NBER WORKING PAPER SERIES

IPO MARKET CYCLES: BUBBLES OR SEQUENTIAL LEARNING?

Michelle Lowry
G. William Schwert

Working Paper 7935
http://www.nber.org/papers/w7935

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 2000

An earlier version of this paper was titled "IPO market cycles: An exploratory investigation." The Bradley Policy Research Center, William E. Simon Graduate School of Business Administration, University of Rochester, provided support for this research. We are indebted to Jay Ritter for the use of his data. We received helpful suggestions from Harry DeAngelo, Gregg Jarrell, Tim Loughran, Vojislav Maksimovic, Jay Ritter, Jerold Warner, Ivo Welch, Jerold Zimmerman, and seminar participants at the University of Rochester. The views expressed are those of the authors and not necessarily those of the National Bureau of Economic Research.

© 2000 by Michelle Lowry and G. William Schwert. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

IPO Market Cycles: Bubbles or Sequential Learning?
Michelle Lowry and G. William Schwert
NBER Working Paper No. 7935
October 2000
JEL No. G32, G24, G14

ABSTRACT

We examine the strong cycles in the number of initial public offerings (IPOs) and in the average initial returns realized by investors who participated in the IPOs. At the aggregate level, initial returns are predictably related to past initial returns and also to future IPO volume from 1960-1997. To understand these patterns, we use firm-level data from 1985-97 to model the initial return. Our results show that aggregate IPO cycles occur because of the time it takes to complete an IPO, the clustering of similar types of IPOs in time, and information spillovers among IPOs.

Michelle Lowry
Smeal College of Business
Penn State University
University Park, PA 16082
mlowry@psu.edu

G. William Schwert
William E. Simon Graduate School of
Business Administration
University of Rochester
Rochester, NY 14627
and NBER
schwert@schwert.ssb.rochester.edu

1. Introduction

The phenomenon of "hot IPO markets" has been recognized for a long time in the financial community. Ibbotson and Jaffe (1975) and Ibbotson, Sindelar, and Ritter (1988, 1994) show that there are pronounced cycles in the number of new issues per month, cycles in the average initial return per month, and also an apparent lead-lag relation between the two series. Specifically, periods of high and rising initial returns tend to be followed by spurts of IPOs. Subsequent to these periods of high IPO volume, average initial returns appear to decrease. Figure 1 shows monthly IPO volume and initial returns between 1960 and 1997, and this pattern is repeated many times over the 38-year period. For example, the high initial returns of early 1961 were followed by large numbers of companies going public in late 1961 and early 1962, and then by especially low average initial returns in late 1962.

While Ibbotson and Jaffe (1975), Ibbotson, Sindelar, and Ritter (1988, 1994), and more recently Cook, Jarrell, and Kieschnick (1999) discuss the apparent lead-lag relations between IPO volume and initial returns, none of these papers investigate the economics underlying these patterns.[1] In contrast, our objective is to examine the lead-lag relations between IPO volume and initial returns in more detail, with a focus on both their statistical reliability and the economic factors that underlie these cycles.

In contrast to the impression given in figure 1, statistical tests show only weak evidence of a negative relation between IPO volume and future initial returns. However, consistent with figure 1, we find a significant positive relation between initial returns and future IPO volume. As a first step towards understanding this phenomenon, we examine the ways in which private companies time their IPOs, in response to the initial returns of recent IPOs. We find that the timing of IPO filings and IPO withdrawals drives the positive relation between initial returns and future IPO volume. More companies file IPOs and fewer companies withdraw IPOs after periods of high initial returns.

[1] Helwege and Liang (1996) examine the reasons that certain companies choose to go public during periods of high versus low average initial returns. However, both their dataset and the focus of their paper differ substantially from ours. They compare one year of high average initial returns with one year of low average initial returns and contrast the types of firms in the two groups.

Given the strong autocorrelation in initial returns, the finding that more companies want to go public when IPOs are being underpriced by the greatest amount is puzzling. Assuming that firms prefer to raise as much money in their IPO as possible, it would seem that companies would prefer to go public when initial returns were the lowest. The observed pattern suggests that high initial returns contain positive information for private companies considering an IPO. Perhaps periods of high initial returns represent times when the market values IPO firms more highly than the firms and their underwriters had previously expected.

To learn about the information content of initial returns, we study the IPO pricing process in detail. The empirical literature on IPOs has found many systematic factors that explain cross-sectional differences in initial returns. For example, the size of the issuing firm, the reputation of the lead investment bank, and the risk of the IPO stock are all factors that partially explain initial returns. In addition, the information that firms and their investment banks learn about the demand for the IPO stock during the registration period is strongly related to initial returns.

By examining the predictability of individual firm initial returns, we are able to provide further insight on the cycles in average initial returns over time. We find that the serial correlation in initial returns is driven by the portion of initial returns that is predictable, that is, by changes in the types of firms that go public over time and, more importantly, by certain information about firm value that becomes available during the registration period but is not incorporated into the offer price. Notably, the serial correlation in initial returns is not driven by a slow reaction of issuing firms or investment bankers to market demand for IPO securities, and the level of initial returns at the time a company files to go public contains no information about that company's eventual underpricing. A company can neither gain nor lose in terms of the magnitude of its underpricing by timing its IPO relative to the level of average initial returns.

Finally, we find that the positive relation between initial returns and subsequent IPO volume is similarly driven by the predictable portion of initial returns, specifically by information learned during the registration period. On the road show, the IPO firm and its underwriters glean information from informed investors about their valuation of this new firm. This information is a determinant of both the pricing of that IPO, and also of the number of private companies that find it optimal to issue public equity in the near future. More positive information in the form of higher expected valuations results in higher initial returns and more companies filing to go public soon thereafter.

In summary, new information learned during the registration period has value implications for both the number of future issues and for the pricing of those issues. Notably, new information provided by the secondary market on the first day of trading has no effect on either the pricing of future IPOs or the number of future IPOs.

Section 2 discusses the data that we use to examine the time-series relations in IPO volume and initial returns. Section 3 investigates the statistical properties of the relations between IPO volume and past and future initial returns. In section 4, we examine the extent to which firms and/or their underwriters manage the timing of the IPO process, conditional on the initial returns of other firms going public. Sections 5 and 6 examine the reasons that more companies go public after observing especially high average initial returns. Specifically, section 5 studies several firm and deal-specific factors that influence the offer price, and section 6 employs these findings to investigate the determinants of the serial correlation of IPO initial returns and of the lead-lag relation between initial returns and IPO volume. Finally, section 7 summarizes the results in the paper.

2. Data

To study the behavior of aggregate IPO market activity, we start with two basic sources of data on initial returns and volume. These data are described below. In later sections of the paper we also examine initial returns at the firm level, and those data will be described at that point.

2.1 Data Sources and Definitions

The Ibbotson, Sindelar, and Ritter (ISR) data [http://bear.cba.ufl.edu/ritter/ipoall.htm] include average, equal-weighted monthly IPO initial returns (IR_t^{EW}) and the number of IPOs per month ($NIPO_t^{ISR}$). The exact sample composition and the calculation of initial returns differ somewhat over the sample period, and a more complete description of the procedures used to calculate these statistics is in Ibbotson, Sindelar, and Ritter (1994). In general, ISR's initial returns represent the average, across all IPOs each month, of the percentage difference between a closing price within the first month after the IPO and the offer price. Each IPO is weighted equally, so that IPOs of small firms have the same influence as IPOs of large firms.

We also use data on all firm-commitment IPOs offered or filed between 1985 and 1997 from Securities Data Company (SDC). Unit IPOs, closed end funds, real estate investment trusts (REITs), and American Depositary Receipts (ADRs) are excluded. These data include the date the IPO was filed with the Securities and Exchange Commission (SEC), the range of prices within which the company expects to price the issue as indicated in the preliminary prospectus (file range), the date each issue is offered or withdrawn, the offer price, and the prices at the close of the first day, second day, and first week of trading. IPO volume is defined as the number of IPOs each month ($NIPO_t^{SDC}$). We also measure the number of offerings filed per month ($NFIL_t$) and the number of offerings withdrawn per month (NWD_t).[2] Finally, we calculate the average length of time in registration, equal to the number of days between the filing and offer dates, weighted by proceeds raised in the IPO ($REGTIME_t^{PW}$).

For the SDC sample, we measure both the initial return and the price update of each issue. The initial return equals the percentage change between the offer price and the first closing price, weighted by proceeds raised in the IPO (IR_t^{PW}). To determine the first closing price of a particular issue, the first

[2] SDC records 48 withdrawals in January, 1990, compared to 4 withdrawals the previous month and 1 the subsequent month. We strongly suspect that this data point is incorrect, and therefore omit it from the time series.

closing price from the Center for Research in Securities Prices (CRSP) is used if price data are available within 14 days of the offer date. If CRSP data are not available, we try to obtain the closing price from SDC. The SDC closing price equals the close on the first day of trading. If that is not available, the close on the second day or otherwise the end of the first week of trading is used. The price update between the initial filing and the final offer is measured as the percentage difference between the midpoint of the file range and the offer price. The average price update for offers made in a particular month, weighted by proceeds raised in the IPO, is denoted ΔP_t^{PW}.

2.2 Descriptive Statistics

Table 1 contains the mean, median, standard deviation, minimum, and maximum of the various data series, along with 12 autocorrelations and the large sample standard error of the autocorrelations. Consistent with the earlier findings of Ibbotson and Jaffe (1975) and Ibbotson, Sindelar, and Ritter (1988, 1994), both the number of IPOs and the average initial returns are highly autocorrelated. Note that the number of observations for initial returns is smaller than the sample size for the number of IPOs, since the initial return is missing in months when no IPOs occur.

In terms of the number of IPOs, in the 1985-97 period ISR's data include more issues, but the general characteristics of the alternative measures $NIPO^{ISR}$, $NIPO^{SDC}$, and NFIL are similar. The number of issues withdrawn (NWD) is small, and the time in registration for offers that occur averages 72.1 days. REGTIME is not highly autocorrelated, indicating that the cyclical behavior of the number of IPOs is not the result of variation in registration times. Rather, it appears to be driven by the number of companies filing and withdrawing offerings each month. Further empirical tests support this proposition.

ISR's measure of initial returns (IR_t^{EW}) is higher on average and more volatile than the SDC measure of initial returns (IR_t^{PW}). This is most likely driven by two factors: first, ISR’s data weight small issues more heavily, and second, over parts of the sample period the ISR data include best efforts offerings and unit offerings, both of which tend to have higher than average initial returns. For the 1985-

97 period, the autocorrelations of initial returns are highest for the first two monthly lags. The autocorrelations of initial returns from 1960-1997 are larger and more persistent (decaying from .60 to .11 between lags 1 and 12).

The average proceeds-weighted price update between the initial filing and the offering (ΔP_t^{PW}) is –3.6 percent, and the autocorrelation is large at lag one, but is small for higher order lags (less than .25 in absolute value for lags 2 through 12).

3. The Relation Between Volume and Initial returns

Ibbotson, Sindelar, and Ritter (1994) use the data in figure 1 to show that both IPO volume and average initial returns fluctuate substantially over time and are highly autocorrelated. Several possible explanations have been suggested for the cyclical pattern in each of these series.

3.1 IPO Volume

Lowry (2000) shows that the observed fluctuations in IPO volume are related to three distinct factors: changes in private firms' aggregate demand for capital, changes in the adverse selection costs of issuing equity, and variation in investor optimism. First, when private firms' total demands for capital are higher, more companies tend to raise public equity for the first time. Lee and Henderson (1999) also find that changing business conditions contribute to the variation in IPO volume. Second, a decrease in market-wide information asymmetry causes the adverse selection costs of issuing equity to fall and consequently more firms to go public. Bayless and Chaplinsky (1996) and Choe, Masulis, and Nanda (1993) similarly find that adverse selection costs affect the number of companies having seasoned equity offerings over time. Finally, when investors are especially optimistic, they are willing to overpay for IPO firms and more firms will therefore have IPOs. Rajan and Servaes (1997), Lee, Shleifer and Thaler (1991) and Helwege and Liang (1996) provide additional evidence that IPO volume is positively related to the level of investor sentiment, and Pagano, Panetta, and Zingales (1998) reach a similar conclusion in an examination of the Italian market.

More generally, Stoughton, Wong, and Zechner (2000) posit that IPO clustering is the result of information effects. They develop a model in which one firm's IPO provides information about industry prospects, thus causing many similar companies to go public soon after.

3.2 Initial returns

Variation in average IPO initial returns can also be caused by a number of different factors. Ritter (1984) finds that underwriter monopsony power and differences in the average risk of companies going public are important. Specifically, the higher average initial returns during the early 1980s were driven by a large number of small, risky, natural resource companies going public and by the underwriters of these IPOs systematically pricing them far below their subsequent market value. In addition, Ritter (1991) provides evidence that investor over-reaction during certain periods contributes to the fluctuations in initial returns. When investors are over-optimistic, they bid up the after-market price of the IPO firms, resulting in especially high initial returns.

3.3 Information Spillover and IPO Cycles

Neither changes in the average risk of companies going public nor time-variation in underwriter monopsony power seem likely to cause initial returns to be positively correlated with subsequent IPO volume or negatively correlated with lagged IPO volume. However, it is plausible that initial returns contain some type of valuable information. For example, van Bommel and Vermaelen (2000) find that firms with higher first-day returns spend more money on investment after the IPO. This finding is consistent with the idea that initial returns are positively related to the market's assessment of the firm's prospects, and firms respond to this information.

More generally, average initial returns across all IPOs in a given period probably contain information on investor sentiment or on growth prospects at that time. If high average initial returns indicate that sentiment is especially high or market conditions better than expected, then more companies are likely to subsequently go public.[3] To the extent that high initial returns indicate that private companies can raise more money in an IPO than they previously thought, high initial returns will be followed by periods of high volume.

Similar theories can explain the negative relation between IPO volume and subsequent initial returns. For example, as more firms go public, the uncertainty surrounding the true value of these firms decreases, thus causing average initial returns to decrease. In a similar spirit, Benveniste, Busaba, and Wilhelm (1999) and Booth and Chua (1996) model initial returns as compensation to investors for learning the true value of firms. As an example, Benveniste, Busaba and Wilhelm note that Netscape's especially high initial return is consistent with this idea that initial returns represent compensation for information gathering, as Netscape was one of the first internet IPOs. When IPO volume is high, these costs are shared among many firms, causing average initial returns to be lower.

3.4 Evidence on Initial returns and Volume

Figure 2 shows the cross correlations between initial returns in month t and IPO volume in month t+k for several versions of these variables, for 12 months before and after the month of the IPO. Panel A uses Ibbotson, Sindelar, and Ritter's (ISR) data for 1960-1997, IR_t^{EW} and $NIPO_{t+k}^{ISR}$. Consistent with the impressions from figure 1, these data show a strong pattern of negative correlations between current initial returns and past numbers of IPOs, along with strong positive correlations between current initial returns and future numbers of IPOs.

Panel B shows that the cross-correlations are somewhat sensitive to the measurement of initial returns. Using data over the 1985 – 1997 period, we are able to measure initial returns on both an equal-weighted and a value-weighted basis. Specifically, when initial returns are equal-weighted, the relations are similar to those shown in Panel A over the longer time period. Initial returns are significantly negatively correlated with past IPO volume and significantly positively correlated with future IPO

[3] Benveniste, Wilhelm, and Yu (1999) find that issuing firms structure their IPOs conditional on various features of recent offerings; for example, actual proceeds raised compared to expected proceeds as stated in the prospectus.

volume. Notably, when initial returns are value-weighted, we see that initial returns are less strongly related to past IPO volume, but the cross-correlations between initial returns and future IPO volume have an even greater magnitude. The cross-correlations using initial returns and the number of filings, IR_t^{PW} and $NFIL_{t+k}$, are similar, but shifted by about one month (so returns to IPOs filed in month t are related to the number of IPOs filed in months t+1 and beyond). This is consistent with the lag between the time an IPO is filed and the time of the offer.

These cross-correlations suggest that there is a difference in the behavior of small and large IPOs. These figures are descriptive in nature, however, and one must be cautious in drawing conclusions from them. To test the statistical significance of these relations, we use second order vector autoregressive (VAR) models. The VAR models allow for the substantial serial correlation in both initial returns and volume that can make inferences about the cross-correlations in figure 2 difficult. These models enable us to test the incremental predictive ability of lagged initial returns to predict future volume and vice versa. Such tests are referred to as Granger (1969) F-tests, since he suggested and popularized them. The VAR models as well as the Granger F-tests are shown in table 2.

The left and middle panels of table 2 show results for ISR's equal-weighted data over the 1960-1997 and 1985-97 periods, and the right panel is based on proceeds-weighted SDC data between 1985 and 1997. These tests confirm that there is a significant positive relation between initial returns and the future number of IPOs. Using either time period and either equal-weighted or value-weighted initial returns, Granger F-tests strongly reject the hypothesis that two lags of IPO initial returns have no power to predict IPO volume, with p-values for these tests all below 0.01. In contrast, the relation between the number of IPOs and future initial returns is negative, but not significant at conventional levels. Thus, the impression from figure 2 that higher numbers of IPOs are associated with lower average returns in the future is somewhat misleading. Also, the impression from figure 2 of a difference between the behavior of small and large IPOs is more apparent than real.[4] The cross-correlations in figure 2 are misleading because both initial returns and IPO volume are highly autocorrelated. Tests using 6 and 12 lags in the VAR models yield qualitatively similar results.

Thus, the F-tests in table 2 strengthen and formalize the impression given by the cross-correlations in figure 2 that past initial returns have a significant positive effect on future IPO volume. However, past IPO volume plays a weak role, if any, in predicting future initial returns.

4. Do Firms Manage the Timing of the IPO Process?

The strong positive relation between initial returns and subsequent IPO volume suggests that companies are timing their IPOs in response to the size of recent initial returns. High initial returns appear to represent good news and therefore be followed by increased numbers of IPOs. In this section, we look more specifically at the potential firm actions that could contribute to this relation.

There are three ways that companies and/or underwriters can affect the timing of the IPO in response to recent IPO initial returns. First, companies must file the issue. Second, they have the option to change the planned issue date. A delay would extend the amount of time between the filing date and the offer date. Third, they have the option to cancel the issue. This section examines the relations between average initial returns and the number of IPO filings, the average registration time, and the proportion of IPO cancellations.

If high initial returns provide positive information about the market's valuation of IPOs, then more private companies should file IPOs after periods of high initial returns. Thus, initial returns should be positively correlated with the number of subsequent filings. In contrast, we expect initial returns to be negatively related to the number of subsequent cancellations. If large average initial returns represent positive information for a company considering an IPO, then fewer firms should cancel IPOs after

[4] The finding of no significant relation between IPO volume and future initial returns contrasts with the results of Booth and Chua (1996). However, their results are based on cross-sectional regressions that do not consider the autocorrelation in either IPO volume or initial returns.

observing such returns. Similar factors would cause initial returns to be negatively correlated with the average registration time of subsequent IPOs. When average initial returns are high, companies have an incentive to expedite the offering process, meaning that high (low) initial returns will be followed by shorter (longer) registration times.

Finally, we also examine whether filing, deferral, and withdrawal decisions forecast future initial returns. Even though table 2 provides little evidence that the number of IPOs predicts subsequent initial returns, the timing of the ultimate offering represents the outcome of several earlier decisions on the part of the firm. It is possible that the behavior of firms in managing the speed of their IPOs through filing, deferral, and withdrawal decisions could forecast future returns. For example, consider the information spillover models of Booth and Chua (1996) and Benveniste, Busaba and Wilhelm (1999), that initial returns compensate investors for the costly information-gathering process. When more companies go public, the incremental costs of gathering information about each company are lower, meaning that initial returns are lower. Thus, as more companies file IPOs and fewer companies cancel IPOs, the total costs of learning about this class of companies is shared between a greater number of issues, meaning that the initial returns of each will be lower. This suggests that higher numbers of filings and fewer withdrawals will be associated with lower subsequent initial returns.

Table 3 contains Granger F-tests from second order VAR models (similar to table 2) relating two measures of initial returns (IR_t^{EW} and IR_t^{PW}) with past and future measures of IPO timing. NFIL is the number of offerings filed per month. $REGTIME_t^{PW}$ is the average length of time in days between the filing date and the offer date for all issues offered in month t. NWD* is the number of offers withdrawn in month t, scaled by the number of issues filed in the prior four months.

The statistical tests in table 3 (rows 1, 3, and 5) indicate that the positive relation between initial returns and the number of IPOs is driven by the timing of firm filings, and possibly the timing of offer withdrawals. Consistent with the evidence in figure 2, both equal-weighted and value-weighted average monthly initial returns are significantly positively related to the number of subsequent IPO filings (F-tests have p-values of 0.000 and 0.003, respectively). Also, proceeds-weighted (but not equal-weighted) initial returns are strongly related to future withdrawals (p-value = 0.008). Fewer companies withdraw offerings following periods of high initial returns. Finally, although there is some evidence that equal-weighted initial returns predict timing (p-value of 0.008 using IR_t^{PW}), the coefficients of the VAR models (not shown) are positive for lagged initial returns. This implies that high initial returns are associated with longer registration times in future months, a result which seems inconsistent with the evidence that initial returns represent good news for companies considering an IPO.

The analysis of the various measures of IPO timing and future initial returns is shown in rows 2, 4, and 6 of table 3. There is no evidence of any significant relation between either IPO filings or IPO registration time and subsequent initial returns. However, there is some evidence that withdrawals predict equal-weighted initial returns (p-value of 0.009 using IR_t^{EW}). Consistent with the information spillover models, fewer withdrawals are associated with lower initial returns in future months. When more firms go public (fewer firms withdraw offerings), initial returns are lower because investors' incremental costs of gathering information about each company are lower.

In summary, the relation between initial returns and future IPO volume is driven by more companies filing IPOs after periods of high initial returns and possibly by the likelihood of cancellation, not by variation in the length of registration. Also, after looking in more detail at the IPO process, we find some evidence of a relation between the frequency of issue cancellation and future initial returns.

5. The Information Content of Initial Returns

The fact that more companies file to go public and fewer companies withdraw their offerings after observing that recent IPOs have earned especially high initial returns suggests that initial returns contain valuable information for private companies considering an IPO. This section, along with section 6, examines the pricing process of IPOs in more detail, in the hope of learning more about the information content of initial returns.

Initial returns, by definition, equal the difference between the underwriters' valuation of the firm, the offer price, and the secondary market's valuation. However, prior evidence shows that underwriters do not fully incorporate all available information into the offer price. Initial returns represent some information known ahead of time by the underwriter plus some incremental information provided by the market. This section examines the entire IPO pricing process, beginning at the time the IPO is filed, in the hope of identifying the various sources of information contained in initial returns. Section 6 employs the results of this analysis to investigate which types of information private companies find most relevant in their decisions of when to go public.

5.1 Overview of the IPO Pricing Process

When a company files an IPO, it must file a prospectus containing a range of anticipated IPO prices. During the registration period, the company and its underwriter go on a road show to market the issue to institutional investors, and these investors have the opportunity to express interest in the offering. If the investors accurately reveal their private information through these expressions of interest, then the information exchange will contribute to a more accurate pricing of the new issue. However, these investors can potentially benefit by not revealing positive information about a new issue, causing the offer price to be set too low and enabling them (assuming they buy in at the offer price) to reap significant gains. To protect themselves against this potential loss, Benveniste and Spindt (1989) hypothesize that underwriters only partially incorporate positive information learned during the registration period into the final offer price. This ensures the investors of some positive return as compensation for revealing their private information, but also enables underwriters and the newly public company to share in the gains. Consistent with this theory, Hanley (1993) finds a significant positive relation between a firm’s price update and its initial return. Evidently, initial returns consist of some information known ahead of time, as well as some incremental information provided by the secondary market.

Loughran and Ritter (1999) note that Benveniste and Spindt’s model implies that underwriters should only partially incorporate *private* information learned about firm value during the registration period, but that *public* information should be fully reflected in the offer price. However, Loughran and Ritter find that there are strong positive correlations between the pre-offer market return and the price update and also between the pre-offer market return and the initial IPO return, indicating that the price adjustment to this *publicly* available information is only partial. In other words, the partial adjustment phenomenon discussed by Benveniste and Spindt exists for observable public information, such as the market return, even though their theory would not predict this.

Finally, Beatty and Ritter (1986), Megginson and Weiss (1991), and Koh and Walter (1989), among others, show that initial returns are significantly related to a variety of firm-specific characteristics, many of which are known at the time the IPO is filed.

In summary, prior evidence indicates that the initial return consists of information related to the type of firm going public, private and public information learned during the registration period but not fully incorporated into the offer price, and finally the new information that is provided by the secondary market when the issue starts trading. This section considers these sources of information in more detail, in the hope of discerning which information companies rely on most heavily in their decisions of when to go public. Our finding of a significant positive relation between average initial returns and subsequent IPO volume indicates that at least one of these information sources represents an important determinant of the timing of firms' IPOs.

5.2 Data on Individual IPOs and Sample Selection Bias

To estimate the portion of initial returns that represents information known ahead of time, we analyze the predictability of initial returns at the firm level. We use SDC and CRSP data from 1985-97 to investigate these relations, and this section discusses these data. The empirical tests are found in sections 5.3 and 5.4.

The variables we use include:

(1) IR, the Initial return, equals the percentage change between the offer price and the first closing price (previously described in section 2.1);

(2) RANK is the underwriter rank, from Carter, Dark, and Singh (1998);

(3) TA equals the logarithm of real total assets before the IPO;

(4) NYSE equals one if the IPO is listed on the New York Stock Exchange, and zero otherwise;

(5) NASDAQ equals one if the IPO is listed on the Nasdaq National Market System, and zero otherwise;

(6) AMEX equals one if the IPO is listed on the American Stock Exchange, and zero otherwise;

(7) TECH equals one if the firm is in a high tech industry [biotech, computer equipment, electronics, communications, and general technology (as defined by SDC)], and zero otherwise;

(8) VOL is the market-adjusted volatility of the IPO stock return, equal to the standard deviation of daily returns to the IPO stock in trading days 1 through 63 after the IPO (the first three months of secondary market trading) minus the standard deviation of daily returns to the CRSP equal-weighted market index during the same period;[5]

(9) ΔP is the percentage change between middle of the range of prices in the initial registration statement and the offer price;

(10) ΔP^+ equals ΔP when it is positive, and zero otherwise (to capture asymmetric effects of price updates);

(11) MKT is the return to the CRSP equal-weighted portfolio of NYSE, Amex, and Nasdaq-listed stocks for the period between the initial filing date and the final offer date, and

(12) MKT^+ equals MKT when it is positive, and zero otherwise (again, to capture asymmetric effects).

5.3 Regression Models for Firm-level Initial Returns

It is well known that the percent change between the offer price and the secondary market price (the initial return) is large on average, but also highly variable across firms. Table 4 contains estimates of regression models that explain this initial return,

$$IR_i = \alpha + \beta_1 RANK_i + \beta_2 TA_i + \beta_3 NYSE_i + \beta_4 NASDAQ_i + \beta_5 AMEX_i + \beta_6 TECH_i + \beta_7 VOL_i + \beta_8 \Delta P_i + \beta_9 \Delta P_i^+ + \beta_{10} MKT_i + \beta_{11} MKT_i^+ + \varepsilon_i, \quad (1)$$

[5] As a robustness check, we also used a measure of market-adjusted volatility based on returns between 22 and 63 days after the IPO. The results were qualitatively similar, so they are not reported.

where the variables have been defined above.

The rank of the investment banker (RANK), the size of the IPO firm (TA), the exchange on which the new issue will trade (NYSE, Nasdaq, or AMEX), and the firm's industry (TECH) are known at the time of the initial prospectus. The price update (ΔP) is known at the time the IPO price is set, as is the market return that occurred during the registration period (MKT). Only the after-market volatility of the IPO stock returns (VOL) is not observable at the time the IPO is priced. This variable has often been used to represent the risk of the IPO stock, and is generally presumed to be an unbiased estimate of information that is available to investors (but not to econometricians) ex ante.

The regression in column (1) of table 4 includes only independent variables that are known at the time the IPO is filed, as well as VOL. We find that IPO firm assets, exchange listing, the technology dummy, and volatility have significant power to explain the cross-sectional differences in the initial return. Specifically, IPO firms that are larger, list on AMEX, are not technology firms, and have less volatile returns after the offering have the least underpricing. Column (3) shows the same regression, but only includes those independent variables with significant explanatory power.

Column (5) adds two measures of price update; ΔP and ΔP^+, to allow for asymmetry. We find that the effect of the price update on initial returns is in fact asymmetric. A 10% increase in the IPO price from the mid-point of the initial filing range predicts a 8.94% (0.207 + 0.687) higher initial return, while a 10% decrease in the IPO price predicts a 2.07% lower initial return. Thus, the initial return responds more to positive price updates than to negative price updates. Investment bankers and issuing firms incorporate negative information more fully into the offer price than positive information. This is consistent with underwriters trying to avoid losses on overpriced issues while allowing informed investors to share the gains on underpriced issues. Consistent with Hanley (1993), when we omit the variable that measures the asymmetric effect of price updates, ΔP_i^+, we obtain a significantly positive coefficient on ΔP_i (coefficient of 0.450 and a t-statistic of 20.70).

As discussed earlier, Benveniste and Spindt's model says that underwriters have an incentive to only partially incorporate *private* information learned during the filing or book-building period into the final offer price. Also, Rock (1986) and Beatty and Ritter (1986), among others, posit that issues that are subject to greater information asymmetry, such as issues by small firms and issues with lower-ranked underwriters, will tend to be more underpriced. However, neither theory suggests that *public* information about market conditions during the registration period should be predictably related to initial returns.

Column (7) of table 4 contains estimates of eq. (1) that include the stock market return during the registration period, MKT (and MKT+ to measure asymmetric effects of MKT, if any). Given the price update, ΔP, and the firm and deal characteristics that are known at the time of the IPO, there is no incremental effect of MKT and MKT^+ on initial returns (t-statistics of 1.28 and –0.83). This is consistent with the IPO price reflecting the public information about market conditions that became available during the registration period.[6]

5.4 Sensitivity Analysis

We conducted a variety of sensitivity analyses to check the robustness of our results. First, we added return on assets to the initial return regressions to see whether prior operating performance affects IPO pricing, but this was not significant and other results were essentially unchanged. Second, we used a variety of different return measures to capture the effects of public information learned during the registration period. For example, we estimated the regressions using CRSP value-weighted (instead of equal-weighted) returns. In addition, we created three different portfolios of firms from our sample of IPOs that had come public within the last year, and calculated the returns to these portfolios. The first portfolio contained all of the firms available in the SDC sample. To incorporate the possibility that public information differs across industries, the second portfolio included the subset of firms that were coded as

6 However, Lowry and Schwert (2000) show that the relation between the price update and market returns during the registration period is highly asymmetric, with substantial adjustments of the IPO price to decreases in market prices, but only modest increases in IPO prices when market prices increase. This puzzling under reaction of IPO prices to market prices was first noted by Loughran and Ritter (1999).

technology firms by SDC, and the third contained the non-technology IPO stocks. Results using all these alternative measures of public information were qualitatively similar.

6. IPO Cycles Controlling for the Characteristics of Issuing Firms

In this section, we employ the results from table 4 to examine the sources of the serial correlation in initial returns and of the positive relation between average initial returns and subsequent IPO volume. First, we hope to shed light on the extent to which companies going public following periods of high initial returns can themselves expect to be especially underpriced. The last section showed that initial returns are predictably related to firm-specific characteristics and to information that is learned during the registration period. Either of these factors could potentially induce serial correlation in the initial return series, but neither implies that a company’s eventual underpricing will be predictably related to average initial returns observed before the filing.

We also examine the source of the information in average initial returns that leads companies to file IPOs. The evidence in section 5 shows that initial returns are comprised of three parts: information related to firm-specific characteristics, information that becomes available during the registration period, but is only partially incorporated into the final offer price, and new information provided by the secondary market. By investigating these three parts of the pricing process, we hope to learn what information companies find to be most relevant in their decisions to file IPOs.

6.1 Autocorrelations of Initial returns

The regressions in table 4 show that there are predictable relations between the characteristics of IPO firms and the initial return. Thus, part of the autocorrelation in aggregate initial returns could be due to cycles in the types of firms that choose to go public. If so, the autocorrelation in initial returns in table 1 could simply reflect patterns in the types of firms going public. Table 4 also showed that the initial return was related to information learned during the registration period. Because the registration period averages two months, IPOs that are close to one another in calendar time will tend to have overlapping registration periods. This could also contribute to the serial correlation of initial returns.

We test these ideas by aggregating the predictions of initial returns that are implied by the cross-sectional regression models in table 4 into expected components and the residuals into unexpected components, where both are weighted by proceeds raised in the IPO. Table 5 shows the mean, median, standard deviation, minimum, maximum, and 12 autocorrelations of the initial return, and its expected and unexpected components from 1985-97.

We use the predictions from column (3) in table 4 to represent the expected initial returns (E_F(IR)) for firms having IPOs in month t, conditional on information available at the time the IPO is *filed* (information in the preliminary prospectus plus volatility as an estimate of firm risk). The unexpected initial return, [IR – E_F(IR)], is the proceeds-weighted residual or forecast error from the same table 4 regression and consists of information learned during the registration period plus the incremental information provided by the secondary market when the firm starts trading.

Looking at row 2 of table 5, the autocorrelations of expected initial returns at the time of the filing, E_F(IR), start around 0.30 and decay slowly. This indicates that at least part of the autocorrelation in observed initial returns is attributable to the mix of firms going public. In addition, the first lag of the unexpected initial return (row 3), [IR – E_F(IR)], equals 0.33, indicating that information learned during the registration period and/or biases in underwriter pricing also contribute to the serial correlation in initial returns.

To determine whether there do in fact exist biases in underwriter pricing, we again decompose initial returns into expected and unexpected components, but this time we condition on all information available at the time of the *offer*. Specifically, we use the predictions from column (5) in table 4 to represent the initial returns conditional on all information in the preliminary prospectus, all information learned during the registration period, and also volatility, E_O(IR). The corresponding measure of unexpected initial returns, [IR – E_O(IR)], consists only of the incremental information provided by the secondary market when the firm starts trading. Note that if underwriters take into account all available information when they set the offer prices of these IPOs, then these unexpected initial returns should not be serially correlated.

The last row of Table 5 shows that the autocorrelations of this measure of unexpected initial returns, [IR – E_O(IR)], are close to zero at all lags. This suggests that the cross-sectional models in column (5) of table 4 capture all of the interesting dynamics in predicting initial returns. The finding that [IR – E_O(IR)] is uncorrelated through time shows that all of the serial correlation in initial returns can be explained by the effects of firm characteristics and information learned during the registration period. Evidently, firms and investment bankers take information about recent market conditions into account in setting the expected IPO price of new offers being filed. The level of recent initial returns contains no information about the expected underpricing of new IPOs being filed, meaning that a company can neither gain nor lose by filing during a period of high versus low initial returns.

6.2 The Information Content of Initial Returns

The results in table 5 provide strong evidence that the level of initial returns at the time a firm files to go public contain no information about that IPO's eventual underpricing. Thus, firms do not appear to be at a disadvantage if they file an IPO during a period of high initial returns. We now consider the factors that lead firms to *prefer* to file an IPO during such periods. This section seeks to identify more precisely the source of the information contained in initial returns that leads so many companies to go public following periods of high underpricing.

Table 6 shows Granger F-tests from second order VAR models (similar to tables 2 and 3) relating initial returns with past and future measures of both the number of IPOs filed per month (NFIL) and the number of IPOs offered per month (NIPO). It also shows the relations between the expected and unexpected components of initial returns, conditional on various information sets, with these measures of IPO volume.

We focus first on the relations between initial returns and subsequent IPO volume, in the hope of understanding the sources of information that companies rely on as they decide when to go public. The first column shows F-tests for the VARs between actual IR and the subsequent NFIL and NIPO. As previously shown in Tables 2 and 3, we find that both pricing measures are significantly positively related to both measures of subsequent IPO volume. The second and third columns employ the results from the previous section to decompose the initial return into expected and unexpected components, based on various information sets, to determine more specifically the source of these relations.

In rows 1 and 3 the expected initial return is conditional on the firm-specific information contained in the preliminary prospectus, as well as volatility. Thus, the expected initial return contains information about the types of companies going public, while the unexpected initial return incorporates all of the information learned during the registration period plus the incremental information provided by the secondary market. Results show that the expected initial return has little power to predict either NFIL or NIPO (p-values of 0.114 and 0.077), while the unexpected initial return is a highly significant predictor of both (p-values of 0.020 and 0.005). This suggests that the relevant information must be related to either information learned during the registration period or to the incremental information provided by the secondary market at the time of the offer, but not to the types of companies going public.

Rows 5 and 7 provide support for the importance of information learned during the registration period. Notably, when information learned during the registration period is included in the expected initial return, the expected initial return is a significant predictor of future IPO volume (p-values of 0.011 and 0.005). However, the unexpected initial return is not significantly related to future IPO volume (p-values of 0.574 and 0.063), indicating that companies do not rely on the incremental information provided by the secondary market in their decisions of when to go public.

The results in rows 1, 3, 5, and 7 indicate that private companies rely heavily on information learned during the registration periods of recent IPOs in their decisions of when to go public. Neither the types of firms that have recently gone public nor the incremental information provided by the secondary market influences the filing or issuing decisions of other private firms.

Finally, table 6 also shows the relations between NFIL and NIPO and subsequent (as opposed to past) initial returns. Consistent with prior evidence, there is no evidence of any significant relation between IPO volume and future initial returns. This lack of any significant evidence also extends to the expected and unexpected components of initial returns.

7. Conclusion

Our results show that the dynamic behavior of initial returns and IPO issues is a complicated function of many factors. First, there are significant biases in the expected offer prices listed in preliminary prospectuses, in the sense that the difference between the expected offer price and the final offer price is predictably related to publicly known firm- and offer-specific characteristics. Further, the predictability of initial returns shows that underwriters only partially incorporate private information that is learned during the registration period into the final offer price, but that public information is fully incorporated.

Despite all of the evidence on the predictability of initial returns, we find that investment bankers do fully incorporate current market conditions into the final offer price. The average initial returns at the time a company files an IPO contain no information about the extent to which that company will be underpriced. Thus, there exists no evidence that companies can benefit by filing IPOs during periods of low versus high average initial returns.

The positive relation between average initial returns and subsequent IPO volume suggests that the initial returns of recent IPOs contain information on the market's valuation of future IPOs. Notably, it is information learned during the registration period that is related to future IPO volume. The portions of initial returns that reflect firm characteristics and information provided by the secondary market are not reliably related to either the number of subsequent filings or the number of subsequent offerings.

Thus, the apparent IPO cycles that have been studied previously reflect two factors. First, similar types of firms choose to go public at about the same time. To the extent that this clustering is associated with predictably different expected initial returns, there will be persistence in initial returns through time. Second, and more important, the information about the value of an IPO firm that becomes available during the registration period has an effect on the prices and offering decisions for other firms. Since the book-building period averages two months, but often lasts as long as four months, IPOs in subsequent months have overlapping registration periods. It is the length of time necessary to produce the information reflected in the initial returns that causes monthly aggregate initial returns to be autocorrelated and to be positively related to future levels of IPO activity.

References

Bayless, Susan and Mark Chaplinsky, 1996, Is there a window of opportunity for seasoned equity issuance? Journal of Finance 51, 253-278.

Beatty, Randolph and Jay Ritter, 1986. Investment banking, reputation, and the underpricing of initial public offerings. Journal of Financial Economics 15, 213-232.

Benveniste, Lawrence M. and Paul A. Spindt, 1989, How investment bankers determine the offer price and allocation of new issues, Journal of Financial Economics 24, 343-362.

Benveniste, Lawrence M., Walid Y. Busaba, and William Wilhelm, 1999, Information externalities in primary equity markets, University of Minnesota, working paper

Benveniste, Lawrence M., William Wilhelm, and Xiaoyun Yu, 1999, Evidence on information spillovers in the production of investment banking services, University of Minnesota, working paper

Booth, James R. and Lena Chua, 1996, Ownership dispersion, costly information, and IPO underpricing, Journal of Financial Economics 41, 291-310.

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

Carter, Richard B. and Steve Manaster, 1990, Initial public offerings and underwriter reputation, Journal of Finance 45, 1045-1067.

Cho, Sung-Il, 1992, The possibility of failure and the pricing of best-efforts initial public offerings, Quarterly Review of Economics & Finance 32, 30-45.

Choe, Hyuk, Ronald W. Masulis, and Vikram Nanda, 1993, Common stock offerings across the business cycle: theory and evidence, Journal of Empirical Finance 1, 3-31.

Cook, Douglas O., Sherry L. Jarrell, and Robert Kieschnick, 1999, An analysis of fluctuations in U.S. IPO returns and volume, University of Mississippi, working paper.

Dunbar, Craig G., 1998, The choice between firm-commitment and best-efforts offering methods in IPOs: the effect of unsuccessful offers, Journal of Financial Intermediation 7, 60-90.

Granger, Clive W. J., 1969, Investigating causal relations by econometric models and cross-spectral methods, Econometrica 37, 424-438.

Hanley, Kathleen Weiss, 1993, The underpricing of initial public offerings and the partial adjustment phenomenon, Journal of Financial Economics 34, 231-250.

Helwege, Jean and Nellie Liang, 1996, Initial public offerings in hot and cold markets, Federal Reserve Board Finance and Economics Discussion Series working paper.

Ibbotson, Roger G. and Jeffrey F. Jaffe, 1975, 'Hot issue' markets, Journal of Finance 30, 1027-1042.

Ibbotson, Roger G., Jody L. Sindelar, and Jay R. Ritter, 1988, Initial public offerings, Journal of Applied Corporate Finance 1, 37-45.

Ibbotson, Roger G., Jody L. Sindelar, and Jay R. Ritter, 1994, The market's problems with the pricing of initial public offerings, Journal of Applied Corporate Finance 7, 66-74.

Koh, Francis, Walter, Terry, 1989, A direct test of Rock’s model of the pricing of unseasoned issues. Journal of Financial Economics 23, 251-272.

Lee, Charles, Andrei Shleifer, and Richard Thaler, 1991, Investor sentiment and the closed-end fund puzzle, Journal of Finance 46, 75-110.

Lee, Jae Nam, and Glenn Henderson, 1999, The hot issue market phenomenon and business conditions University of Cincinnati, working paper.

Loughran, Tim and Jay R. Ritter, 1999, Why don’t issuers get upset about leaving money on the table in IPOs? University of Florida, working paper.

Lowry, Michelle, 2000, Determinants of IPO volume, Penn State University, working paper.

Lowry, Michelle and G. William Schwert, 2000, Biases in the IPO Pricing Process, Penn State University, working paper.

Megginson, William, and Kathleen Weiss, 1991, Venture capitalist certification in initial public offerings. Journal of Finance 46, 879-904.

Pagano, Marco, Panetta, Fabio, Zingales, Luigi, 1998, Why do companies go public? An empirical analysis, Journal of Finance 53, 27-64.

Rajan, Raghuram and Henri Servaes, 1997, Analyst following of initial public offerings, Journal of Finance 52, 507-529.

Ritter, Jay R., 1984, The 'hot issue' market of 1980, Journal of Business 57, 215-240.

Ritter, Jay R., 1991, The long run performance of initial public offerings, Journal of Finance 46, 3-28.

Rock, Kevin, 1986, Why new issues are underpriced. Journal of Financial Economics 15, 187-212.

Stoughton, Neal M., Keith Wong, and Josef Zechner, 2000, IPOs and product quality, University of California at Irvine, working paper.

Van Bommel, Jos and Theo Vermaelen (2000), Market feedback during Initial Public Offerings: Do managers listen? INSEAD, working paper.

White, Halbert, 1980, A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity, Econometrica 48, 817-838.

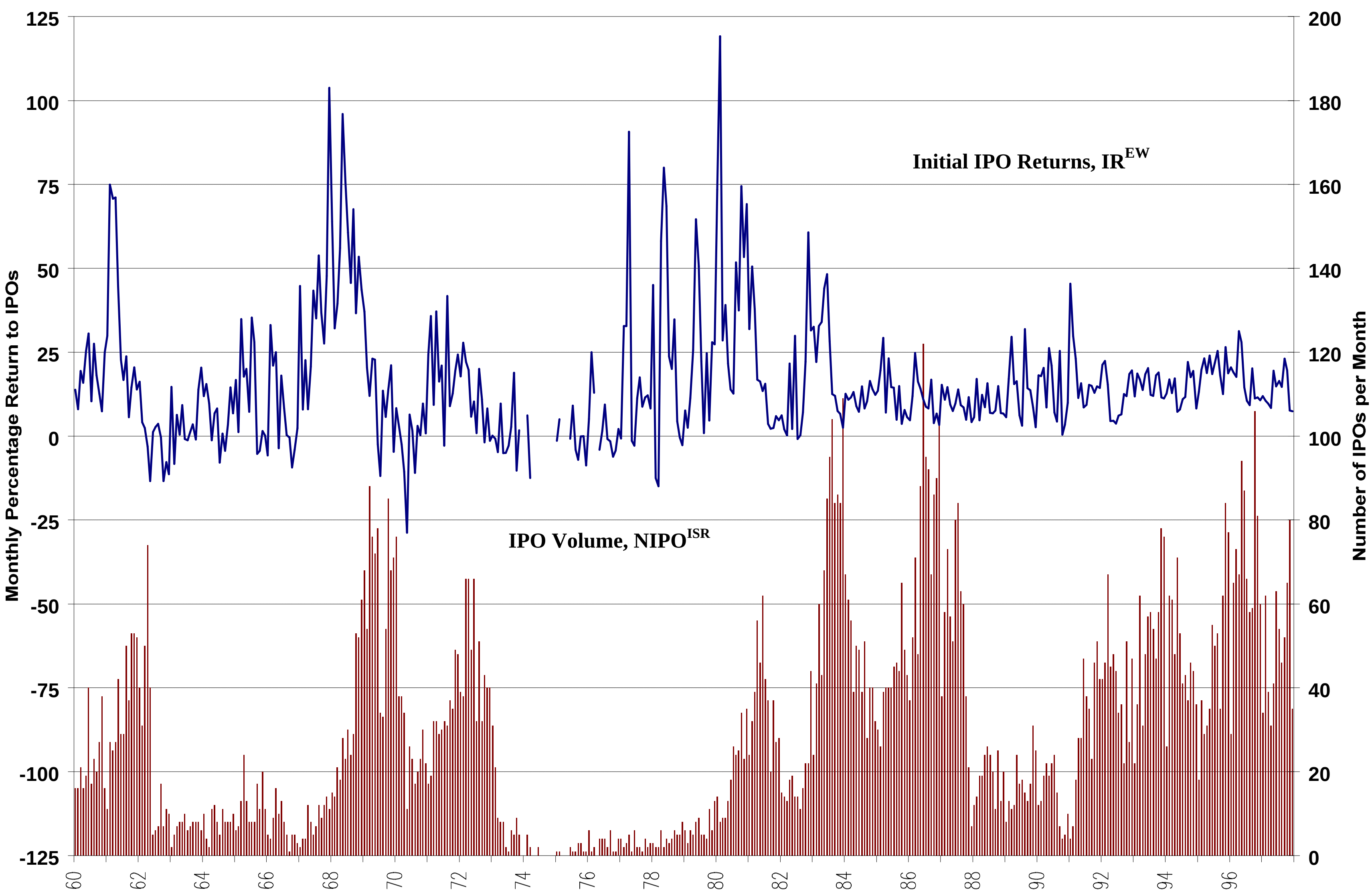
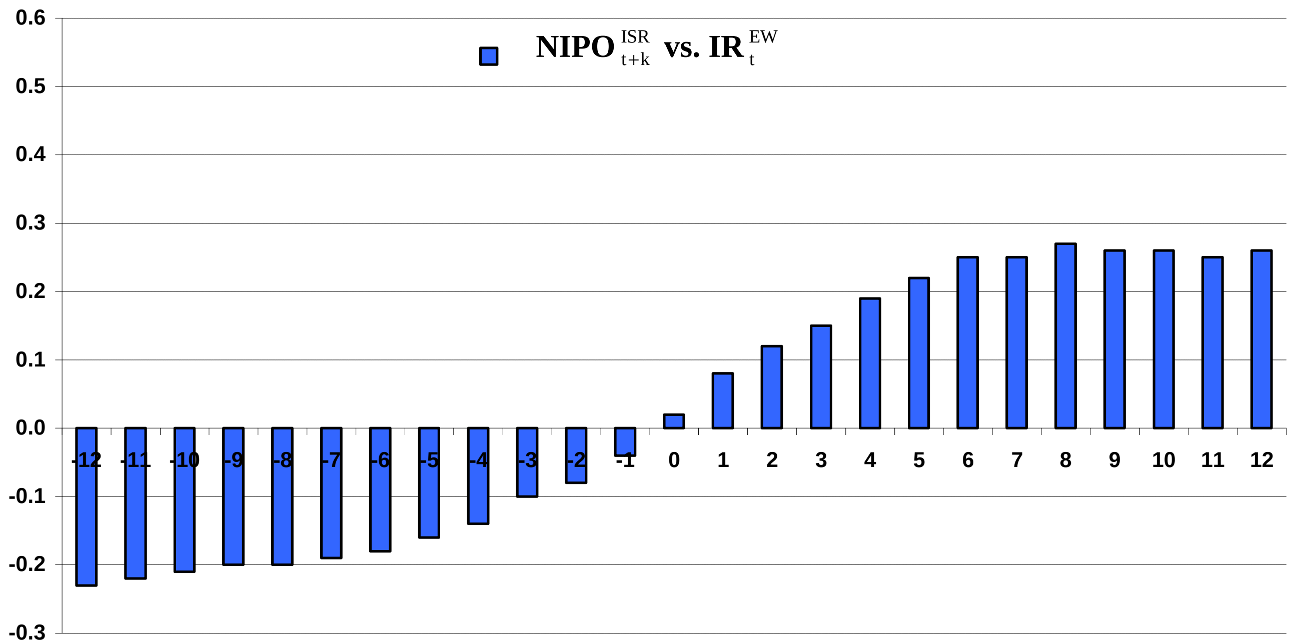


Figure 1. **Ibbotson, Sindelar, and Ritter's (1994) monthly data on aggregate US initial public offerings per month ($NIPO^{ISR}$) and average initial returns to IPO investors (IR^{EW}), 1960-97.**

A. Cross Correlations of Monthly IPOs and IPO Returns, 1960-97



B. Cross Correlations of Monthly IPOs and IPO Returns, 1985-97

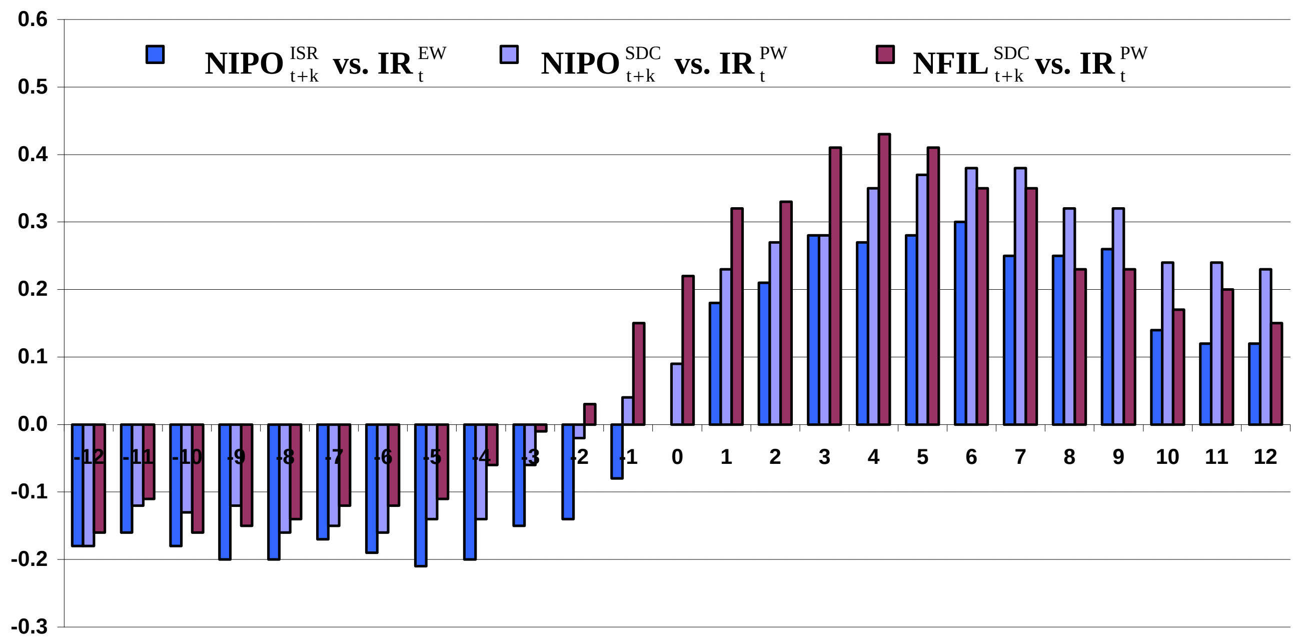


Figure 2. **Cross correlations of the number of IPOs in month t+k with the return to IPOs in month t, for k = -12, . . . , 12. The large sample standard error for these correlations is .05 for 1960-97 and .08 for 1985-97.**

Table 1

Descriptive Statistics for Aggregate IPO Returns and Volume

The mean, median, standard deviation, minimum, and maximum of the number of initial public offerings per month (NIPO) and the initial return to IPO investors (IR). Autocorrelations for 12 lags (ρ_1 to ρ_{12}) and their large sample standard error, under the hypothesis of no autocorrelation, S(ρ), are also shown. The first two rows are from Ibbotson, Sindelar, and Ritter from 1960-97 (IR^{EW} and $NIPO^{ISR}$).

The remaining rows of the table use data from SDC for the 1985-97 period. The Securities Data Corporation (SDC) data includes the number of IPOs per month ($NIPO^{SDC}$), the number of offerings filed per month (NFIL), and the number of offerings withdrawn per month (NWD). $REGTIME^{PW}$ is the average length of time in registration, the number of days between the file and offer dates, weighted by proceeds raised in the IPO. The average return to issues offered in a particular month, IR^{PW}, is weighted by proceeds raised in the IPO. Finally, there is a measure of the price update that occurs between the initial filing and the offer (i.e., the difference between the mid-point of the initial offer range and the final IPO price). ΔP^{PW} is the average price update for offers made in a particular month, weighted by proceeds raised in the IPO.

	Mean	Median	Std Dev	Min	Max	Sample Size, T	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8	ρ_9	ρ_{10}	ρ_{11}	ρ_{12}	S(ρ)
1960-97																			
$NIPO^{ISR}$	29.4	23.5	25.2	0.0	122.0	456	0.87	0.80	0.77	0.74	0.71	0.65	0.61	0.57	0.53	0.47	0.45	0.44	0.05
IR^{EW}	15.8	12.4	18.4	-28.8	119.1	442	0.60	0.44	0.32	0.33	0.28	0.22	0.24	0.25	0.25	0.17	0.15	0.11	0.05
1985-97																			
Number of IPOs per Month																			
$NIPO^{ISR}$	43.4	41.5	24.1	4.0	122.0	156	0.75	0.64	0.62	0.62	0.55	0.47	0.45	0.41	0.38	0.29	0.31	0.34	0.08
$NIPO^{SDC}$	31.8	29.0	19.6	2.0	92.0	156	0.72	0.61	0.57	0.57	0.50	0.40	0.38	0.36	0.29	0.22	0.27	0.31	0.08
NFIL	32.2	29.5	20.1	1.0	99.0	156	0.74	0.67	0.53	0.52	0.42	0.43	0.31	0.30	0.25	0.29	0.23	0.29	0.08
NWD	6.0	4.0	5.2	1.0	32.0	134	0.37	0.42	0.25	0.33	0.23	0.23	0.21	0.22	0.23	0.15	0.18	0.18	0.09
Time in Registration in Days																			
$REGTIME^{PW}$	72.1	63.1	61.3	11.0	624.0	156	0.19	0.16	0.08	0.06	0.02	-0.01	0.02	0.03	0.00	0.03	0.00	0.03	0.08
Average Initial Returns																			
IR^{EW}	13.9	13.4	7.1	0.0	45.0	156	0.30	0.11	-0.01	0.13	0.04	0.05	-0.01	0.09	0.05	0.18	0.13	0.21	0.08
IR^{PW}	10.6	10.2	6.6	-5.0	27.0	156	0.42	0.30	0.18	0.10	0.12	0.06	0.21	0.24	0.13	0.21	0.17	0.11	0.08
Average Price Updates between Filing and Offer Dates																			
ΔP^{PW}	-3.6	-1.8	10.2	-81.0	18.0	156	0.40	0.04	-0.10	-0.01	-0.07	-0.13	-0.24	-0.02	0.03	-0.01	-0.14	-0.15	0.08

Table 2

Do IPO Initial Returns Predict the Number of IPOs, or Vice Versa?

Second order vector autoregressive (VAR(2)) models for initial returns and the number of IPOs using ISR's data on aggregate IPO activity in the U.S., 1960-97. IR_t^{EW} is the equal-weighted return to IPO investors and $NIPO_t^{ISR}$ is number of IPOs offered in the month. Also, VAR(2) models for initial returns and the number of IPOs using SDC data on aggregate IPO activity in the US, 1985-97. IR_t^{PW} is the proceeds-weighted return to IPO investors and $NIPO_t^{SDC}$ is the number of IPOs offered in the month. The t-statistics use White's (1980) heteroskedasticity-consistent standard errors, and the Granger F-tests for incremental predictability ("causality") are also corrected for heteroskedasticity. The F-tests indicate the incremental explanatory power of the two lags of the predictor variable, given two lags of the dependent variable. R^2 is the coefficient of determination, adjusted for degrees of freedom. S(u) is the standard error of the regression.

	ISR Data, 1960-97				ISR Data, 1985-97				SDC Data, 1985-97			
Dependent Variable	IR_t^{EW}		$NIPO_t^{ISR}$		IR_t^{EW}		$NIPO_t^{ISR}$		IR_t^{PW}		$NIPO_t^{SDC}$	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Regressors												
Constant	7.342	5.28	1.449	1.95	11.226	4.55	0.166	0.05	4.948	4.70	2.236	0.88
IR_{t-1}	0.512	5.82	0.093	2.82	0.285	3.36	0.540	2.98	0.359	4.09	0.454	2.83
IR_{t-2}	0.146	2.35	0.029	1.05	0.026	0.29	0.051	0.29	0.154	1.87	0.165	0.90
$NIPO_{t-1}$	-0.025	-0.69	0.646	9.61	-0.016	-0.68	0.590	5.95	-0.001	-0.03	0.533	6.49
$NIPO_{t-2}$	-0.034	-1.00	0.245	3.91	-0.022	-0.76	0.218	2.42	0.008	0.28	0.195	2.22
R^2	0.376		0.754		0.083		0.590		0.184		0.564	
S(u)	14.584		12.426		6.848		15.459		5.949		12.952	
Granger F-tests:												
Lagged NIPO	2.680				1.060				0.060			
(p-value)	(0.069)				(0.348)				(0.946)			
Lagged IR			7.870				5.030				5.260	
(p-value)			(0.0004)				(0.007)				(0.005)	
Sample Size, T	431		435		156		156		156		156	

Table 3

Relations between IPO Initial Returns and IPO Filings, Timing or Withdrawals, 1985-97

Granger F-tests for the incremental explanatory power of the two lags of the predictor variable, given two lags of the dependent variable in VAR(2) models for initial returns and the measures of IPO timing. IR^{EW} is the equal-weighted return to IPO investors in IPOs offered in the month from ISR. IR^{PW} is the proceeds-weighted return to IPO investors in IPOs offered in the month from SDC. $REGTIME^{PW}$ is the average length of time in registration, the number of days between the file and offer dates, weighted by proceeds raised in the IPO, from SDC. NWD* is the number of offerings withdrawn per month divided by the number of offers filed for the prior four months, also from SDC. The Granger F-tests are corrected for heteroskedasticity.

	Initial Return Measures			
	IR^{EW}		IR^{PW}	
IPO Timing Measures	F-test	p-value	F-test	p-value
NFIL				
(1) Filing predicts Returns	1.67	0.188	1.27	0.282
(2) Returns predict Filing	10.81	0.000	5.86	0.003
Sample Size	154			
$REGTIME^{PW}$				
(3) Timing predicts Returns	0.82	0.440	0.74	0.478
(4) Returns predict Timing	0.77	0.464	4.83	0.008
Sample Size	154			
NWD*				
(5) Withdrawals predict Returns	4.70	0.009	2.00	0.136
(6) Returns predict Withdrawals	1.07	0.343	3.84	0.021
Sample Size	125			

Table 4

Factors Related to IPO Returns, 1985-97

Regression models for the returns to IPO investors in the U.S. using SDC data from 1985-97. RANK is the underwriter rank, from Carter and Manaster (1990) and Carter, Dark, and Singh (1998). TA equals the logarithm of real total assets before IPO. NYSE equals one if the IPO firm will be listed on the New York Stock Exchange, and zero otherwise. NASDAQ equals one if the IPO firm will be listed on the Nasdaq National Market System, and zero otherwise. AMEX equals one if the IPO firm will be listed on the American Stock Exchange, and zero otherwise. TECH equals one if the firm is in a high tech industry [biotech, computer equipment, electronics, communications, & general technology (as defined by SDC)], and zero otherwise. VOL is the market-adjusted volatility of the IPO stock return, the log of the standard deviation of daily returns to the IPO stock in the first 63 trading days after the IPO divided by the standard deviation of daily returns to the CRSP equal-weighted market index of NYSE, Amex, and Nasdaq-listed stocks during the same period. ΔP is the percentage change between middle of the range of prices in the initial registration statement and the offer price. ΔP^+ equals ΔP when it is positive, and zero otherwise. MKT is the return to the CRSP equal-weighted portfolio for the period between the filing date and the offering date for the IPO. MKT^+ is the return to the market MKT when it is positive, and zero otherwise. The t-statistics use White's (1980) heteroskedasticity-consistent standard errors. R^2 is the coefficient of determination, adjusted for degrees of freedom. S(u) is the standard error of the regression. The sample size is 3,832 IPOs.

	(1) Coefficient	(2) t-statistic	(3) Coefficient	(4) t-statistic	(5) Coefficient	(6) t-statistic	(7) Coefficient	(8) t-statistic
Constant	19.552	6.20	19.202	6.64	18.008	5.99	17.655	5.85
RANK	-0.071	-0.61			-0.442	-4.10	-0.418	-3.91
TA	-1.248	-5.45	-1.236	-6.96	-0.957	-4.39	-0.952	-4.38
NYSE	0.993	0.87			-1.191	-1.12	-1.472	-1.37
NASDAQ	0.629	0.71			-1.761	-2.12	-2.008	-2.37
AMEX	-5.789	-3.90	-6.204	-4.60	-4.669	-3.21	-4.665	-3.20
TECH	3.709	4.74	3.715	4.70	1.225	1.78	1.249	1.82
VOL	4.077	5.43	4.185	6.02	3.954	5.79	3.965	5.80
ΔP					0.207	9.76	0.205	9.66
ΔP^+					0.687	8.89	0.676	8.68
MKT							0.223	1.28
MKT^+							-0.156	-0.83
R^2	0.047		0.047		0.221		0.222	
S(u)	21.151		21.145		19.118		19.106	

Table 5

Descriptive Statistics for Expected and Unexpected Initial Returns to IPOs, 1985-97

The mean, median, standard deviation, minimum, and maximum of the initial return to IPO investors (IR). The initial returns are weighted by proceeds raised in the IPO within each calendar month. Autocorrelations for 12 lags (ρ_1 to ρ_{12}), which have a large sample standard error of 0.08 under the hypothesis of no autocorrelation, are also shown.

The measure of expected initial returns, based on column (3) in table 4, uses data known at the time the IPO is filed (from the preliminary prospectus) as well as the after-market volatility of the IPO stock returns, where E[IR] is the expected initial return and IR - E[IR] is the unexpected initial return.

The measure of expected initial returns, based on column (5) in table 4, uses data known at the time the IPO is offered (including the price update) as well as the after-market volatility of the IPO stock returns, where E[IR] is the expected initial return and IR - E[IR] is the unexpected initial return.

	Mean	Median	Std Dev	Min	Max	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8	ρ_9	ρ_{10}	ρ_{11}	ρ_{12}
Initial Returns (proceeds-weighted average of issued offered in month t)																	
IR	10.6	10.2	6.6	-4.8	27.2	0.42	0.30	0.18	0.10	0.12	0.06	0.21	0.24	0.13	0.21	0.17	0.11
Expectations at the time of the IPO, based on information in the preliminary prospectus and after-market return volatility [column (3), table 4]																	
E[IR]	13.0	13.3	2.6	3.6	18.8	0.30	0.32	0.27	0.13	0.17	0.14	0.14	0.22	0.13	0.20	0.13	0.19
IR - E[IR]	-2.0	-2.4	6.9	-15.7	24.8	0.33	0.16	0.08	0.02	0.01	0.01	0.12	0.19	-0.01	-0.08	0.06	-0.03
Expectations at the time of the IPO, based on information in the final prospectus and after-market return volatility [column (5), table 4]																	
E[IR]	10.9	10.7	5.4	-5.1	30.3	0.44	0.25	0.21	0.15	0.13	0.09	0.08	0.13	0.19	0.12	0.13	0.07
IR - E[IR]	-0.7	-1.3	6.1	-14.9	46.8	0.13	-0.06	0.07	0.11	0.05	0.04	-0.05	-0.03	-0.01	0.08	0.03	0.08

Table 6

Relations between Initial Returns to IPOs and IPO Filings or Offers, 1985-97

Granger F-tests for the incremental explanatory power of the two lags of the predictor variable, given two lags of the dependent variable in VAR(2) models for initial IPO returns and the measures of IPO volume. The return to IPO investors IR is the proceeds-weighted return to IPOs from SDC studied in table 5. The columns labeled "Expected" represent VAR(2) models using the predicted initial return from the cross-sectional regression models in table 4. Similarly, the columns labeled "Unexpected" represent VAR(2) models using the forecast errors for the initial return from the cross-sectional regression models in table 4. For the IPO returns, two forecasts are studied: first, using public information available at the time the IPO is filed [col. (3) in table 4], and second, using public information available at the time of the IPO [col. (5) in table 4]. The Granger F-tests are corrected for heteroskedasticity.

	Actual		Expected		Unexpected	
	F-test	p-value	F-test	p-value	F-test	p-value
Expectations based on public information at the time the IPO is filed, along with the after-market volatility of the IPO stock return [col. (3) in table 4]						
NFIL predicts IR	1.87	0.155	0.93	0.393	2.60	0.074
IR predicts NFIL	5.86	0.003	2.18	0.114	3.93	0.020
NIPO predicts IR	0.04	0.962	0.39	0.676	0.45	0.637
IR predicts NIPO	4.99	0.007	2.57	0.077	5.25	0.005
Expectations based on public information at the time of the IPO, along with the after-market volatility of the IPO stock return [col. (5) in table 4]						
NFIL predicts IR			2.80	0.061	2.68	0.068
IR predicts NFIL			4.50	0.011	0.56	0.574
NIPO predicts IR			0.72	0.485	2.35	0.095
IR predicts NIPO			5.35	0.005	2.76	0.063