IPO Market Cycles:
"Bubbles or Sequential Learning?"

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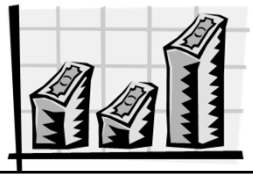


IPO "Hot Issue" Markets

- **Facts:**
  - Dramatic cycles in the number of IPOs & in initial returns to IPO investors
    - AKA "underpricing"
  - Also, autocorrelations in:
    - Length of time in registration ("book-building")
    - Price updates (between initial filing & IPO)

Why Care About IPO "Hot Issue" Markets?

- **Underpricing is an interesting and pervasive phenomenon**
  - To the extent that it is predictable, it seems to imply that firms could manage the amount of underpricing by timing their IPOs
    - Ceteris paribus, lowering underpricing would seem to be desirable
  - Are cycles an indication that investment bankers and firms do not adapt (completely) to market conditions?
    - Why?

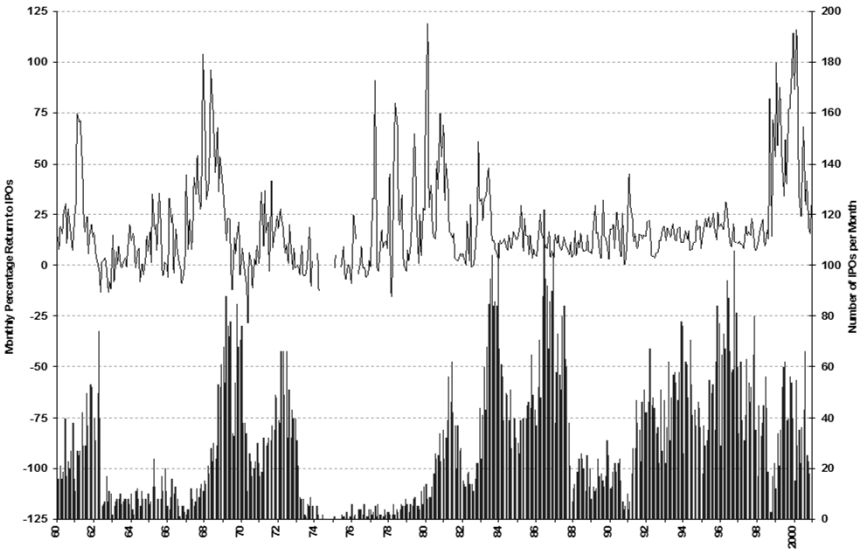


Figure 1. Ibbotson, Sindelar, and Ritter's (1994) monthly data on aggregate US initial public offerings per month ($NIPO^{ISR}$) and average initial returns to IPO investors (IR^{EW}), 1960-2000.

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number of IPOs per month ($NIPO^{SDC}$), the number of offerings filed per month (NFIL), and the number of offerings withdrawn per month (NWD).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

IPO "Hot Issue" Markets

- **<u>Facts:</u> Looks like there are lead-lag relations between returns and IPOs**
  - Seems to imply that underpricing varies in predictable ways
  - IPO returns seem to predict future number of IPOs
  - Number of IPOs seems to predict future IPO returns
    - equal-weighted, but not proceeds- (or value-) weighted

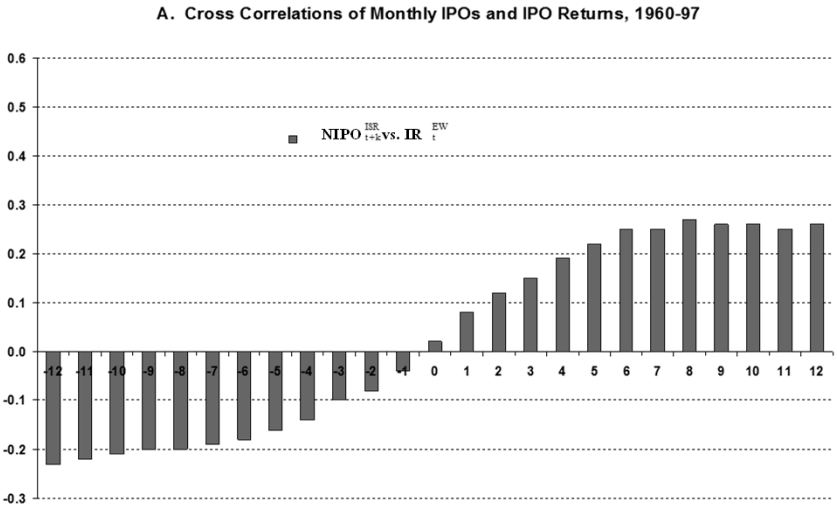
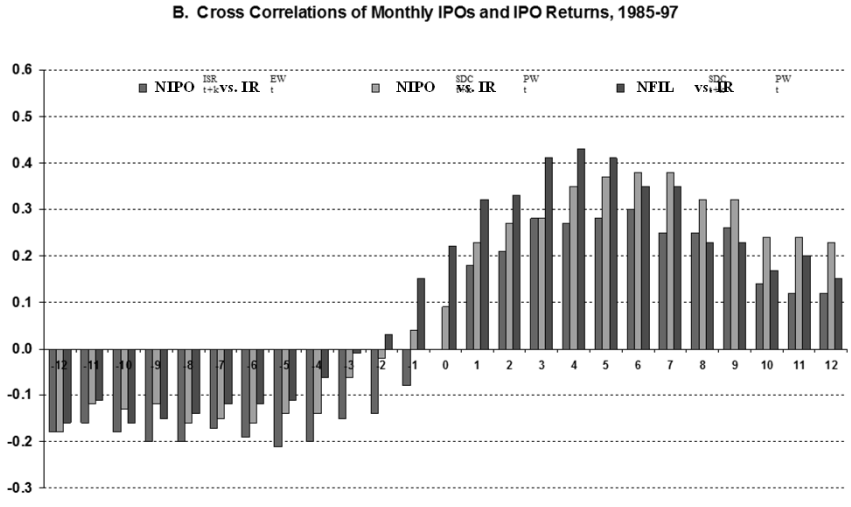


Figure 2. Cross correlations of the number of IPOs in month t+k with the return to IPOs in month t, for k = -12, . . . , 12. The large sample standard error for these correlations is .05 for 1960-98 and .07 for 1981-97.



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VAR(3) Models for Returns & IPOs

- **Taking into account own autocorrelation cleans up inferences about lead-lag relations**
  - Returns predict the future number of IPOs
  - But, not vice versa

Table 2

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. 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	

How Can Firms Adjust the Timing of Their IPO?

- Decision of when to **File**
- After filing, the length of **Time in Registration**
  - Book-building, selling effort
- If bad news happens, can **Withdraw** registration

VAR(3)s for Returns with Filings, Time & Withdrawals

- **The action seems to be with Filings**
  - Time in registration and withdrawals do not seem to be related with returns
  - The relation between withdrawals and future equal-weighted returns seems to go in the "wrong" direction
    - More withdrawals are associated with higher than average initial returns to IPO investors in future months

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 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
(2) Filing predicts Returns	0.92	0.430	0.94	0.420
Sample Size	153			
$REGTIME^{PW}$				
(3) Returns predict Timing	0.58	0.625	3.36	0.018
(4) Timing predicts Returns	0.53	0.661	0.57	0.633
Sample Size	153			
NWD*				
(5) Returns predict Withdrawals	5.02	0.002	4.10	0.006
(6) Withdrawals predict Returns	4.15	0.006	2.05	0.105
Sample Size	119			

Control for Firm- & Deal-level Effects on IPOs

- **Extensive literature on the reasons for underpricing IPOs**
  - Underwriter monopsony power
  - Risk
  - Asymmetric information
    - By underwriters
    - By issuing firm
  - Insurance
    - Avoid subsequent litigation

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. The dependent variable is the percentage initial return. 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. 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 15 trading days before the offering date. 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 3,979 IPOs.

	Information at Time of Registration		Information at Time of Offering	
	(1) Coefficient	(2) t-statistic	(3) Coefficient	(4) t-statistic
Constant	33.657	8.19	28.835	7.27
RANK	-0.034	-0.30	-0.407	-3.78
TA	-1.308	-4.79	-0.996	-3.77
NYSE	0.111	0.07	-2.374	-1.64
NASDAQ	1.056	1.08	-1.668	-1.81
AMEX	-6.580	-4.09	-5.641	-3.59
TECH	4.257	5.40	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)	23.357		21.499	

IPO Returns at the Firm Level

- **At initial registration [col. (1)]:**
  - Larger firms underpriced less
  - Amex firms underpriced less
  - Tech firms underpriced more
  - Note that R^2 is only 3%

IPO Returns at the Firm Level

- **At offering [col. (3)]:**
  - Higher-ranked underwriters underprice less
    - Although this effect is weak
      - Given that cross-sectional standard errors are probably too small => t-stats too big
  - This doesn't show up in col. (1) because high-ranked underwriters low-ball initial filing range
    - Price updates are predictably positive (see other Lowry-Schwert paper)

IPO Returns at the Firm Level

- **At offering [col. (3)]:**
  - Effect of price update is asymmetric
    - When prices rise, relation with IPO return is large and positive (0.865)
      - Benveniste & Schmidt (1989) – share gains from positive information with informed investors
      - => partial adjustment
    - When prices fall, relation with IPO return is small (0.185)
      - Investment bankers and firms avoid overpricing, so adjustment is full

IPO Returns at the Firm Level

- **At offering [col. (3)]:**
  - Given the effect of the price update, there is no additional effect of market returns
    - Different message than Loughran & Ritter (RFS, forthcoming)
    - price updates reflect private and public information
      - market returns just reflect public information
  - Note that R^2 is now 18%

IPO Returns at the Firm Level

- **The reason for considering cross-sectional model in table 4 is to estimate firm- and deal-specific predictable parts of IPO returns**
  - To the extent that there is clustering in the types of firms coming public through time, this may contribute to aggregate correlation patterns

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 in row 2, based on column (1) in table 4, 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 4, uses data known at the time the IPO is offered (including the price update), 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}
Initial Returns (proceeds-weighted average of issued 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 of the IPO, based on information in the preliminary prospectus [column (1), table 4]																	
(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 4]																	
(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

Aggregate IPO Returns Adjusting for Firm and Deal Effects

- Measure expected and unexpected IPO returns at time of registration [rows (2) and (3)]:
  - Expected IPO returns based on firm & underwriter characteristics are highly autocorrelated
    - => part of IPO cycles are due to the types of firms going public
  - Unexpected IPO returns are autocorrelated for about the first 5 lags
    - Remember that the average registration period is 72 days (about 2.5 months)

Aggregate IPO Returns Adjusting for Firm and Deal Effects

- Measure expected and unexpected IPO returns at time of offering [rows (4) and (5)]:
  - Expected IPO returns based on firm & underwriter characteristics and information learned during the registration period are highly autocorrelated
    - Strong autocorrelations at lags 1 and 2 reflect contagion – information about one IPO affects value of other contemporaneous IPOs
  - Unexpected IPO returns are not autocorrelated
    - Private information learned during multi-month book-building process induces autocorrelation in aggregate IPO returns

VAR(3) Models for IPOs and Unexpected IPO Returns

- These tests let us see what type of information affects future IPO values and issuance decisions
  - Using public information at time of registration to measure expected price updates
  - Using public & private information at time of offering to measure expected price updates

Table 7

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 5. The columns labeled "Expected" represent VAR(3) models using the predicted initial return from the cross-sectional regression models in table 4. 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 4. For the IPO returns, two forecasts are studied: first, using public information available at the time the IPO is filed [col. (1) in table 4], and second, using public information available at the time of the IPO [col. (3) 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 [col. (1) in table 4]						
(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 4]						
(3) IR predicts NFIL			7.99	0.00003	1.55	0.199
(4) IR predicts NIPO			4.97	0.002	3.74	0.011

VAR(3) Models for IPOs and Unexpected IPO Returns

- At time of registration [rows (1) and (2)]:
  - It is the unexpected part of initial returns that predicts future filing and issuance decisions by firms
- At time of offering [rows (3) and (4)]:
  - It is the expected part of initial returns that predicts future filing and issuance decisions by firms
- =>Private information learned during registration period is the important predictor of future IPO activity

Conclusions

- Cyclical behavior of IPO market comes from three sources:
  - Overlap in book-building periods and information overlap between IPOs
  - Clustering of similar types of firms having IPOs
  - Partial adjustment of IPO prices to private information produced by book-building

Conclusions

- No evidence the firms/investment bankers ignore available information in setting IPO prices
  - But,
    - Asymmetric reaction of price updates to market returns is puzzling (Loughran-Ritter)
    - Predictable biases in initial filing ranges are puzzling
    - These are results in the other Lowry-Schwert paper