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IPO Market Cycles: Bubbles or Sequential Learning?

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ABSTRACT

Both IPO volume and average initial returns are highly autocorrelated. Further, more companies tend to go public following periods of high initial returns. However, we find that the level of average initial returns at the time of filing contains no information about that company's eventual underpricing. Both the cycles in initial returns and the lead-lag relation between initial returns and IPO volume are predominantly driven by information learned during the registration period. More positive information results in higher initial returns and more companies filing IPOs soon thereafter.

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 and also in the average initial return per month. Further, there appears to be a lead-lag relation between the two series. Figure 1 shows monthly IPO volume and initial returns between 1960 and 2000. It seems that periods of high and rising initial returns tend to be followed by spurts of IPOs, which are themselves followed by periods of lower initial returns. 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. This pattern is repeated many times over the 41-year period.

Notably, neither the statistical reliability of these lead-lag relations nor the economics underlying these patterns have been examined. Consequently, we have little understanding of the factors that drive these fluctuations or of the implications of such phenomena for companies considering an IPO.

As a first step toward understanding these patterns, we examine their statistical significance. 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

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Figure 1, we find a significant positive relation between initial returns and future IPO volume. It appears that increased numbers of companies go public after observing that IPOs are being underpriced by the greatest amount. As first noted by Ibbotson and Jaffe (1975), this pattern 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.

Having established the statistical significance of the positive relation between initial returns and subsequent IPO volume, we ask whether companies that file IPOs during periods of especially high initial returns can themselves expect to also be extremely underpriced. We also investigate the specific factors that lead increased numbers of companies to go public following periods of high initial returns.

We first analyze the relation between average initial returns at the time a company files its IPO and that company's eventual underpricing. We find that the level of initial returns at the time a company files to go public contains no information about that company's eventual underpricing. In fact, our results show that the serial correlation in initial returns is entirely driven by changes in the types of firms that go public over time and by information that becomes available during the registration period but is only partially incorporated into the offer price. Note that a firm cannot control either of these components of its initial return by filing the offering at a different time. Managers generally cannot substantially alter basic firm characteristics, such as size and industry, meaning they cannot affect this component of underpricing. Further, at the time the offering is filed, managers do not know what information will become available during the registration period or how such information will affect the offer price. Thus, it seems that a company cannot affect the magnitude of its underpricing by altering the timing of its IPO.

To understand why companies go public following periods of high initial returns, we look more specifically at the portion of initial returns to which IPO volume is related. We find that the positive relation between initial returns and subsequent IPO volume is driven by the information that is learned during the registration period but only partially incorporated into the offer price. In the process of marketing the IPO (after the IPO has been filed), the 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, at first glance the cycles in initial returns and IPO volume present two puzzles. First, the serial correlation in initial returns suggests that underwriters ignore the market's valuation of recent IPOs in their pricing of new offerings. Periods of high initial returns appear to represent avoidable *bubbles*, that is, such periods could be avoided if the market for underwriting services was more competitive. Second, in spite of this serial correlation, more companies choose to go public after observing high average initial returns. It would seem that companies could raise more money if they filed their offerings when average initial returns were low.

Our findings address both of these apparent puzzles. First, we find that the cycles in initial returns predominantly reflect investment bankers' *learning* process. Because the registration periods of many IPOs overlap, the information that underwriters learn during one firm's registration period contributes to the first-day returns of many IPOs, thereby causing initial returns to be serially correlated. Second, while more companies go public following periods of high initial returns, this does not mean that they also will be especially underpriced. The level of initial returns at the time a company files its IPO contains no information about that firm's eventual underpricing. Rather, we find that more companies file IPOs following periods of high initial returns because the high returns are related to positive information learned during the registration periods of those offerings, suggesting that companies can raise more money in an IPO than they had previously thought. The conclusion that firms can raise more money immediately after a period of high initial returns is consistent with Ritter (1984).

Section I discusses the data that we use to examine the time-series relations in IPO volume and initial returns. Section II investigates the statistical properties of the relations between IPO volume and past and future initial returns. In Section III, 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. Section IV investigates the factors that contribute to initial returns, thus providing the foundation for the analyses in Sections V and VI. In Section V, we examine the relation between average initial returns at the time a company files its IPO and that company's eventual underpricing, and Section VI investigates the reasons that more companies go public after observing especially high average initial returns. Section VII describes the out-of-sample results for 1998-1999. Finally, Section VIII summarizes the results in the paper.

I. 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. Later sections of the paper also employ firm-level initial returns, and those data will be described at that point.

A. 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 or amended 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).[1] Finally, we

[1] SDC records 48 withdrawals in January 1990, compared to 4 withdrawals the previous month and 1 the subsequent month. We strongly suspect that this observation is incorrect, so we omit it.

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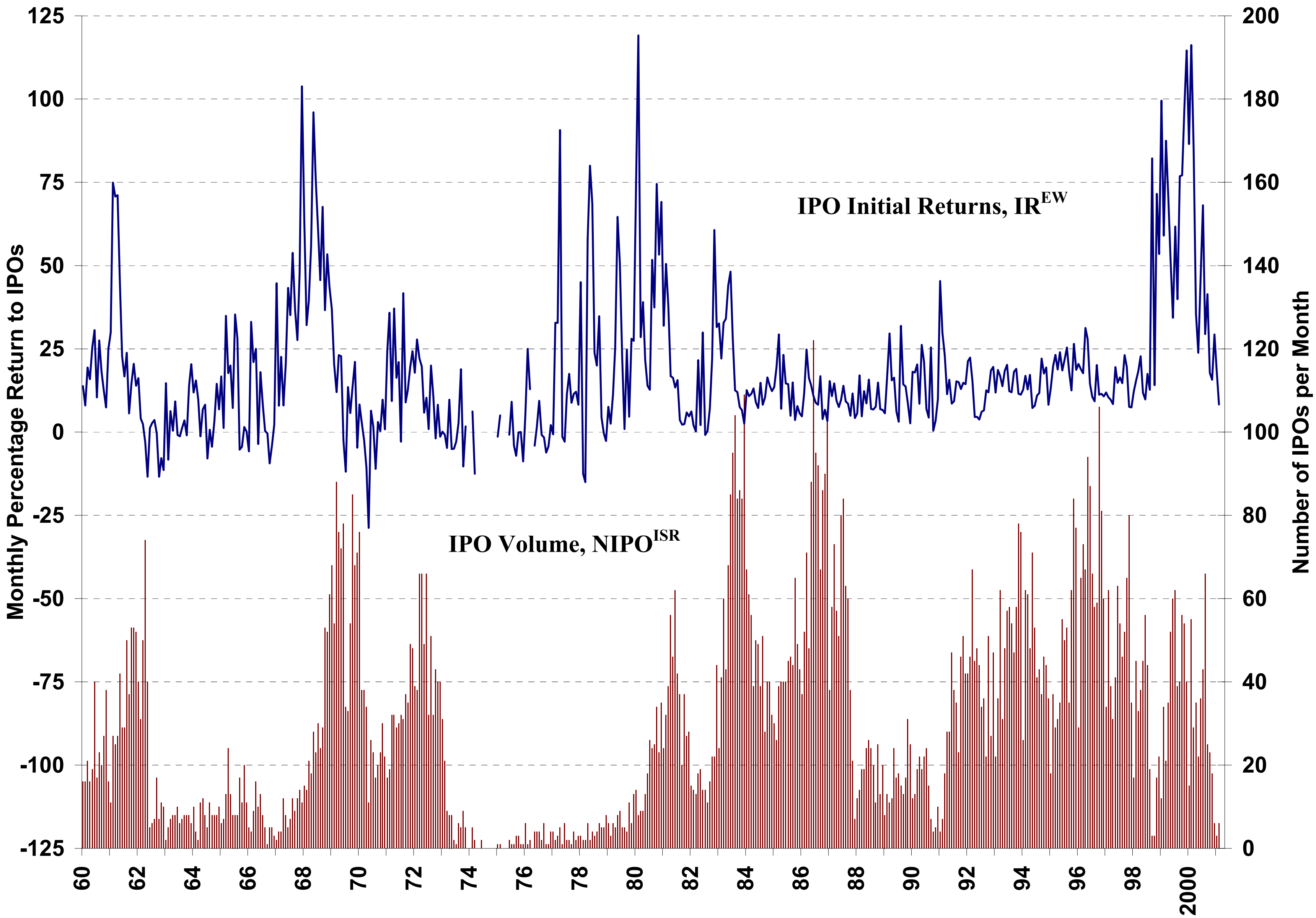

Figure 1. Ibbotson, Sindelar, and Ritter's (1994) monthly data on aggregate US initial public offerings per month ($NIPO^{ISR}$) and average initial returns to IPO investors (IR^{EW}). Updated on Jay Ritter's web site [http://bear.cba.ufl.edu/ritter/ipoall.htm] to cover the period January 1960 - February 2001.

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 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}.

B. Descriptive Statistics

Table I 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 average initial returns. For the 1985-97 period, the autocorrelations of proceeds-weighted initial returns are highest for the first two monthly lags. The autocorrelations of equal-weighted 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).

Table I

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 percentage initial return to IPO investors (IR). In general, the initial return is the percentage return from the offer price to the closing price on the first day of trading. 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 (ISR) from 1960-97 (IR^{EW} and $NIPO^{ISR}$).

Remaining rows of the table use data from 1985-97. In addition to the ISR data, we use information from Securities Data Corporation (SDC). $NIPO^{SDC}$ is the number of IPOs per month, NFIL is the number of offerings filed per month, and NWD is the number of offerings withdrawn per month. $REGTIME^{PW}$ 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 percentage 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 percentage difference between the mid-point of the initial offer range and the final IPO price). ΔP^{PW} is the average percent 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

II. The Relation Between Volume and Initial Returns

Before analyzing the determinants of the lead-lag relation between IPO volume and initial returns, it is helpful to review the existing evidence on the determinants of the fluctuations of IPO volume and the fluctuations in initial returns individually. Several possible explanations have been suggested for the cyclical pattern in each of these series.

A. IPO Volume

Lowry (2001) shows that the observed fluctuations in IPO volume are related to three factors: changes in private firms' aggregate demand for capital, changes in the adverse selection costs of issuing equity, and variation in investor optimism. More companies tend to raise public equity for the first time when private firms' total demands for capital are higher, the adverse selection costs of issuing equity are lower, and investors are especially optimistic and therefore willing to overpay for IPO firms. Lee and Henderson (1999), Bayless and Chaplinsky (1996), Choe, Masulis, and Nanda (1993), Rajan and Servaes (1997), Lee, Shleifer and Thaler (1991), Helwege and Liang (1996), Pagano, Panetta, and Zingales (1998), and Cook, Jarrell, and Kieschnick (1999) provide additional evidence that equity issuance is related to one or more of the above factors.

More generally, both Persons and Warther's (1997) and Stoughton, Wong, and Zechner's (2000) models suggest that the cycles in IPO volume are potentially consistent with efficient markets and do not necessarily reflect irrational bubbles. Persons and Warther show that if firms rationally condition their decision to go public on the outcome of recent IPOs, then we may observe clustering of IPOs in certain periods. Stoughton, Wong, and Zechner posit that the clustering of IPOs is the result of information effects. One firm's IPO provides information about industry prospects, thus causing many similar companies to go public soon after.

B. 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. Finally, Loughran and Ritter's (2000) prospect theory explanation says that initial returns are related to public information that becomes available during the registration period. Such information is only partially incorporated into the offer price, meaning that offerings whose registration periods coincide with periods of high market-wide returns will tend to be especially underpriced. Because the registration periods of IPOs close to one another in time overlap, this generates cycles in initial returns.

C. 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 related to subsequent or lagged IPO volume. However, suppose that initial returns are related to some value-relevant information. For example, Loughran and Ritter (2000) find that initial returns are related to public information learned during the registration period, and Hanley (1993) finds that initial returns are related to private information learned in this same period. In addition, van Bommel and Vermaelen (2000) find that firms with higher first-day returns spend more money on investment after the IPO, suggesting that initial returns are positively related to the market's assessment of the firm's prospects. In a similar spirit, Stoughton, Wong, and Zechner (2000) show that firms with higher first-day returns should gain larger market share in the product market. Consistent with Stoughton, Wong, and Zechner's predictions, Ward (1997) finds that when a firm announces an IPO, the stock price reactions of competitor firms are strongly negatively correlated with the IPO firm's eventual underpricing.

Benveniste, Busaba, and Wilhelm (2000) note that the information produced by firms that go public influences not only their own production decisions but also those of their rivals. Consistent with this idea, Benveniste, Wilhelm, and Yu (1999) find that issuing firms structure their IPOs conditional on various features of recent offerings. If high initial returns indicate that private companies can raise more money in an IPO than they previously thought, then these prior findings suggest that high initial returns should be followed by periods of high volume.

Information spillovers can similarly explain the negative relation between IPO volume and subsequent initial returns. As more firms go public, companies have better information about how much money they can expect to raise in an IPO. Thus, the uncertainty surrounding the true value of these companies decreases, and average initial returns decrease.[2]

D. 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 pattern of cross-correlations is similar over the shorter time period, 1985-1997, on which the majority of our empirical tests focus. The cross-correlations using initial returns and the number of filings, IR_t^{PW} and $NFIL_{t+k}$, are 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 figures are descriptive in nature, however, and one must be cautious in drawing conclusions from them. To test the reliability of these relations, we use third 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 II.

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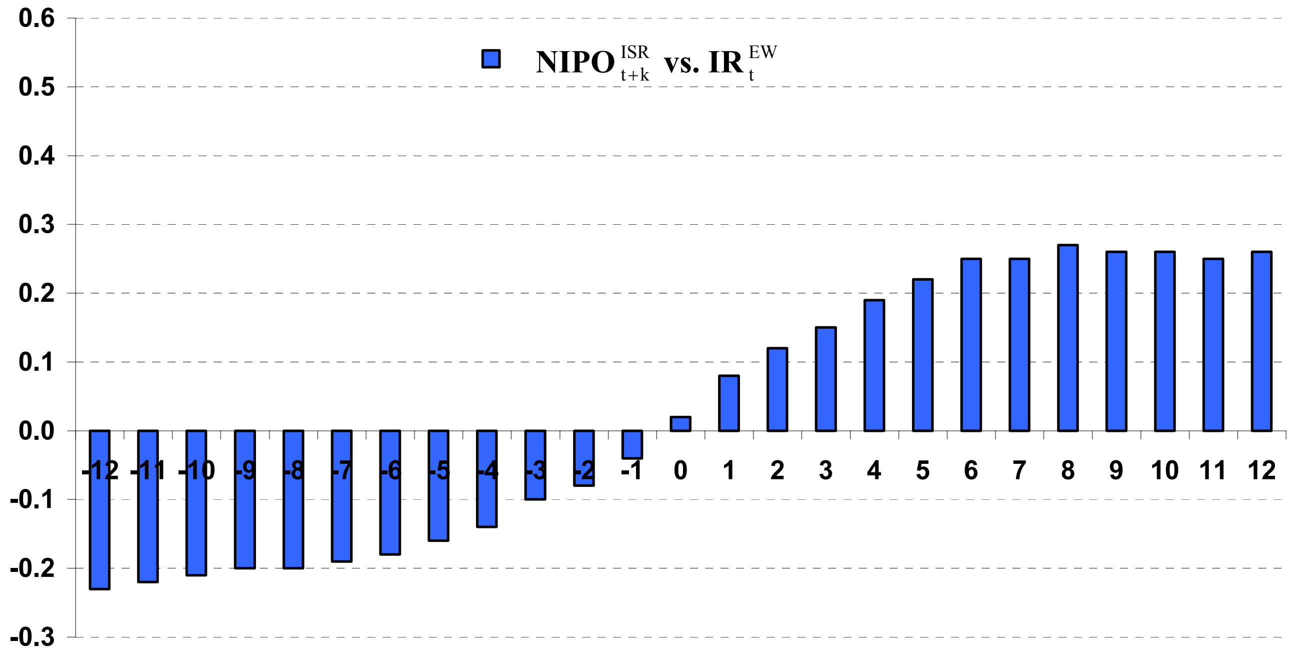
[2] Although Benveniste, Busaba, and Wilhelm's (2000) information spillover model differs slightly from the intuition presented here, they arrive at a similar prediction. They model initial returns as compensation to investors for learning the true value of firms, and they show that as more firms go public, investors must expend fewer resources to learn the true value of subsequent IPOs, thereby causing initial returns to decrease.

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



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

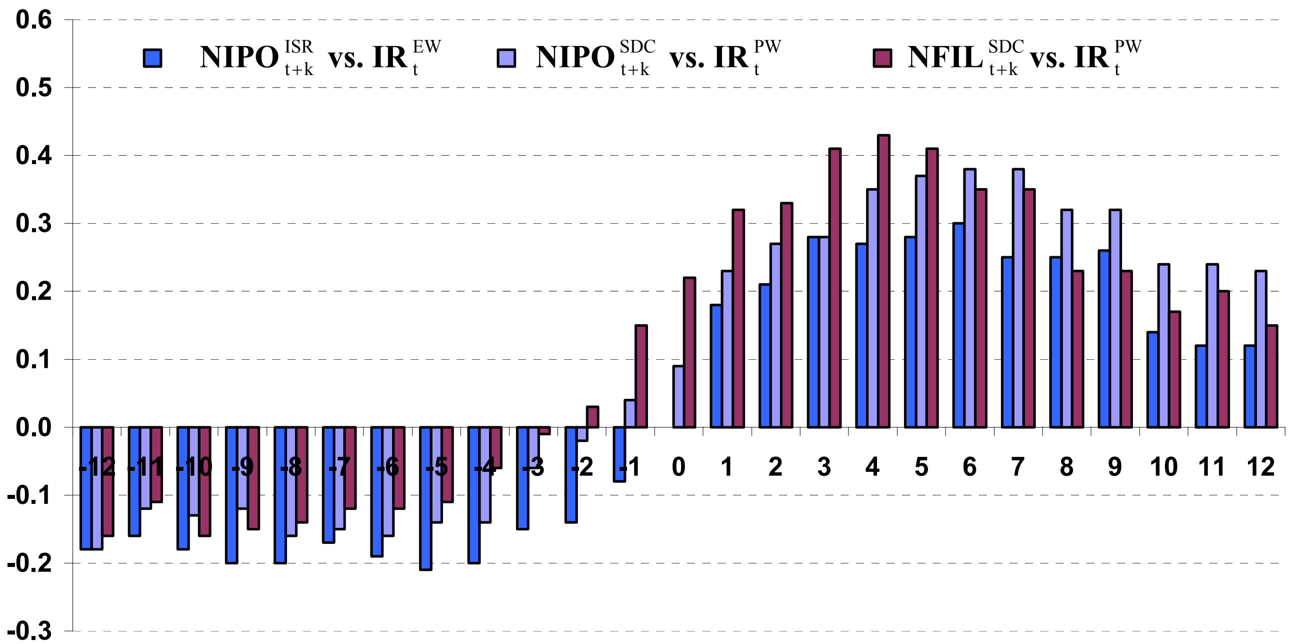


Figure 2. Cross correlations of the number of IPOs in month t+k with the return to IPOs in month t, for k = -12, . . ., 12. The large sample standard error for these correlations is .05 for 1960-97 and .08 for 1985-97. $NIPO^{ISR}$ is the number of IPOs per month and IR^{EW}_{t} is the equal-weighted average initial return to IPO investors in month t both from Ibbotson, Sindelar, and Ritter (1994). $NIPO^{SDC}_{t}$ is the number of IPOs per month and IR^{PW}_{t} is the proceeds-weighted average initial return to IPO investors in month t both using data from SDC.

Table II

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

Third order vector autoregressive (VAR(3)) models for initial returns and the number of IPOs using ISR's data on aggregate IPO activity in the U.S., 1960-97 and 1985-97. 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(3) 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 three lags of the predictor variable, given three 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	7.426	5.18	0.321	0.41	11.643	4.03	-6.810	-1.86	5.029	4.54	0.069	0.03
IR_{t-1}	0.510	5.66	0.094	2.85	0.286	3.33	0.565	3.52	0.359	4.08	0.418	2.60
IR_{t-2}	0.136	1.91	0.025	0.81	0.039	0.47	0.046	0.26	0.152	1.73	0.120	0.63
IR_{t-3}	0.014	0.24	0.037	1.24	-0.048	-0.58	0.337	2.07	0.002	0.02	0.224	1.23
$NIPO_{t-1}$	-0.023	-0.61	0.596	9.31	-0.016	-0.62	0.528	6.00	0.001	0.03	0.485	6.16
$NIPO_{t-2}$	-0.027	-0.71	0.111	1.57	-0.019	-0.63	0.036	0.37	0.015	0.44	0.063	0.71
$NIPO_{t-3}$	-0.012	-0.33	0.204	3.69	-0.003	-0.09	0.292	3.75	-0.012	-0.39	0.203	2.66
R^2	0.373		0.760		0.072		0.622		0.173		0.580	
S(u)	14.643		12.261		6.886		14.826		5.987		12.712	
Granger F-tests:												
Lagged NIPO (p-value)	1.87 (0.132)				0.70 (0.551)				0.09 (0.964)			
Lagged IR (p-value)			7.22 (0.0001)				7.07 (0.0001)				4.90 (0.002)	
Sample Size, T	428		430		156		156		156		156	

The left and middle panels of Table II 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 proceeds-weighted initial returns, Granger F-tests strongly reject the hypothesis that three lags of 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.[3] 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 II 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.

III. 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. The finding that high initial returns are followed by increased numbers of IPOs suggests that high initial returns represent good news to private companies considering an IPO. 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 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.

Table III contains Granger F-tests from third order VAR models (similar to Table II) 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. $REGTIME^{PW}$ 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

[3] 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.

Table III

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

Granger F-tests for the incremental explanatory power of the three lags of the predictor variable, given three lags of the dependent variable in VAR(3) 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) Returns predict Filing	8.19	0.00002	4.72	0.003
Sample Size	153			
$REGTIME^{PW}$				
(2) Returns predict Timing	0.58	0.625	3.36	0.018
Sample Size	153			
NWD*				
(3) Returns predict Withdrawals	5.02	0.002	4.10	0.006
Sample Size	119			

number of offers withdrawn in month t, scaled by the number of issues filed in the prior four months.

The statistical tests in Table III show that the positive relation between initial returns and the number of IPOs is driven by the timing of firm filings and of offer withdrawals. Consistent with the evidence in Figure 2, both equal-weighted and proceeds-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, both equal-weighted and proceeds-weighted initial returns are strongly related to future withdrawals (p-values of 0.002 and 0.006, respectively). More companies file IPOs and fewer companies withdraw offerings following periods of high initial returns. Finally, although there is some evidence that proceeds-weighted initial returns predict timing (p-value of 0.018 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. At first glance, this result seems inconsistent with the evidence that initial returns represent good news for companies considering an IPO. However, it is possible that high initial returns lead so many companies to file IPOs that the SEC is not able to process the registration statements in a timely manner, or that investment banks cannot provide service to all of these firms simultaneously, resulting in longer registration times.

In summary, the positive relation between initial returns and future IPO volume is driven by more companies filing IPOs after periods of high initial returns and by the likelihood of cancellation, not by variation in the length of registration.

IV. 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 Sections V and VI, examines the pricing process of IPOs at the firm level to learn more about the information content of initial returns.

Section IV.A reviews the most relevant existing literature, and Section IV.B defines the firm-level data used in the remainder of the paper. Section IV.C presents a brief empirical analysis of the determinants of initial returns. We note that most of the cross-sectional results in Section IV.C confirm the findings of the prior literature. The main purpose of this analysis is to facilitate our aggregate time series tests in Sections V and VI. Sections V and VI employ the results of Section IV.C to determine whether initial returns at the time a firm goes public are related to that firm's eventual underpricing and, more generally, to determine why more firms go public following periods of high initial returns.

A. Overview of the IPO Pricing Process

Initial returns equal the difference between the underwriters' valuation of the firm, as represented by 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 underwriters plus some incremental information provided by the market.

When a company files an IPO, it must file a prospectus containing a variety of firm- and offer-specific information. Either in this prospectus or in an amended prospectus that is filed later, the company must also provide 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 prior to the offering, as well as some incremental information provided by the secondary market.

Loughran and Ritter (2000) 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, Baron (1982) posits that issues that are characterized by greater uncertainty tend to be more underpriced to compensate investors for learning about their true values. Ritter (1984) notes that Rock's (1986) model has a similar implication, and Beatty and Ritter (1986) develop Ritter's assertion in more detail, that is, issues characterized by greater uncertainty should be more underpriced on average. Beatty and Ritter (1986) and Megginson and Weiss (1991), among others, find empirical support for these ideas. 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. 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.

B. 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 Section IV.C.

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 I.A);
(2) RANK is the underwriter rank, from Carter, Dark, and Singh (1998) (underwriters not covered by Carter, Dark, and Singh are assigned a rank of zero);
(3) TA equals the logarithm of real total assets (in 1983 dollars) before the IPO;
(4) NYSE equals one if the IPO is listed on the New York Stock Exchange, and zero otherwise;
(5) NMS 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) ΔP is the percentage change between middle of the original file price range and the offer price;
(9) ΔP^+ equals ΔP when it is positive, and zero otherwise (to capture asymmetric effects of price updates);
(10) MKT is the return to the CRSP equal-weighted portfolio of NYSE, Amex, and Nasdaq-listed stocks for the 15 trading days prior to the offer date, and
(11) MKT^+ equals MKT when it is positive, and zero otherwise (again, to capture asymmetric effects).

C. 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 IV contains estimates of regression models that explain this initial return,

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

where the variables have been defined above.

The rank of the investment banker (RANK), the size of the IPO firm (TA), the market on which the new issue will trade (NYSE, NMS, or AMEX), and the firm's industry (TECH) are known at the time of the initial prospectus. The price update (ΔP) and market returns during the 15 trading days prior to the offer (MKT) are not known until the IPO price is set, typically one day before the offering.

The cross-sectional regressions in Table IV have many potential statistical problems. For example, since IPOs are clustered in time the regression errors in Table IV are likely to be correlated. Moreover, the coefficients may not be constant over time. Our main interest in these cross-sectional regressions is to identify firm and deal characteristics that are likely to be systematically related to initial returns so that we can aggregate the predictions and the prediction errors from these models to learn more about aggregate IPO market cycles. For this

Table IV

Firm and Deal Characteristics Related to IPO Returns Across Firms, 1985-97

Regression models for the returns to IPO investors in the U.S. using SDC data from 1985-97. The dependent variable is the percentage initial return. RANK is the underwriter rank from Carter, Dark, and Singh (1998). TA equals the logarithm of real total assets before the IPO. NYSE equals one if the IPO firm will be listed on the New York Stock Exchange, and zero otherwise. NMS 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. ΔP is the percentage difference between the mid-point of the initial offer range and the final IPO price. ΔP^+ equals ΔP when it is positive, and zero otherwise. MKT is the return to the CRSP equal-weighted portfolio for the 15 trading days before the offering date. MKT^+ equals 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 3,976 IPOs.

	Information at Time of Registration		Information at Time of Offering	
	(1)	(2)	(3)	(4)
	Coefficient	t-statistic	Coefficient	t-statistic
Constant	33.727	8.16	28.835	7.27
RANK	-0.036	-0.31	-0.407	-3.78
TA	-1.311	-4.77	-0.996	-3.77
NYSE	0.111	0.07	-2.374	-1.64
NMS	1.047	1.07	-1.668	-1.81
AMEX	-6.591	-4.09	-5.641	-3.59
TECH	4.245	5.38	1.662	2.42
ΔP			0.185	8.41
ΔP^+			0.680	8.65
MKT			0.371	1.47
MKT^+			0.434	1.26
R^2	0.029		0.177	
S(u)	23.363		21.499	

purpose, we are not really concerned about the reliability of the t-statistics in columns (2) and (4). Further, we do not include any variables that would proxy directly for recent initial returns to IPOs, such as time trends or yearly dummy variables. The predictions from Table IV reflect only the firm and deal characteristics, not the recent state of the IPO market.

The regression in column (1) of Table IV includes only independent variables that are known at the time the IPO is filed. We find that larger IPO firms, those that list on AMEX, and those that are not technology firms have the least underpricing. Note that the coefficient of determination R^2 is about 2.9%, so only a small part of the variation in initial returns is explained by these characteristics that are known at the time of the initial registration. Moreover, the standard error of the regression is 23.4%, implying that there is a lot of unexplained dispersion in initial returns.

Column (3) adds explanatory variables that are not known until the actual offering. Thus, the difference between the portion of initial returns explained in the column 1 regression versus the column 3 regression represents the effects of information learned during the registration period. Hanley (1993) shows that initial returns are significantly related to the price update, and Loughran and Ritter (2000) show that initial returns are significantly related to market returns during the 15 days prior to the offering. We include both of these variables, ΔP and MKT. We also allow for any asymmetric effects by including ΔP^+ and MKT^+.

Consistent with Lowry and Schwert (2001), we find that the price update has an asymmetric effect on initial returns. Specifically, we find that a 10% increase in the IPO price from the mid-point of the initial filing range predicts a 8.65% (0.185 + 0.680) higher initial return, while a 10% decrease in the IPO price predicts a 1.85% 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.

The effect of market returns is more ambiguous. Given the price update and the firm and deal characteristics that are known at the time of the IPO, there is little evidence that MKT and MKT^+ are strongly related to initial returns. Both MKT and MKT^+ have modest t-statistics (1.47 and 1.26, respectively), even given the likely problems with these t-statistics mentioned above. However, if we had specified the asymmetric market return variable to be zero when MKT is positive and equal to MKT when it is negative (call it MKT^-), the estimate of the coefficients of MKT and MKT^- would be 0.804 and –0.434 with t-statistics of 5.02 and -1.26. As mentioned earlier, the purpose of including market returns in the regression is to capture information learned during the registration period. The question raised by Loughran and Ritter (2000) of whether public information learned during the registration period is or is not fully incorporated into the offer price is beyond the scope of this paper.

V. Cycles in Initial Returns

Given the serial correlation in initial returns, it seems surprising that more companies choose to go public after observing high initial returns. However, Section IV shows that initial returns are predictably related to several factors. The extent to which a company can affect its own underpricing by altering the timing of its IPO depends on which of these factors drive the serial correlation in initial returns.

A. Autocorrelations of Initial Returns

By definition, the serial correlation in initial returns indicates that underwriters do not incorporate all available information into the IPO offer price. If the IPOs in a given month are especially underpriced, one can expect that IPOs in the subsequent month will also be underpriced by a large amount. However, the regressions in Table IV show that there are predictable relations between the characteristics of IPO firms and the initial return. Thus, the autocorrelation in aggregate initial returns in Table I could simply reflect patterns in the types of firms going public. Table IV also shows that the initial return is related to information learned during the registration period but only partially incorporated into the offer price. Because the registration period averages two months, IPOs that are close in calendar time will tend to have overlapping registration periods. This could also contribute to the serial correlation of initial returns.

To examine the source of the serial correlation in initial returns, we aggregate the predictions of initial returns that are implied by the cross-sectional regression models in Table IV into expected components and the residuals into unexpected components, where both are weighted by proceeds raised in the IPO. Table V 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 (1) in Table IV 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). This expected return measure should capture the portion of initial returns that is related to the types of firms going public. The unexpected initial return, $[IR - E_F(IR)]$, is the proceeds-weighted residual or forecast error from the same Table IV regression and consists of information learned during the registration period plus the incremental information provided by the secondary market when the firm starts trading.

Row (2) of Table V shows the autocorrelations of expected initial returns at the time of the filing, $E_F(IR)$. Many of these autocorrelations are reliably different from zero, indicating that at least part of the serial correlation in observed initial returns is attributable to the mix of firms going public. There are patterns in the type of firms going public, and (consistent with the information asymmetry hypothesis) similar firms tend to earn similar initial returns. In addition, the first lag of the unexpected initial return in row (3), $[IR - E_F(IR)]$, equals 0.34, and many of the higher order lags are also significantly different from zero. This indicates that information learned during the registration period but only partially incorporated into the offer price and/or unexplained biases in underwriter pricing also contribute to the serial correlation in initial returns.

To determine the effect of information learned during the registration period, we use the predictions from column (3) in Table IV to represent the initial returns conditional on information in the preliminary prospectus and information learned during the registration period. The corresponding measure of unexpected initial returns, $[IR - E_O(IR)]$, consists of the incremental information provided by the secondary market when the firm starts trading. Note that if similarities in the types of firms going public and information learned during the registration period entirely account for the serial correlation in initial returns, then these unexpected initial returns will not be serially correlated.

The last row of Table V shows that the autocorrelations of this measure of unexpected initial returns, $[IR - E_O(IR)]$, are in fact close to zero at all lags. This suggests that the cross-sectional model in column (3) of Table IV captures all of the interesting dynamics in predicting initial

Table V

Autocorrelations of Expected and Unexpected Initial Returns to IPOs, 1985-97

In addition to the autocorrelations, we show 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}) have a large sample standard error of 0.08 under the hypothesis of no autocorrelation. The measure of expected initial returns in row 2, based on column (1) in Table IV, uses data known at the time the IPO is filed (from the preliminary prospectus), where E_F[IR] is the expected initial return and IR – E_F[IR] is the unexpected initial return. The measure of expected initial returns in row 4, based on column (3) in Table IV, uses data known at the time the IPO is offered (including the price update and market returns), where E_O[IR] is the expected initial return and IR – E_O[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}
Percentage Initial Returns (proceeds-weighted average of issues offered in month t)																	
(1) 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 the IPO is filed, based on information in the preliminary prospectus [column (1), Table IV]																	
(2) E_F[IR]	10.6	10.7	2.2	4.9	17.0	0.05	0.23	0.07	0.16	0.03	0.26	0.24	0.05	0.19	0.07	0.22	0.05
(3) IR – E_F[IR]	-0.5	-1.2	7.0	-14.1	44.6	0.34	0.18	0.23	0.22	0.16	0.09	0.00	0.04	0.07	0.09	0.03	0.07
Expectations at the time of the IPO, based on information in the final prospectus [column (3), Table IV]																	
(4) E_O[IR]	11.3	10.5	5.7	-5.6	26.2	0.44	0.20	0.07	0.05	-0.03	-0.07	-0.02	0.05	0.18	0.10	0.07	-0.06
(5) IR – E_O[IR]	-1.1	-1.4	5.8	-13.9	44.1	0.13	-0.03	0.08	0.12	0.08	0.09	0.03	0.04	0.01	0.13	0.17	0.08

returns, despite the fact that there are no measures of IPO market conditions in this regression. The finding that [IR – E_O(IR)] is uncorrelated through time shows that the serial correlation in initial returns can be explained by the effects of firm characteristics and information learned during the registration period. As mentioned previously, a firm cannot know what value-relevant information will become available after it files its offering (during its registration period), and it presumably cannot substantially alter its basic characteristics (such as size, industry, etc.) Thus, it seems that companies have little ability to control the size of their initial returns by filing their IPO at different times.[4] In summary, the level of recent average 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.

B. Fama-MacBeth Regressions

As a check on the robustness of our results, we also employ an alternative test of the relation between average initial returns at the time a company files an IPO and that company's eventual underpricing. Specifically, we regress the initial returns of a company that files in month t on the average initial returns of offerings in month t-1 as well as the firm and deal characteristics used in Table IV. If a company can predict its level of underpricing at the time it files based on the initial returns of recent offerings, then we would expect to find a significant relation.

As mentioned above, pooled cross-sectional regressions such as those in Table IV can give misleading inferences because IPOs are clustered in time, resulting in correlated errors. To test whether recent initial returns in the IPO market predict a firm's initial return, we use Fama-MacBeth (1973) bootstrap estimates in Table VI. We estimate cross-sectional regressions each year from 1985 - 1997, then average the year-by-year coefficient estimates. The t-statistics in Table VI are based on the standard error of the mean of these 13 year-by-year estimates. Column (1) includes the firm-specific characteristics known at the time the offering was filed, and column (3) also includes the price update and market return information that is available at the time of the offering.

Consistent with the results in Table V, the average initial return to IPOs in the month before filing is insignificant in both regressions (t-statistics of -1.61 and –0.23). Moreover, the point estimates are negative, which is opposite of the positive autocorrelation seen in the unadjusted aggregate initial returns. The results in Table VI provide further evidence that the initial returns of a company filing in month t are unrelated to the average initial returns observed in recent offerings. It seems that a company cannot control its level of underpricing by filing during a period of high versus low average initial returns.

C. Discussion

In summary, firms tend to register to go public when average initial returns are especially high, but those firms should not themselves expect to be especially underpriced. In fact, the average initial returns of these firms are largely unpredictable. The serial correlation in aggregate initial returns is explained by similarities in the types of firms going public over time

[4] While the price update is not known until the day before the offering (when the offer price is set), if firms could predict the price update at the time of the filing they may be able to predict their initial return at the same time. However, the finding that the price update is only autocorrelated at lag one (Table I) combined with the fact that the registration period averages two months mitigates this concern. As a further check, we disaggregate the price update into expected and unexpected components, conditional on information available at the time of the filing. When we include this expected price update measure in expected initial returns the results are similar.

Table VI

Effects of Average IPO Initial Returns in Month t-1 on Initial Returns to Firms Filing in Month t, Fama-MacBeth Bootstrap Estimates, 1985-97

Fama-MacBeth estimates for the returns to IPO investors in the U.S. using SDC data from 1985-97. Coefficient estimates are an average of the year-by-year regression coefficients and the t-statistics are based on the standard deviation of the time-series of coefficient estimates. The dependent variable is the percentage initial return. RANK is the underwriter rank from Carter, Dark, and Singh (1998). TA equals the logarithm of real total assets before the IPO. NYSE equals one if the IPO firm will be listed on the New York Stock Exchange, and zero otherwise. NMS 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. ΔP is the percentage difference between the mid-point of the initial offer range and the final IPO price. ΔP^+ equals ΔP when it is positive, and zero otherwise. MKT is the return to the CRSP equal-weighted portfolio for the 15 trading days before the offering date. MKT^+ equals MKT when it is positive, and zero otherwise. IR_{t-1} is the proceeds-weighted average initial return to IPO investors in the month before this IPO is first registered with the SEC. R^2 is the average coefficient of determination, adjusted for degrees of freedom. The sample size is 3,976 IPOs.

	Information at Time of Registration		Information at Time of Offering	
	(1) Average Coefficient	(2) t-statistic	(3) Average Coefficient	(4) t-statistic
Constant	28.990	3.81	22.368	2.68
RANK	-0.059	-0.34	-0.307	-2.19
TA	-0.667	-1.22	-0.374	-0.63
NYSE	-8.252	-2.82	-8.556	-2.67
NMS	-6.189	-3.33	-5.750	-2.75
AMEX	-10.191	-4.30	-8.859	-3.41
TECH	2.207	1.92	0.330	0.53
ΔP			0.272	3.34
ΔP^+			0.362	1.44
MKT			0.865	2.41
MKT^+			0.163	0.38
IR_{t-1}	-0.136	-1.61	-0.015	-0.23
R^2	0.045		0.197	

and information learned during the registration period. Thus, the cross-sectional predictability of initial returns also explains the apparent time-series autocorrelation of aggregate initial returns.

Our results indicate that several of the theories that were developed to explain the cross-sectional patterns in initial returns can also explain the time-series dynamics. For example, the finding that a portion of the serial correlation in initial returns is driven by similarities in the types of firms going public, combined with the evidence that initial returns vary predictably with firm characteristics, is consistent with the information asymmetry hypothesis. Similarly, the finding that information learned during the registration period but only partially incorporated into the offer price contributes to the serial correlation in initial returns is consistent with the partial updating theory and possibly the prospect theory explanation. To the extent that the relevant information learned during the registration period is all private information (as represented by the price update in Tables IV and VI), the evidence is consistent with Benveniste and Spindt's partial updating theory. However, to the extent that public information learned during this period (as represented by market returns in Tables IV and VI) is similarly only partially incorporated into the offer price, our results indicate that the Loughran and Ritter's prospect theory explanation also explains at least a portion of the serial correlation in initial returns.

VI. The Information Content of Initial Returns

We next examine the source of the information in average initial returns that leads more companies to file IPOs following periods of high average underpricing. Table VII shows Granger F-tests from third order VAR models (similar to Tables II and III) relating initial returns with 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.

By focusing on the relations between initial returns and subsequent IPO volume, we hope to learn more about 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 II and III, we find that IR is 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 2 the expected initial return is conditional on the firm-specific information contained in the preliminary prospectus (the Table IV, column 1 regression). 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 0.565 and 0.766), while the unexpected initial return is a highly significant predictor of both (p-values of 0.001 and 0.003). 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.

In rows 3 and 4, the expected initial return includes firm-specific information contained in the preliminary prospectus plus information learned during the registration period (the Table IV, column 3 regression). When information learned during the registration period is included in the

Table VII

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

Granger F-tests for the incremental explanatory power of the three lags of the predictor variable, given three lags of the dependent variable in VAR(3) 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 V. The columns labeled "Expected" represent VAR(3) models using the predicted initial return from the cross-sectional regression models in Table IV. Similarly, the columns labeled "Unexpected" represent VAR(3) models using the forecast errors for the initial return from the cross-sectional regression models in Table IV. For the IPO returns, two forecasts are studied: first, using public information available at the time the IPO is filed [col. (1) in Table IV], and second, using public information available at the time of the IPO [col. (3) in Table IV]. The Granger F-tests are corrected for heteroskedasticity.

	Components of Initial Returns, IR					
	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 [col. (1) in Table IV]						
(1) IR predicts NFIL	4.72	0.003	0.68	0.565	5.17	0.001
(2) IR predicts NIPO	4.90	0.002	0.38	0.766	4.74	0.003
Expectations based on public information at the time of the IPO [col. (3) in Table IV]						
(3) IR predicts NFIL			7.99	0.00003	1.55	0.199
(4) IR predicts NIPO			4.97	0.002	3.74	0.011

expected initial return, the expected initial return is a highly significant predictor of both future filings and future offerings (p-values of 0.00003 and 0.002). Thus, it seems that the positive relation between initial returns and new offerings reflects information learned during the registration period. When the information that becomes available during a new offering's registration period is positive, that company experiences a positive initial return and a larger number of other companies choose to go public, resulting in an increase in the numbers of subsequent filings and offerings.

These findings suggest that positive information learned during the registration period indicates that other companies can go public at higher valuations than they had previously expected. This interpretation is consistent with the prior findings of Pagano, Panetta, and Zingales (1998) and Lowry (2001) that more companies tend to go public when the average market-to-book ratio (M/B) of public firms in their industry is especially high. Positive information learned during an IPO's registration period results in a high initial return and consequently a higher M/B for the IPO firm. Assuming that such information likewise affects already public firms, the average M/B of the similar public firms will also increase. Thus, positive information that becomes available during an IPO's registration period is associated with higher initial returns for that offering, higher M/B ratios for similar public firms, and more private companies choosing to go public soon after.

Interestingly, the unexpected initial returns in rows 3 and 4 are not significantly related to the future number of filings (p-value of 0.199), but they are significantly related to the number of future offerings (p-value of 0.011). Further, the relation between unexpected initial returns and future offerings is negative. Together, these results suggest that companies do not rely on this secondary market information in their decisions of when to file their offerings, yet such information does affect the time in registration. Companies appear to go public less quickly when the incremental information provided by the secondary market is more positive. This is consistent with the finding in Table III that proceeds-weighted initial returns are significantly positively related to the length of the registration period of subsequent IPOs (p-value of 0.018).

In summary, the results in Table VII show that private companies rely heavily on information learned during the registration periods of recent IPOs in their decisions of when to go public. The types of firms that have recently gone public have no influence on the filing or issuing decisions of other private firms. The incremental information provided by the secondary market similarly does not affect firms' decisions to file offerings, but it does affect the speed with which IPOs are brought to market.

VII. Out-of-sample Results, 1998-99

As can be seen in Figure 1, the IPO market was very active in 1998-99, with a large number of IPOs and high average initial returns. This occurred after we had initially constructed and analyzed the data in this paper. A natural question arises as to whether our results would hold up when extended past 1997.

We have analyzed many of the questions addressed above using data through 1999 and the conclusions drawn are sensitive to the methods used. In particular, a simple application of the methods used in Tables I through VII causes many of the parameter estimates to change substantially from their values in the 1985-97 sample. This occurs because the dispersion of initial returns across IPOs is extremely high in 1998-99. Figure 3 shows the cross-sectional standard deviation of initial returns for each month from 1980-99. It is clear from this graph that

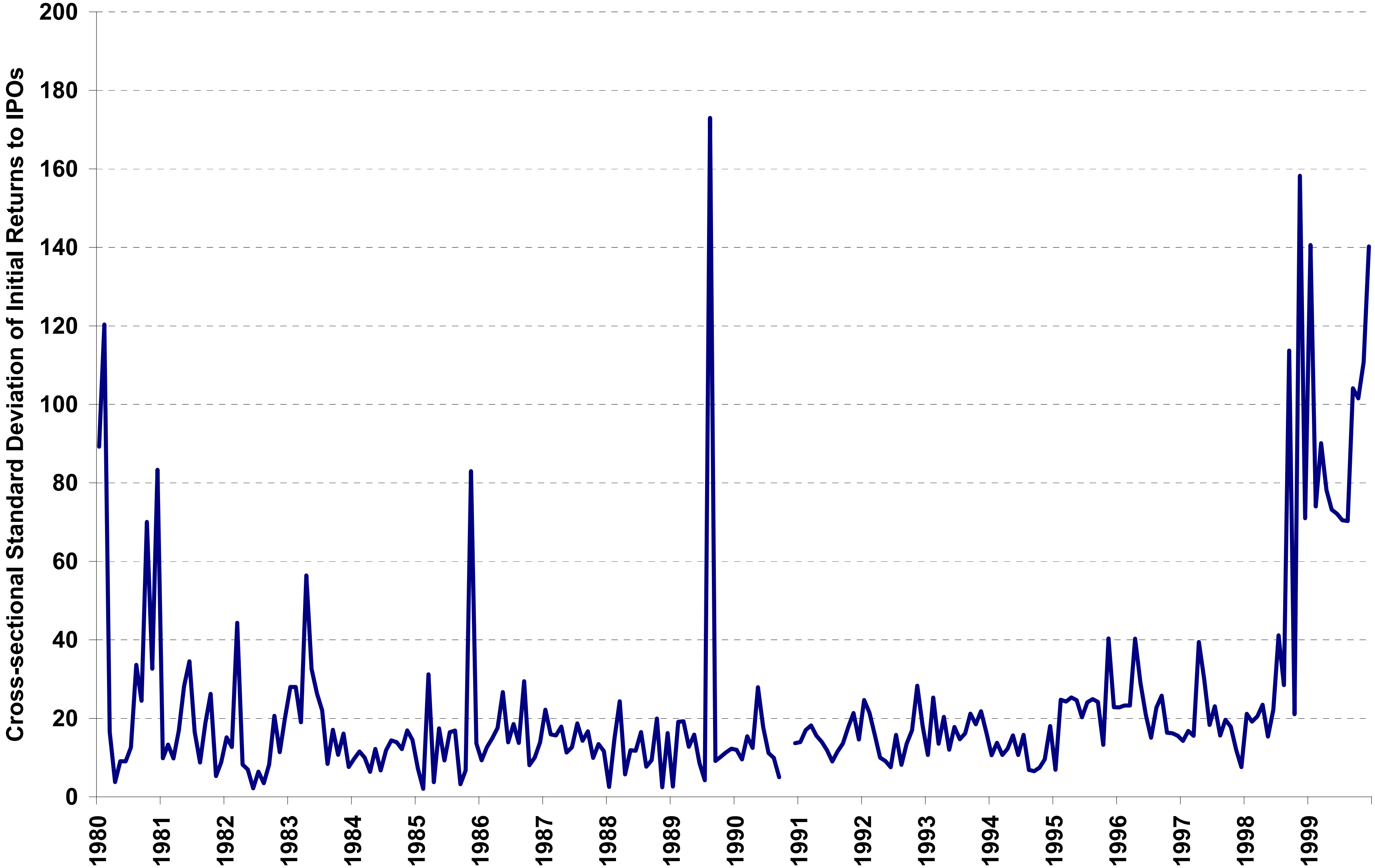


Figure 3. Cross-sectional standard deviation of initial returns to IPOs monthly, 1980-99, using data from SDC and CRSP.

not only were average returns high in 1998-99, but the dispersion of returns was also extraordinary.

The methods in this paper are all based on least squares techniques, so data from 1998-99 dominate the rest of the sample. To correct this problem, we have computed weighted least squares (WLS) Fama-MacBeth bootstrap estimates of the models in Table VII. The yearly cross-sectional regression coefficient estimates are weighted by the estimates of their standard errors. The WLS estimates are quite similar to the results from the 1985-97 sample reported in Table VII.

Thus, when the out-of-sample data from 1998-99 are adjusted to reflect their unusual dispersion and included with the 1985-97 data, our conclusions do not change. We decided not to present the 1985-99 sample results as the focus of this paper because the extra complexity associated with the weighted least squares bootstrap estimates probably distracts from the economic analysis of the problem, and the 1985-97 sample was the basis for the first several drafts of this paper. Nevertheless, researchers who study IPO markets in the future will have to deal with the unusual events of 1998-99 that are reflected in the high average returns shown in Figure 1 and the even larger dispersion of returns shown in Figure 3. Perhaps a variant of our WLS procedure will help prevent these data from dominating the inferences drawn from IPO samples.

VIII. Conclusion

Our results show that the dynamic behavior of initial returns and IPO issues is a complicated function of many factors. There are significant biases in IPO offer prices (as forecasts of secondary market trading prices) that arise from underwriters not fully incorporating all available information when they set offer prices. These biases affect both the serial correlation in initial returns and the lead-lag relation between initial returns and IPO volume.

At first glance, the cycles in initial returns suggest that underwriters fail to account for the market's valuation of recent IPOs in their pricing of new offerings, resulting in avoidable high first-day return 'bubbles'. However, we find that the serial correlation in initial returns is predominantly driven by information learned during the registration periods of recent IPOs but only partially incorporated into the offer price. Although investment bankers do not fully incorporate information learned during the registration period into the offer price, they do seem to fully incorporate the market's valuation of recent IPOs into their pricing of new offerings. 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 achieve lower underpricing by filing IPOs during periods of low versus high average initial returns.

The observation that more companies file IPOs following periods of high underpricing suggests that the initial returns of recent IPOs contain information on the market's valuation of future IPOs. We find that it is information learned during the registration period that is positively related to future IPO volume. The portion of initial returns that reflects firm characteristics is not reliably related to either the number of subsequent filings or the number of subsequent offerings. The portion of initial returns that reflects information provided by the secondary market is similarly unrelated to the number of subsequent filings, but it does appear to be related to the length of the registration period.

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. Investment bankers' learning process throughout this registration period causes monthly aggregate initial returns to be autocorrelated and to be positively related to future levels of IPO activity.

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