redemption, liquidation, or carrying value (in this order), depending on availability. Book value is measured as of the end of the fiscal year, market value is measured each quarter, and book value is lagged by at least four months relative to market value. I form size quintile breakpoints and BM quintile breakpoints using only NYSE firms. Twenty-five size/BM portfolios are then formed by taking the intersection of these breakpoints. Finally, all NYSE, Amex, and Nasdaq firms with the necessary size and BM data are placed into the appropriate portfolios. Firms that have had an IPO or SEO within the previous 36 months are excluded. The portfolio return equals the value-weighted return of all stocks in that portfolio during the following month. The portfolio breakpoints and composition are updated quarterly. Each IPO firm with sufficient data to calculate size and BM is placed in the appropriate portfolio.

To the extent that size and BM capture a firm's risk characteristics, the level of abnormal returns should be well specified. However, Barber and Lyon (1997) show that CAARs are positively skewed, meaning that the assumption of multivariate normality is violated. Also, observations are not independent, which causes conventional standard errors to be understated and significance levels to be overstated. Brav (2000) and Mitchell and Stafford (2000) show that such cross-correlations can significantly affect long-run test statistics.

The second method of calculating abnormal returns, the calendar-time abnormal-return (CTAR) method, was first implemented by Jaffe (1974) and Mandelker (1974). This method accounts for the dependence between IPO firm returns. Also, it allows factor loadings to change over time, unlike the Fama-French three-factor model. Each month a portfolio is formed that includes all firms that have gone public in the previous three years. Abnormal monthly returns represent the difference between the average portfolio returns and the portfolio expected return,

$$\mathrm{CTAR}_t = R_{p,t} - \mathrm{E}[R_{p,t}]. \tag{A.2}$$

CTARs should have a zero mean and be independent. Two models of expected returns are used: a portfolio of firms matched on size and BM, and the Fama-French three-factor model. The first employs the same 25 size and BM portfolios that were described earlier. The abnormal return for each firm equals the difference between the IPO firm return and the return on its matched size/BM portfolio. These abnormal returns are averaged across all firms in the portfolio. Using the three-factor model as the benchmark, expected returns for each calendar month portfolio equal the fitted value from the three-factor model, where factor loadings equal the average of the component firms' factor loadings. Factor loadings for each individual firm are obtained from a regression of 36 months of post-IPO returns on the three Fama-French factors. Abnormal returns equal the difference between actual portfolio returns and these expected returns.

The average abnormal return, using either benchmark, is then standardized by the residual standard deviation, which is calculated using 36 months of post-IPO portfolio residuals. In other words, for a given portfolio at month t, 36 months of average abnormal returns from month $t - t + 35$ are obtained, and the standard deviation equals

$$\hat{\mathrm{SD}} = \sqrt{\frac{1}{35}\sum_{j=1}^{36}\left(\hat{e}_{t,t-j+1} - \frac{1}{36}\sum_{i=1}^{36}\hat{e}_{t,t-i+1}\right)^2}. \tag{A.3}$$

This standardization procedure has the added benefit of adjusting for differences in the number of firms in the portfolio across different months.

References

Baker, M., Wurgler, J., 2000. The equity share in new issues and aggregate stock returns. Journal of Finance 55, 2219–2257.

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

Bayless, M., Chaplinsky, S., 1996. Is there a window of opportunity for seasoned equity issuance? Journal of Finance 51, 253–278.

Brav, A., 2000. Inference in long-horizon event studies: a Bayesian approach with application to initial public offerings. Journal of Finance 55, 1979–2016.

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

Brav, A., Geczy, C., Gompers, P., 2000. Is the abnormal return following equity issuances anomalous? Journal of Financial Economics 56, 209–250.

Choe, H., Masulis, R., Nanda, V., 1993. Common stock offerings across the business cycle. Journal of Empirical Finance 1, 1–29.

Clark, J., Berko, E., 1996. Foreign investment fluctuations and emerging market stock returns: the case of Mexico. Unpublished working paper, Federal Reserve Bank of New York, New York, NY.

Dickey, D., Fuller, W., 1979. Distribution of the estimators for autoregression time series with a unit root. Journal of the American Statistical Association 74, 427–431.

Dierkins, N., 1991. Information asymmetry and equity issues. Journal of Financial and Quantitative Analysis 2, 181–199.

Fama, E., French, K., 1992. The cross-section of expected stock returns. Journal of Finance 47, 427–465.

Fama, E., French, K., 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33, 3–56.

Fama, E., French, K., 2000. The equity premium. Unpublished working paper, University of Chicago.

Fama, E., MacBeth, J., 1973. Risk, return, and equilibrium: empirical tests. Journal of Political Economy 81, 607–636.

Gompers, P., Lerner, J., 2000. Money chasing deals? The impact of fund inflows on private equity valuations. Journal of Financial Economics 55, 281–325.

Granger, C., Newbold, P., 1974. Spurious regressions in econometrics. Journal of Econometrics 2, 111–120.

Ibbotson, R., Jaffe, J., 1975. 'Hot issue' markets. Journal of Finance 30, 1027–1042.
Ibbotson, R., Sindelar, J., Ritter, J., 1988. Initial public offerings. Journal of Applied Corporate Finance 1, 37–45.
Ibbotson, R., Sindelar, J., Ritter, J., 1994. The market's problems with the pricing of initial public offerings. Journal of Applied Corporate Finance 7, 66–74.
Jaffe, J., 1974. Special information and insider trading. Journal of Business 47, 411–428.
Jegadeesh, N., 2000. Long-term performance of seasoned equity offerings: benchmark errors and biases in expectations. Financial Management 29, 5–30.
Jindra, J., 2001. Seasoned equity offerings, valuation, and timing. Unpublished working paper, Cornerstone Research, Menlo Park, CA.
Korajczyk, R., Lucas, D., McDonald, R., 1992. Equity issues with time-varying asymmetric information. Journal of Financial and Quantitative Analysis 27, 397–417.
Lee, C., Shleifer, A., Thaler, R., 1991. Investor sentiment and the closed-end puzzle. Journal of Finance 46, 75–109.
Lerner, J., 1994. Venture capitalists and the decision to go public. Journal of Financial Economics 35, 293–316.
Lerner, J., Shane, H., Tsai, A., 2003. Do equity financing cycles matter?: evidence from biotechnology alliances. Journal of Financial Economics, forthcoming.
Loughran, T., Ritter, J., 1995. The new issues puzzle. Journal of Finance 50, 23–51.
Loughran, T., Ritter, J., 2000. Uniformly least powerful tests of market efficiency. Journal of Financial Economics 55, 361–389.
Loughran, T., Ritter, J., Rydqvist, K., 1994. Initial public offerings: international insights. Pacific Basin Journal 2, 165–199.
Lowry, M., Schwert, G., 2002. IPO market cycles: bubbles or sequential learning? Journal of Finance 57, 1171–1200.
Lucas, D., McDonald, R., 1990. Equity issues and stock market dynamics. Journal of Finance 45, 1019–1043.
Lyon, J., Barber, B., Tsai, C., 1999. Improved methods for tests of long-run abnormal stock returns. Journal of Finance 54, 165–201.
Mandelker, G., 1974. Risk and return: the case of merging firms. Journal of Financial Economics 1, 303–335.
Mikkelson, W., Partch, M., Shah, K., 1997. Ownership and operating performance of companies that go public. Journal of Financial Economics 44, 281–307.
Mitchell, M., Stafford, E., 2000. Managerial decisions and long-term stock price performance. Journal of Business 73, 287–330.
Myers, S., 1977. Determinants of corporate borrowing. Journal of Financial Economics 5, 147–175.
Myers, S., Majluf, N., 1984. Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics 13, 187–221.
Pagano, M., Panetta, F., Zingales, L., 1998. Why do companies go public? An empirical analysis. Journal of Finance 53, 27–64.
Plosser, C., Schwert, G., 1978. Money, income, and sunspots: measuring economic relationships and the effects of differencing. Journal of Monetary Economics 4, 637–660.
Purnanandam, A., Swaminathan, B., 2001. Are IPOs underpriced? Unpublished working paper, Cornell University.
Rajan, R., Servaes, H., 1997. Analyst following of initial public offerings. Journal of Finance 52, 507–530.
Rajan, R., Servaes, H., 2003. The effect of market conditions on initial public offerings. In: McCahery, J., Renneboog, L. (Eds.), Venture Capital Contracting and the Valuation of High-tech Firms. Oxford University Press, Oxford, forthcoming.
Ritter, J., 1984. The "hot issue" market of 1980. Journal of Business 57, 215–240.
Ritter, J., 1991. The long-run performance of initial public offerings. Journal of Finance 46, 3–27.
Schwert, G., 1987. Effects of model specification on tests for unit roots in macroeconomic data. Journal of Monetary Economics 20, 73–103.

Stulz, R., 1999. International portfolio flows and security markets. In: Feldstein, M. (Ed.), International Capital Flows. University Chicago Press, Chicago, pp. 257–293.
Warther, V., 1995. Aggregate mutual fund flows and security returns. Journal of Financial Economics 39, 209–236.
Wermers, R., 1999. Mutual fund herding and the impact on stock prices. Journal of Finance 54, 581–622.
Wiesenberger, A., 1960–1968. Investment Companies. Arthur Wiesenberger and Co., New York.