The Indian IPO Market: Empirical Facts

Ajay Shah*

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Abstract

In this paper, we identify some of the stylised empirical regularities about India's IPO market, via a dataset of 2056 IPOs which had trading commence between January 1991 and April 1995.

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*This file is http://www.cmie.ernet.in/~ajayshah/PROSE/ARTICLES/empirical.ps.gz Email address `ajayshah@cmie.ernet.in` Address for correspondence : Centre for Monitoring Indian Economy, 110-120 Kaliandas Udyog Bhavan, Prabhadevi, Bombay 400 025, India.

1 Introduction

From the viewpoint of finance research, IPO underpricing in the sense of abnormal short–run returns on IPOs has been found in nearly every country in the world (Loughran et al., 1994 [LRR94]). This suggests that IPO underpricing may be the outcome of basic problems of information and uncertainty in the IPO process, and is unlikely to be a figment of institutional peculiarities of any one market. Relatively little work has been done so far on IPO underpricing in India (Aggarwal, 1994 [Agg94], Krishnamurthi and Kumar, 1994 [KK94]).[1]

The primary market in India is unique by world standards in many ways – it has been shaped by an unusual history of regulation, the institutional details of how IPOs take place are singular, the sheer size and scope of the primary market is enormous and the large–scale direct participation in the primary market by millions of retail investors is unlike that in any other country in the world. The total resources raised on India's primary market in 1994-95 were 20% of domestic savings (this includes both IPOs and seasoned offerings).

Because the IPO market is so important as a channel for resource allocation, it is important for us to have definitive results on the positive economics of the IPO market, this will be the foundation upon which the companion paper on normative issues [Sha95a] is built. India's IPO market also presents a rare research opportunity in form of a wealth of data. In the US, roughly 350 IPOs take place per year. In contrast, our dataset of 2056 IPOs is composed of all IPOs which took place over a period of just 4.5 years, and the IPO market currently experiences over a thousand IPOs per year. This generates a wealth of data which can help answer empirical questions with high statistical efficiency.

2 Institutional Backdrop

Prior to the recent economic reforms, a government agency named the Controller of Capital Issues (CCI) had regulatory control over all capital issues. Before any public issue could take place, the offer price had to be cleared by the CCI. The "CCI formula" was used to calculate a "fair price" of equity in the light of accounting information. This often led to extreme underpricing, and heavy over–subscription. Investors often applied for ten times as many shares as were put up for sale. This extent of underpricing deterred firms from going public: relatively few issues took place and debt played a major role in financing projects. In our dataset, we have only 86 issues which clearly took place under the old regime, i.e. listings from 1 January 1991 to 1 November 1991.

[1] In his M. Tech. dissertation, Aggarwal studies IPO underpricing in India using a dataset of 194 IPOs over the period April 1992 – September 1993. Krishnamurthi and Kumar analyse IPO underpricing using a sample of 386 IPOs over July 1992 – December 1993.

From October 1991 to May 1992, the BSE was embroiled in a speculative bubble engineered by an illegal diversion of funds from the banking system. This episode is commonly called “the scam”. It had two kinds of consequences for the primary market: issues priced just before the scam often produced enormous returns from issue date to listing date, and issues priced during the scam often produced very poor returns from issue date to listing date.

Shortly after the scam, on 29 May 1992, the CCI was abolished, and firms were free to price equity at whatever price they chose. There was a transitional phase after the abolition of the CCI in which extremely few issues took place. The newly created regulatory agency governing financial markets, the Securities and Exchanges Board of India (SEBI), then took up the role of vetting prospectuses for public offerings with an eye to ensuring truthful information disclosure in the prospectus. SEBI was functional in this role from late 1992 onwards. We can think of new listings from the start of 1993 onwards as being the product of the new regulatory regime.

With the abolition of the CCI, firms were now free to price issues as they pleased, subject to several caveats. The number of public issues taking place per month has gone up sharply in the period following the abolition of the CCI, and the role of debt in financing projects has diminished. However, the post–CCI period is also characterised by extremely high levels of underpricing by world standards. Using our empirical evidence, we may be able to shed some light on the factors underlying this systematic underpricing.

Today, as in the entire post–CCI period, the sequence of events in an IPO are as follows:

- The firm and the merchant banker choose an offer price, and prepare a prospectus. This takes place roughly five months before the issue date.

  The “face value” of shares in India is typically Rs.10, and the difference between the offer price and the face value is called “premium”. By law, IPOs are prohibited from pricing equity with a positive “premium” unless this condition is met: Either the issuing company, or any company promoted by the owners of the issuing company, should have made profits for atleast the most recent three years. For companies which are allowed to price shares above Rs.10 in the light of these criteria, there is no hurdle in choosing the offer price.

  There is also a regulatory control on the amount of equity which can be sold: the post–issue ownership of the promoters should be greater than 25%.

- This prospectus is submitted to SEBI for approval.

  From 1 April 1995 onwards, SEBI no longer requires the offer price to be precisely chosen at the time the prospectus is submitted for vetting. If the company specifies an offer price of x at this time, then the actual offer price can be anything between x and $1.2\,x$. Another constraint on choosing a price early is the Registrar of Companies, which has to be told the offer price 21 days before the issue opens.

- After SEBI approves of the information disclosures in the prospectus, a mass media advertising campaign targeted at the lay investor commences. This is roughly a month before the issue date.

A consortium of underwriters is often put together. Each underwriter guarantees to bring forth application forms (either from lay investors, or failing that, from own funds) worth Rs. x, and is paid a fee which is typically 2.5% of x. The underwriting arrangements were mandatory before January 1995, and are now optional.

- The issue closes four to ten days after it opens. Investors apply for shares, and pay an amount which is often less than the full offer price. If there is over–subscription, then there is a possibility that the money paid at the time of application may be returned some months hence. In this event, the investor has lost the time value of money for these months.

  Many banks offer "stockinvest" schemes which help eliminate this. This allows the investor to create a special kind of savings account. When submitting the application for shares, the investor furnishes information about his stockinvest account. The offering firm only withdraws money from an investors stockinvest account to the tune necessitated by the allotment received by him.

  For issues where the issuer chose to not put together an underwriting consortium, if the subscriptions received fall below 90% of the shares offered, then the issuing company is required to refund all applications within 90 days.

- After the issue closes, the allotment itself takes place. For issues which are highly oversubscribed, many application forms may yield no allotment. For issues which are highly oversubscribed, the allotment process is often delayed owing to the volume of paperwork. Once allotment takes place, the investors receive shares and/or refund cheques.

- The actual listing, and the date of first trading, takes place long after the issue itself opens - the modal listing delay is 11 weeks. We will closely examine this time–lag between issue date and listing date in Section 7.

Many features of this process are unique by world standards. The offer price is chosen by the firm months before the issue opens, and there is no feedback mechanism through which market demand can alter this offer price. Instead of IPOs being sold to institutional investors such as mutual funds, in India, IPOs are directly sold to relatively uninformed lay investors. The delay from issue date to listing date is enormous in India as compared with other countries. Each of these three factors is likely to generate high underpricing, by world standards.

3 Factors underlying Underpricing

In this section, we will take a conceptual look at the sources of underpricing, so as to define the theoretical backdrop for the empirical results. Underpricing is not a violation of no–arbitrage; it is not a market inefficiency which will vanish when some agents become aware of it. Instead, underpricing is structural; i.e. it derives from sound microeconomics underlying the behaviour of investors and firms.

Further, there is no simple monocausal explanation for underpricing. There appear to be six major themes causing underpricing which may be relevant in India. We will examine these issues in this section. A simple theoretical framework which integrates all these factors does not yet exist. The six factors are also not additive: for example, the “building loyal shareholders” factor may well generate no additional underpricing if the firm feels that the degree of underpricing caused by asymmetric information is adequate for the purpose.

3.1 Asymmetric Information

The most basic problem of the IPO process is the presence of both “good” and “bad” firms going public, coupled with asymmetric information between firms and investors. Firms know themselves reasonably well, but investors do not. When information and analysis is costly, it is optimal for investors to not learn about a firm thoroughly. This is true of IPOs all over the world, and is likely to particularly relevant in India, where IPOs are marketed to lay investors who know extremely little about the issuing firm.

George Akerlof’s model of the used-car market is an excellent analogy here. The seller of the car knows its true worth, but the buyer will not know the blemishes, and it is not optimal for the buyer to research each potential used-car thoroughly. Thus, at equilibrium, the presence of bad used-cars or “lemons” implies that good used-cars have to be underpriced. In the case of the IPO market, at equilibrium, good firms will have to underprice themselves to compensate investors for the risk taken in investing in a relatively unknown firm. Bad firms will command higher prices (under uncertainty about firm quality) as compared with their true value. Thus, under asymmetric information, the primary market is the conduit for a systematic subsidy from good firms to poor firms.

While such situations occur in diverse areas of economics, they are particularly important in IPOs as the value of firms going public is often in the growth opportunities which the firm may hope to capture, rather than in fixed assets and a clear track record. The greatest strength of an IPO is often likely to be in the ideas and creativity of the promoters, and not the fixed assets of the firm (which are relatively easily measurable and quantifiable).

Firms would resort to numerous signalling strategies to try to communicate their true value to investors. We will not examine these strategies here; for our purposes it suffices to observe that to the extent that this basic informational asymmetry exists, firms going public would have to underprice themselves.

In a classic article, Rock, 1986 [Roc86] explores the role of the “winner’s curse” in IPO underpricing. Rock’s model has two kinds of investors: those who are perfectly informed about the true value of the firm and those who are completely uninformed about the true value of the firm. The number of shares being sold at an issue is fixed, and informed investors will only attempt to buy shares when an issue is relatively underpriced. Hence uninformed investors, who do not know whether a given issue is underpriced or not, suffer from a winner’s curse: they get all the shares they want of the poor issues, and they get small allocations of the good issues. This sort of phenomenon is obviously at work in India. In Rock's model, this adverse selection will force firms to underprice themselves at equilibrium to remain attractive to uninformed investors.

3.2 Fixing the Offer Price Early

The firm sets the offer price at time 0, and the issue opens at time T. Let us imagine that there is a "shadow stock price" (which is not known to the world, since listing has not yet taken place). Nevertheless, this notional market–clearing stock price fluctuates from day to day, and even if the firm has an exact idea of the price at time 0, it would be afraid of a drop in stock prices by date T which renders the public issue unattractive. A famous example of such risk is the (seasoned) offering of British Petroleum, which was priced just before the NYSE crash of 19 October 1987.

Firms are likely to be risk–averse with respect to the prospect of issues failing. Hence they would underprice in order to forestall this possibility. The delay between choosing an offer price and the issue date has diminished in some sense with the new SEBI policy which allows firms to choose a price band at the time of vetting the prospectus instead of a precise price. However, the Registrar of Companies still requires a precise offer price 21 days before the issue opens, and the price band which SEBI tolerates is quite narrow. Hence the IPO market is still characterised by an early choice of offer price.

Under the standard model of stock prices, i.e. the geometric brownian motion model, uncertainty about the future stock price blows up at the rate $\sqrt{T}$ as the delay T increases, so the degree of underpricing will worsen as T increases.

This picture is consistent with a collation of the international evidence on IPO underpricing, taken from Chowdhry and Sherman, 1994 [CS94] (who, in turn, cite Loughran et al., 1994 [LRR94] as the original source).

Table 1 IPO Underpricing: International Evidence

Elapsed Time	Discretionary Allocation Underpricing	Country	Non-Discretionary Allocation Underpricing	Country
0 days	16%	Chile		
1 day	12%	US (FC)	4%	France
			4%	Netherlands (tender)
			29%	Portugal (auctions)
			2%	UK (offer by tender)
2 days	8%	Belgium	11%	Belgium (tender)
5 days	15%	UK (placing)		
10 days	9%	Canada		
2 weeks	11%	Germany	11%	UK (offer for sale)
	15%	Japan, post 1/4/89		
	42%	Japan, pre 1/4/89		
1 month	12%	Australia	18%	Hong Kong
	78%	Brazil	27%	Singapore
	60%	Korea, post 6/88	45%	Taiwan
	36%	Switzerland		
2 months	36%	Sweden	135%	Portugal
	42%	US (best efforts)	58%	Thailand
3 months	55%	Finland	12%	Finland
	28%	Italy		

The delay between date of setting offer price and the listing date clearly seems to be an important factor here. However, this table serves to remind us that IPO underpricing resists simple explanations; for example, something happened in Japan on 1/4/1989 which dropped the extent of underpricing from 42% to 15% (we will return to this particular episode in the companion paper on policy issues [Sha95a]). Similarly, the differences in contractual arrangements makes a difference of 43 percentage points in Finland for the identical three month delay. Clearly, there is much unexplained variance in the magnitude of underpricing after accounting for the elapsed time.

3.3 The Interest Rate Float

The issuing company controls the application money for a few months. Even if stockinvest were widely used, the interest rate on stockinvest accounts of around 12% is quite low. At equilibrium, markets would compensate investors for this low (zero or 12%) rate of return, through underpricing.

A back–of–the–envelope calculation will help illustrate the magnitudes involved. Suppose an issue of size x appears, where half the offer price is paid at the time of application, suppose it is over-subscribed three times, and suppose the issuing company controls this application money for three months. Using a nominal interest rate like 18%, the interest earned by the issuing company is around 7% of the issue size. Thus the interest rate float argument may account for underpricing of around five to ten percentage points.

3.4 The Liquidity Premium

Investors who apply for public issues lose liquidity on the amount paid at issue date. At equilibrium, markets would compensate them for this by paying a liquidity premium, which would show up in IPO underpricing.

The existence of such a premium follows inexorably from finance theory. It is difficult to empirically test whether it is indeed at work in IPO underpricing in India, and to quantify its role. This is especially true in the light of the ex–ante unpredictability of the delays from issue date to listing date.

3.5 Building Loyal Shareholders

Firms may have an incentive to underprice when they expect to return to the capital market to raise further resources at a later date, via a rights issue or a public issue. In this case, it helps the firm to leave purchasers at the IPO underpricing with "a good taste in the mouth".

3.6 Merchant Banker Rewarding Favoured Clients

The interaction between the merchant banker and the company going public is typically a one–shot interaction, but the merchant banker is in a repeated game with many of his large clients, especially the large institutional investors. In this situation, the merchant banker has an incentive to underprice as a way of favouring his established clients (Baron, 1982) [Bar82].

While this would hurt the interests of the issuing company, this may frequently not affect the profit maximisation of the merchant banker directly. This is especially true in a situation where summary statistics of the degree of IPO underpricing for each lead manager are not readily available to firms going public.

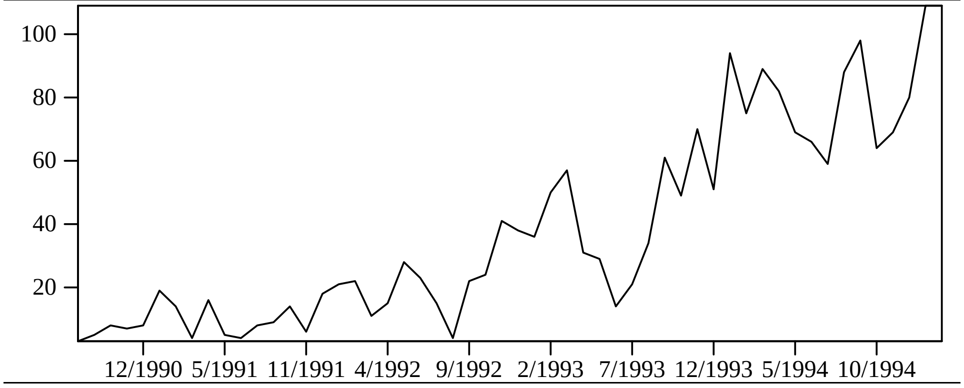
While the microeconomics underlying this idea is impeccable, its empirical significance may be limited. In the US, this proposition has been tested by measuring the extent of underpricing observed when underwriters themselves go public (Muscarella and Vetsuypens, 1989 [MV89]). This has found to not be seriously different from the overall average underpricing.

In the remainder of this paper, our objective is to establish the stylised empirical regularities about India's IPO market. We will start by establishing basic time-series properties of the number and value of IPOs per month, and of aggregate underpricing. We then turn to exploring the determinants of listing delay. These subproblems set the stage for problem of modelling the cross-sectional variation of underpricing. Beyond the first trading day, on which underpricing is measured, we take up the questions of returns and trading frequency after listing date. The paper ends with a summary of the results and suggestions for further research.

4 Aggregate volume of issues

Our sample is built of all new listings on the BSE from 1 January 1991 to 15 May 1995. We would like to know the time-series properties of the number of issues per month, but our picture is likely to be clouded by "edge effects": of the issues which took place in 1990, we are more likely to observe the issues which experienced greater delays from issue date to listing date, and of the issues which took place in the recent past, we are more likely to observe the issues which were listed relatively swiftly. This leads us to the following graph, where the x-axis represents the issue date.

Figure 1 Time-series of Number of IPOs per month



This shows a dramatic increase in the number of IPOs per month, from the region of 20 a month before the abolition of the CCI in May 1992 , to the region of 80 a month from late 1993 onwards. The picture obtained via the *value* of IPOs per month, in millions of rupees, is similar.

Figure 2 Time-series of Value of IPOs per month (log scale)

One strong factor clearly at work in this time series is the sheer time trend. The regression shown below suggests a compound growth rate of 5.86% *per month* over this period. The average inflation rate over this period was in the region of 9% per annum.

Beyond the time trend, we would expect the value of IPOs in a month to respond to secondary market fluctuations, so that more resources are raised from IPOs when returns on the market index have been good. We find that the following model is good at capturing some of the time-variation of the value of IPOs per month (t stats are shown in brackets).

Table 2 Model explaining value of IPOs in a month (in logs)

	M1
Time	0.05864
	(8.016)
$r_2 + r_3 + r_4$	0.00884
	(1.900)
Intercept	5.93228
	(24.15)
N	49
R^2	0.593
σ	0.734
DW	2.0206

Let us represent monthly returns on the market index as r, and let us use the notation r_1 for the returns of the previous month, r_2 for the returns of two months before, etc. The explanatory variable used in the regression is $r_2 + r_3 + r_4$. There is a little lag structure here, in the sense that the coefficients of the unrestricted model in r_2, r_3 and r_4 (not shown here) are not all equal, but we ignore this in the interests of parsimony.

This model implies that the value of IPOs in May is influenced by stock market returns from 1 January to 31 March. Our estimation results suggest that while this effect is somewhat weak statistically, it is significant numerically. For example, if returns prove over these three months prove to be 10%, then it has an impact in logs of 0.0884, i.e. IPOs worth 9.2% more than would otherwise have been the case.

The timelags seen here are quite short – this may suggest that firms do not strongly *plan* IPOs in response to fluctuations in the market index. There is always a pool of companies who have obtained SEBI approval, and their precise choice of the issue date is influenced by stock market returns of the immediate past. Stock market returns may also affect the very IPO planning process via longer lags, but our sample runs over too short a period to identify this with statistical precision.

Could variations in ex-ante volatility of the BSE Sensex influence the decision to launch an IPO? Thomas, 1995 [Tho95] finds that while the volatility of the BSE Sensex is autoregressive, the forecastability of volatility is most pronounced in daily and weekly returns – after controlling for regime shifts and budget-related seasonality, monthly returns are essentially homoscedastic. Hence the time–series of the aggregate value of IPOs in a given month may be affected by the seasonality. Our dataset does not permit examination of this problem.

5 Aggregate underpricing

We now turn to IPO underpricing. Of the 2056 IPOs that we observe, 1819 gave positive returns from issue date to listing date. The percentage returns from issue date to listing date have the following properties:

Table 3 Summary statistics about underpricing (%)

	Min.	Max.	Mean	Std. Devn
Full Dataset (N=2056)				
Equally Weighted	-60	3400	105.6	200.8
Issue-size Weighted			113.7	218.6
2% trimmed (N=1974)				
Equally Weighted	-30	650	87.6	105.7
Issue-size Weighted			96.3	120.3

The full dataset exhibits mean underpricing of 105.6%, and if issues are weighted by issue size, the mean underpricing comes to 113.7%. To limit our sensitivity to extreme observations, we trim the highest 2% and lowest 2% of observations and recalculate these measures using the middle 1974 observations: this gives us a halving of the standard deviations, and an average underpricing of 87.6%, or 96.3% using weights proportional to issue size

These summary statistics are, however, of relatively limited value because of the long and variable lags from issue date to listing date. Slightly under half the issues have a listing delay between 10 and 13 weeks, and the remainder have listing delays worse than 13 weeks. This suggests that the IPO underpricing, calculated as the sheer returns seen between offer price and listing price, is influenced by heterogenous listing delays, over periods when the market index has been performing very differently. This simple averaging ignores the value of time, and fluctuations in the market index, and is hence not a good way to measure IPO underpricing.

We will hence depart from the literature in expressing underpricing as *returns per week*. We will additionally express this in excess returns form, i.e. *returns per week on the IPO in excess of returns (per week) on the market index*, where returns on the market index are calculated between issue date and listing date. This gives us the following summary statistics:

Table 4 Summary statistics about underpricing, all **weekly** (%)

	Min.	Max.	Mean	Std. Devn
Full Dataset (N=2056)				
Equally Weighted				
Raw returns	-10.97	68.88	3.986	4.552
Excess returns	-10.81	69.07	3.803	4.591
Issue-size Weighted				
Raw returns			4.020	4.299
Excess returns			4.079	4.194
2% trimmed (N=1974)				
Equally Weighted				
Raw returns	-1.91	16.45	3.763	3.510
Excess returns	-3.88	16.85	3.583	3.599
Issue-size Weighted				
Raw returns			3.815	3.620
Excess returns			3.883	3.545

Both the above tables show a extremely high degree of underpricing by world standards. This fact comes across in all the different methods of calculation shown here. The simplest summary statistic that we can take away from this is: on average, IPOs yield an enormous 3.8% per week in excess of returns on the market index (which yields 0.45% per week on average). This measure of IPO underpricing, of 3.8% per week in excess of r_M, has good strong statistical precision: the 95% confidence interval ranges from 3.6% to 4%.

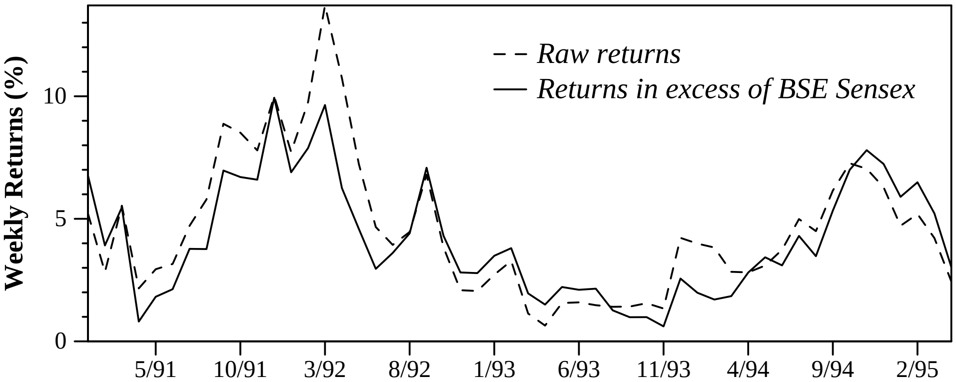
6 Time-series of aggregate underpricing

In this section, we will focus on the average underpricing (measured in returns per week in excess of returns on the market index), calculated over new listings of each month, which allows us to measure average underpricing seen in new listings of the month without being confounded either by the varying listing delays or by fluctuations of the market index.

Is this average underpricing the returns to a naive strategy of investing Rs.1 in every single IPO that appears? In Section 3.1 above, we had touched upon Rock's model of underpricing, where uninformed investors get less shares in the good IPOs and more shares in the bad IPOs. By this reasoning, the average underpricing *overestimates* the returns obtained by uninformed strategies such as investing in IPOs at random, or investing equally in every IPO.

The following graph shows the simple average of underpricing of all new listings of a given month.

Figure 3 Time-series of IPO underpricing in a month



Similar graphs for other countries often show some months in which the raw returns on IPOs are negative. In the period under examination here, this has never happened. If we use the modal listing delay of 11 weeks, then the least underpricing seen in this graph, i.e. around 2% per week, translates to returns of 25% from issue date to listing date. In the recent past, there have been many months with average weekly underpricing of around 5%, this translates to 71% over 11 weeks.

One strong feature of this graph is that *underpricing* has systematic variation over time, i.e. that the unpredictable fluctuations of the market index between issue date and listing date alone do not explain the month-to-month variation in raw returns – if anything, the major feature of this graph is the slow variation of average returns in excess of returns on the BSE Sensex, and the raw returns fluctuates around this basic pattern. It is hence useful for us to study factors underlying this time-variation in the returns on IPOs in excess of returns on the market index.

We will now show time-series regressions which explain the mean underpricing in a given month. As is the case in the previous section, the notation r_1 refers to returns on the BSE Sensex in the previous month. t-statistics are shown in brackets.

Table 5 Models explaining mean underpricing in a month

Coefficient	M2	M3
Intercept	3.21799	3.21280
	(10.75)	(11.09)
Scam	3.33893	3.29938
	(4.504)	(4.618)
r_5	0.03595	
	(1.499)	
r_6	0.03057	
	(1.255)	
r_7	0.03739	
	(1.565)	
r_8	0.02087	
	(0.869)	
$r_5 + r_6 + r_7 + r_8$		0.03185
		(3.044)
T	49	49
R^2	0.4723	0.4688
σ	1.8405	1.7853
DW	0.6693	0.6764

Here, model M2 is an unrestricted model. It finds that monthly returns on the BSE Sensex affect aggregate underpricing with lags of five, six, seven and eight months. The scam period (1 Nov 1991 to 29 May 1992) appears to be structurally different in having substantially higher underpricing.

Model M3, which imposes the restriction that all four lagged-returns must have the same slope, this proves to be a parsimonious model which seems to be a good description of the data. Thus stock market returns from 1 January to 30 April affect the mean underpricing of the new listings of September.

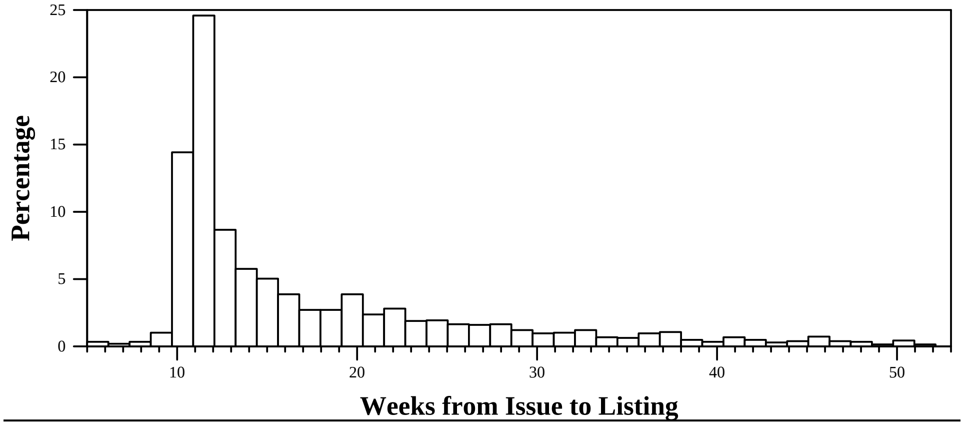
One result is clear from both these models, and from every specification which was estimated but not shown here: the effect of lagged returns on aggregate underpricing is *positive*. This contradicts the simplistic view "when the stock market is doing well, IPOs take place at higher offer prices, thus generating *reduced* underpricing a few months hence".

Instead, this evidence may be consistent with the following behaviour. Let us think in terms of "good" firms and "bad" firms, both of which are making choices about the timing and pricing about their IPOs. When stock markets are doing well, more bad firms may take the plunge as compared with times when stock markets are faring poorly. Because investors cannot distinguish good firms from bad firms, on average, they would have to be compensated for the increased risk of investing in a bad firm by higher returns, on average. Hence underpricing proves to be *worse* when stock market returns have been high.

7 Listing Delay

The delay from issue date to listing date is suppposed to be no worse than 70 days according to rules of the stock exchanges. In practise, it is long and variable. Slightly under half the issues are listed between 10 to 13 weeks from issue date, and we will think of 11 weeks as being representative of the listing delay most commonly experienced. A histogram of the listing delay is exhibited here.

Figure 4 Distribution of listing delay



Listing delay affects IPO underpricing, because to the extent that the issuing firm earns the interest rate float on the application money, and to the extent that investors lose liquidity on their application money, they must be compensated for it by enhanced underpricing. It is important for us to know the factors that explain the listing delay. Are smaller issues more delayed, or are larger issues more delayed? This would affect the cross-sectional distribution of IPO underpricing. Another relevant question concerns how listing delay has changed over time. Advances in information technology, and tighter enforcement by SEBI in the last two years, would be expected to diminish the listing delay.

Our ability to answer these questions is clouded by a sample selection problem : of the recent issues, we only observe those issues which listed relatively quickly. This will bias us towards thinking that the listing delay has reduced of late.

We will deal with this problem using a censored regression. We augment our dataset of 2056 IPOs which have already listed with data for 428 IPOs which have not yet been listed – for each of these 428 IPOs, the number of days which have elapsed since issue date constitutes a lower bound on the listing delay. Our dataset for studying listing delay is thus composed of 2494 observations in all.

Let X be a K–vector of regressors which explain listing delay. Suppose D is the listing delay, which is either observed exactly or with censoring, then the likelihood of one observation is:

$$L = \frac{1}{\sigma}\phi(\frac{D - \beta' X}{\sigma})$$

for issues where D is known exactly, and

$$L = 1 - \Phi(\frac{D - \beta' X}{\sigma})$$

for issues where D is a lower bound on the listing delay. Here, $\phi(t)$ is the probability density of the standard normal distribution $N(0,1)$, and $\Phi(x) = \int_{-\infty}^{x} \phi(t)\, dt$. We will estimate the parameter vector $[\beta, \sigma]'$ via maximum likelihood estimation.

We show the estimation results for two alternative specifications. The numbers in brackets are t-statistics, where standard errors have been calculated using White's method [Whi82].

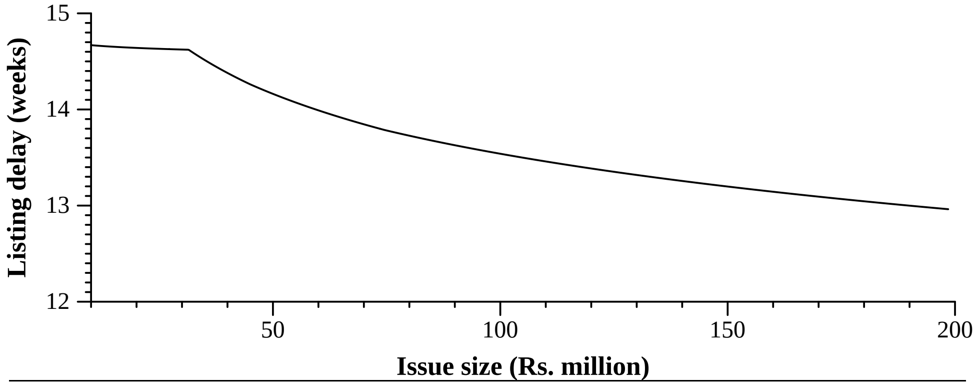
Table 6 Models explaining listing delay

	M4	M5
Intercept	37.15575	19.8597
	(26.727)	(13.399)
Log issue size	-0.76019	
	(-4.492)	
LIS Q1		-0.0415
		(-0.109)
LIS Q2		-1.0054
		(-0.566)
LIS Q3		-0.9412
		(-0.684)
LIS Q4		-0.8413
		(-2.615)
Time	-3.61462	
	(19.288)	
d91		-0.9089
		(-0.511)
d92		8.51034
		(4.854)
d93		4.93505
		(2.917)
d94		-5.7003
		(-3.499)
d95		-4.6794
		(-2.880)
Log sigma	2.05605	1.93393
	(87.380)	(75.8404)
T	2493	2493
LogL	-7316.29	-7038.11

Model M4 here is a simple model, a censored regression using log issue size and time (measured in years since 1/1/1990) as explanatory variables. It tells us that issue size is strongly significant, with larger issues have smaller listing delays, and that the listing delay has improved by roughly 3.5 weeks per year ever since 1/1/1990 on average.

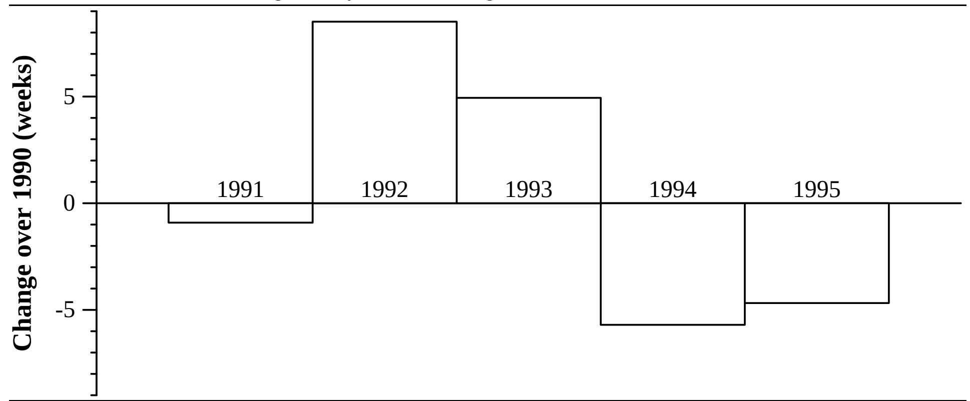
We get a more disaggregated answer to both these questions using Model M5, which expands log issue size into quartile splines, and which replaces the time explanatory variable by five year dummies (issue dates in 1990 are the omitted category). The log likelihood improves by 278.18 in going from M4 to M5, at the price of 8 additional free parameters, and $\log \sigma$ drops from 2.06 to 1.93.

Figure 5 How issue size affects expected listing delay



In model M5, issue size steadily reduces the listing delay from an issue size of Rs.30 million onwards. The statistical precision of this decline is the best for top quartile issues (these have issue size above Rs.71.5 million). To the extent that listing delays affect underpricing, we would expect reduced underpricing by the largest issues, because they seem to be able to get listed in the shortest time.

Figure 6 How listing delay has changed over time



The behaviour of listing delay over time also has interesting patterns - there was no difference in the delays of issues in 1991 as compared with 1990, the issues of 1992 and 1993 were 8.5 weeks and 5 weeks worse, respectively, than the issues of 1990, and the issues of 1994 and 1995 are around five weeks better than the issues of 1990. There was a clear improvement from 1992 till 1994, but the issues of 1995 have roughly the same listing delay as those of 1994.

8 Cross-sectional variation in underpricing

In this section, we will try to describe the broad regularities of IPO underpricing. We will write models which explain the weekly returns on IPOs in excess of returns on the market index. To avoid problems caused by influential observations, we will trim off the highest and lowest 2% observations, reducing our dataset from 2056 to 2015 observations. In this process, the sample standard deviation of our measure of underpricing drops from 4.6 to 3.8. t-statistics are shown in brackets.

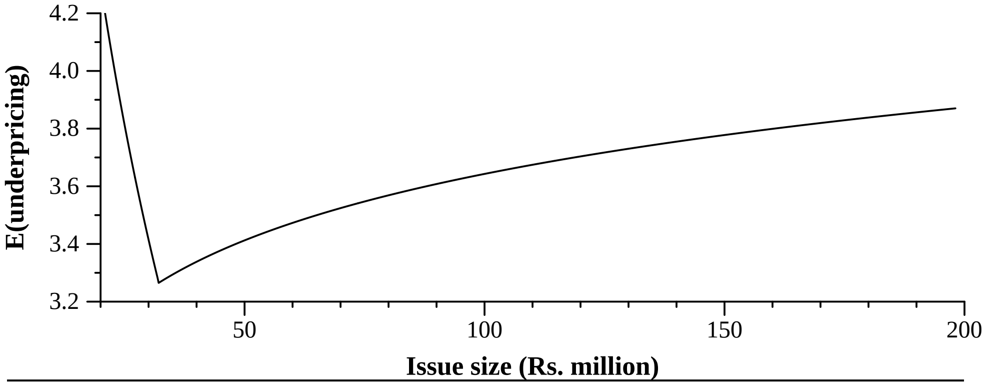
Table 7 Model of cross-sectional variation in underpricing

	M6	M7
Intercept	-4.13850	8.33632
	(-2.22541)	(2.43316)
Inscam	0.93953	0.91154
	(2.76141)	(2.69046)
$r_5 + r_6 + r_7 + r_8$	2.00400	2.01877
	(4.80164)	(4.85824)
Log Isize	0.06877	
	(0.606471)	
Lis Q1		-2.18361
		(-4.09994)
Lis Q234		0.33256
		(2.59213)
Premium>0	-1.50819	-1.22086
	(-2.89139)	(-2.33189)
Log premium	0.50008	0.39858
	(2.85795)	(2.26748)
Isize/Projout	-1.66764	-1.37407
	(-6.00368)	(-4.82555)
T	2010	2010
R^2	0.04520	0.05400
σ_ϵ	3.76090	3.74440

The Inscam dummy variable is true for all IPOs affected in any way by the scam period (i.e. new listings between 11/1991 and 12/1992). Lagged returns on the market index influence inter-company differences in underpricing just as we had seen earlier, in our analysis of the variation of aggregate underpricing over time.

Model M6 differs from M7 on the handling of issue size. Model M6 uses log issue size as an explanatory variable, and finds thar larger issues suffer somewhat more underpricing, however this relationship actually contains a strong nonlinearity, which is expressed in Model M7.

Figure 7 How E(underpricing) changes with issue size



Here, we use a linear spline which differentiates the response to size of companies in the bottom quartile (i.e. issue size below Rs.32 million) by issue size as compared with companies in the higher three quartiles. This shows that underpricing drops sharply with size in the bottom quartile, and slowly rises beyond that. This is in contrast with IPO underpricing in many other countries, where underpricing is found to mainly be associated with the smallest companies – our results show strong underpricing amongst the largest of issues as well.

In India, a great deal of attention is paid to the "premium" implicit in the offer price, i.e. the difference between the offer price and the face value. We model the relationship of underpricing to offer price using a dummy variable which is true if the offer price is above face value, and a log premium explanatory variable which is forced to 0 for issues where the offer price is the face value. We find that underpricing drops sharply for issues which have a premium, and rises beyond with increases in the log premium.

Finally, the ratio of issue size to project outlay appears to diminish underpricing. For issues where the objective was financing of working capital, the value of this variable was set to 0.

While many of the above inferences are quite robust statistically, this model is able to explain very little of the cross-sectional variation of IPO underpricing. The R^2 of M7 is only 5.4%.

9 Post-listing performance

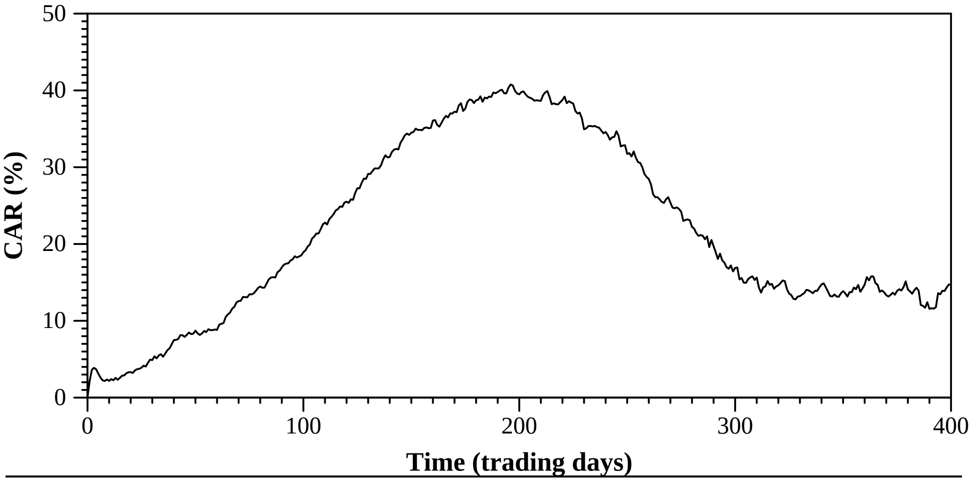
Our exploration of post-listing performance will focus on the returns obtained by a portfolio strategy of buying Rs.100 of every IPO on the first day that it gets traded, and financing this by shorting the BSE Sensex.

On the subject of the returns to the IPO process itself, we had focussed on the portfolio strategy of investing Rs.100 into every single issue. Those results *overestimate* the actual returns obtained from IPOs, becase this strategy is not implementable in practise – *applying* for Rs.100 in every issue that takes place would win better allotment in the low-underpricing issues and less allotment in the high-underpricing issues. In contrast, when it comes to post-listing performance, it is genuinely feasible to invest Rs.100 into every single security on the first day that it gets listed.

Measuring the returns to this portfolio strategy is equivalent to doing an event study using market adjustment, i.e. $\epsilon_j = r_j - r_M$. To correctly calculate the returns to this strategy, we impute $r_j = 1$ (i.e. 0% profit) for days when company j was not traded.

This approach to the measurement of the long-run performance of Indian IPOs has one serious weakness: the BSE Sensex is a poor benchmark for this purpose. Most IPOs are low market capitalisation companies upon listing, so that if we could use a broader market index, it would show better returns by harnessing smaller companies, and that would also make post-listing returns of IPOs look somewhat worse as compared to our results ahead. A fuller understanding of post-listing performance hence awaits the creation of a good market index.

Figure 8 Post-listing returns



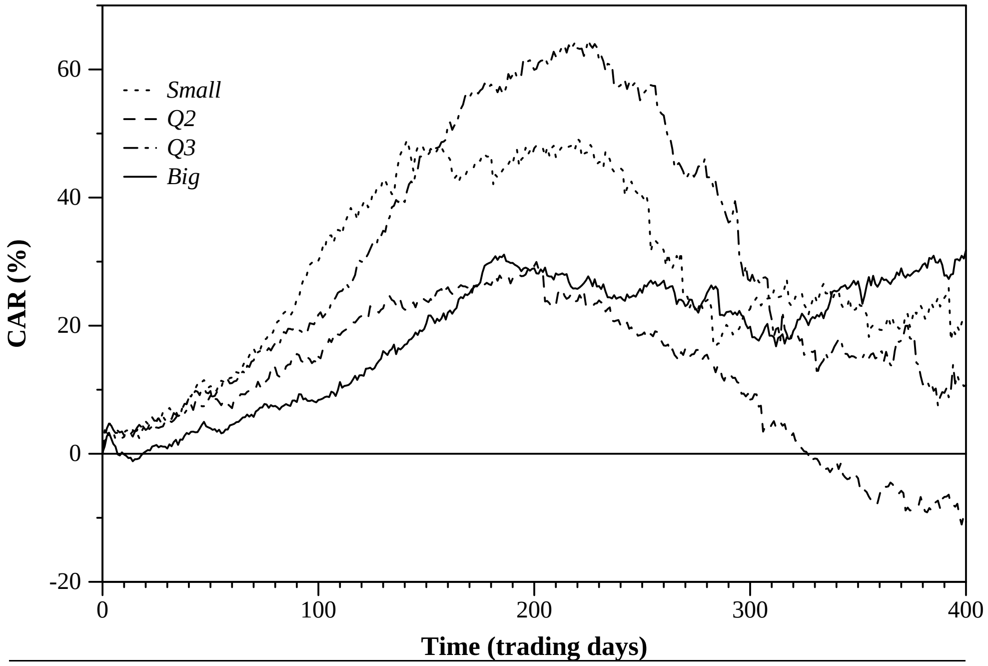
Our event study shown here runs for 400 trading days, this amounts to roughly 1.7 calendar years. The number of observations available steadily shrinks, from 2056 IPOs used to calculate returns on date 1 to 459 IPOs on date 400 – the early dates have much more statistical efficiency as compared with the later dates, which have fewer observations. This explains how the CAR time-series is smoother in the begininning and more volatile towards the end.

There appear to be massive returns on IPOs in excess of returns on the BSE Sensex from date 0 to 200 (i.e. roughly for the first year), which are reversed in the following six months. Promoters of IPOs are often accused of price manipulation in the early days after listing, these abnormal returns may well be a manifestation of that. After this mispricing is eliminated by date 300, returns on the set of IPOs seem to be comparable to returns on the BSE Sensex.

These results have one remarkable implication: that the market price at the close of the very first day of trading is an approximately unbiased estimator of the market price of 400 trading days hence, net of fluctuations of the market index, in the sense that *on average*, the returns from date 0 to date 400 on IPOs are close to returns on the BSE Sensex. Because the BSE Sensex underestimates the returns on the market, and because our sample is relatively weak towards date 400, it appears reasonable to say that by date 400, the average IPOs has essentially performed just as well as the market index.

If this abnormal rise and fall in the first 1.5 years after listing is a market inefficiency brought about by price manipulation, then it will not persist into the future as agents learn about it and arbitrage strategies are put into place (see, for example, the experience with mispricing prior to GDR issues [Sha95b]). We can gain a little more insight into this phenomenon by calculating the CAR for quartiles by issue size.

Figure 9 Post-listing returns by issue-size quartiles



Of the four sets of 514 companies each, only the smallest companies finish on day 400 around behind the market index. The abnormal initial returns are extremely pronounced for the third quartile by issue size, i.e. IPOs with issue size between Rs.45 million and Rs.75 million. The price manipulation explanation is least applicable for the biggest companies – even though they earn around 30% more on average as compared with the marrket index in the first year or so, these excess returns are not reversed thereafter. This is consistent with the price manipulation explanation for the other quartiles, in the sense that price manipulation is likely to be the most difficult for the biggest companies.

These results are quite different from results for other countries. For example, in the US [Rit91], the early excess returns last for around two months, and IPOs steadily underperform the market index for the following three years . Our evidence appears to be different: on date 400, IPOs are 13.7% ahead of the BSE Sensex.

9.1 Price Discovery

In the ideal efficient market, prices would converge to the correct levels at the very first day of trading, and fluctuate in response to the flow of news thereafter. However, price discovery in the real world may be slower than this. It may take several days for agents to learn the correct price for a given company, which would mean that mispriced assets are present in the early days after listing.

For a given date t in event time, let us focus on

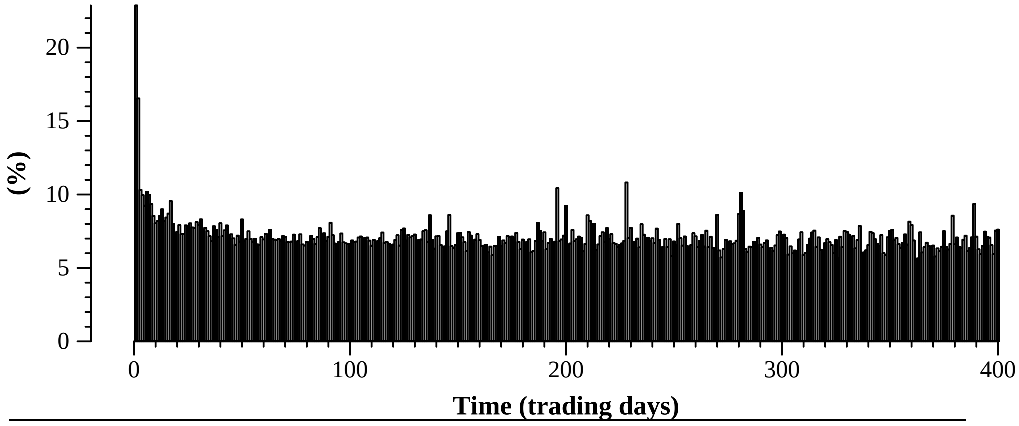
$$\mathrm{RMS}_t = \sqrt{E[(r_{jt} - r_{Mt})^2]}$$

RMS_t is a measure of the price change on date t in event time. It averages the abnormal price changes across all IPOs on day t after listing. If t is high, and price discovery is mostly completed, then RMS_t will only reflect fluctuations in response to news – our data will give us an idea about the kinds of values that this can take. However, when t is small, if price discovery is not complete, then it will generate excess variance in the price changes. This gives us a way to quantify how price discovery unfolds in time.

The standard deviation of price changes is vulnerable to outliers, and for companies which are infrequently traded, daily returns take large values. To avoid being confounded by these companies, we will calculate RMS_t using only 1431 companies which meet the criterion of having had a post-listing trading frequency above 70%. Once again, there are initially the full 1431 companies, but the sample tapers off in time, and at $t = 400$, we have only 353 companies.

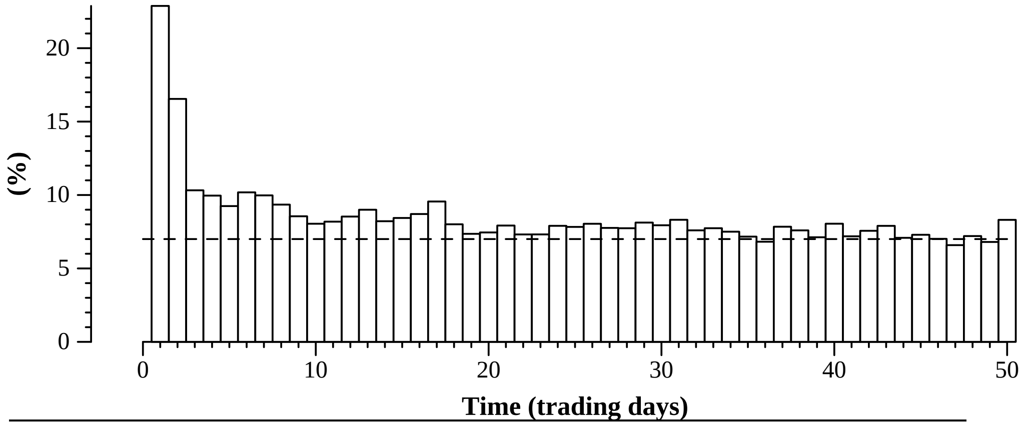
We will start by examining RMS_t calculated over the full 400 days. The early dates have much more statistical efficiency as compared with the later dates, which have fewer observations. The isolated spikes in this graph after date 200 in event time are often large values of returns for one single company, which is an influential observation for our second-moment estimator in the light of the diminished sample size.

Figure 10 RMS_t over 400 days



This shows that a year or more after listing, the long-run average RMS_t is around 7% – i.e. that the standard deviation of $r_{jt} - r_{Mt}$ of the companies in our sample is around 7% on a day-to-day basis, where prices are fluctuating in response to the flow of news. However, in the early days, we see substantial excess volatility, which we will attribute to the process of price discovery. The event of listing itself is not "news" about the company and should not be associated with excess variance, thus the early excess volatility implies that there are mispriced assets, where prices are changing sharply. This is seen more clearly in the next graph, which zooms into the first 50 days, a region of time where the statistical precision is much better – starting from 1431 companies at date 1, we have 1250 companies on date 50.

Figure 11 RMS_t over the first 50 days



Here, we see that the standard deviation of $r_j - r_M$ on the second day of trading (i.e. the price on day 2 as compared with price on day 1) is 23%, which is 16 percentage points in excess of the long run average of 7%. This is a measure of the extent to which assets are mispriced on date 1. This excess volatility fades away sharply in the first 4 days of trading, but the volatility reaches the region of 7% (the long-run average) only after the first 35 days of trading.

Thus price discovery for new listings appears to be characterised by the following three properties:

- The price at the end of the first day of trading, p_1, is approximately an unbiased estimator of the price on day 400, net of fluctuations in the market index,
- The unbiasedness of p_1, reflects a cancelling out of too-low and too-high prices; numerous mispriced assets experience large price changes in the early days of trading,
- There are two phases in price discovery for new listings on the BSE - sharp price changes in the first four days of trading, followed by smaller price changes in the following 35 days, after which price changes are close to the long-run response to the flow of news, i.e. a daily standard deviation of $r_j - r_M$ of 7%.

9.2 Implications for portfolio strategies

Our analysis of post-listing returns and price discovery has two major implications for operational portfolio management:

- The abnormal returns obtained by IPOs are extremely striking – on average, IPOs produce 40% in excess of the market index in the first 200 days of listing. It is likely that this is associated with price manipulation by promoters.

  This mispricing is associated with many arbitrage strategies, for example, that of buying new listings close to listing date and selling within a year or so. This arbitrage will face minimum unsystematic risk if purchases are made after date 10 in event time, where the process of price discovery has mostly finished. More generally, unusual returns on new listings beyond date 10 or so, net of fluctuations in the market index, should generate intense scrutiny.

  This mispricing is likely to be eliminated after enough market participants start applying this strategy.

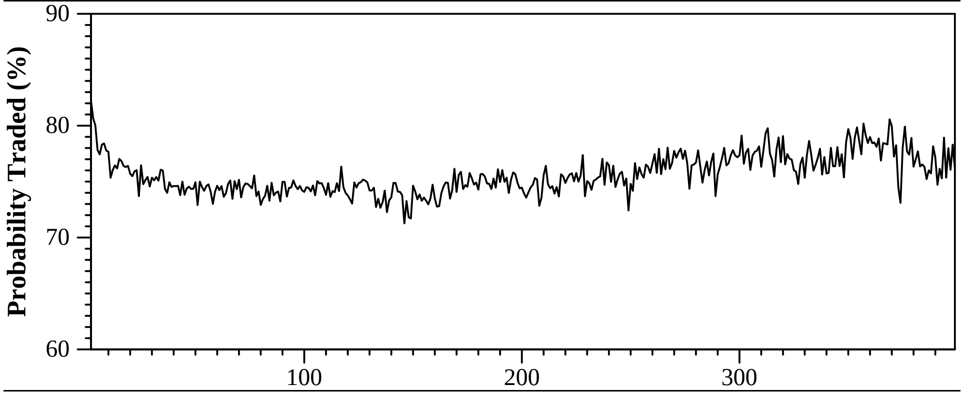
- Apart from this, mispriced assets do appear to be present on the first listing date. Financial market participants should subject newly listed companies to intense research and scrutiny, in searching for mispriced assets. The price discovery appears to be mostly completed by day 10, and fully completed by date 35 or so, after which few mispriced assets are likely to persist.

  The speed of price discovery is likely to become faster as market participants start utilising these ideas, and as the new BSE and NSE online trading systems are more widely deployed.

10 Post-listing trading frequency

How well do IPOs trade after listing? We would expect small new listings to be afflicted with a certain degree of non-trading, especially after the early phase of price discovery is completed.

Figure 12 Time-series of trading probability amongst all IPOs



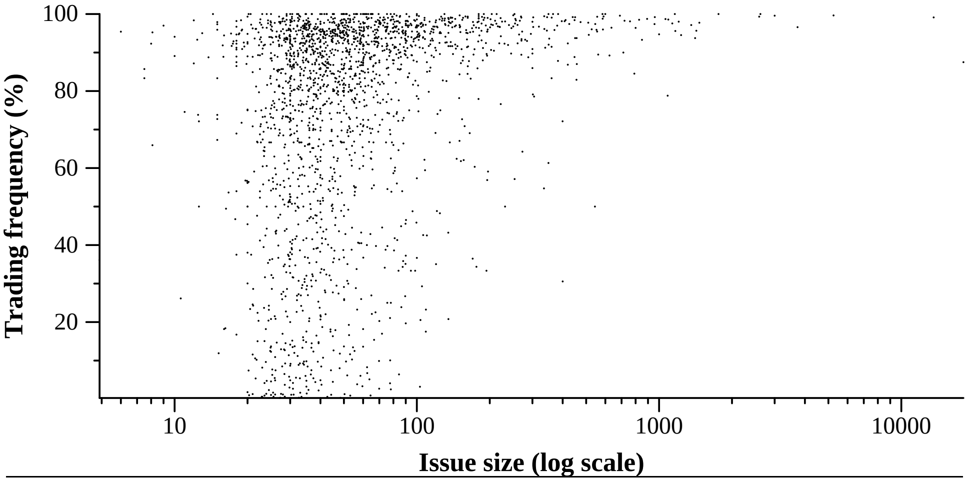
In the graph above, we show the probability of an IPO being traded x days after it first got listed. The probability starts out at 1.0, because all IPOs are traded on day 0, the listing date. On the first day after listing, it is 82%, which is equivalent to saying that out of the 2056 IPOs that we observe, 1690 trade on the first date after listing. This is a remarkably low number – it suggests that many IPOs do not trade, for all practical purposes, after listing.

This probability decays in the early phase - from 82% on date 1 to 75% on date 10. Beyond this date, the trading probability appears to be broadly stable at around 75%. For a frame of reference, the average trading frequency of the A group companies is 94%.

The time taken for the initially high trading probability to reach its steady state is consistent with our picture of price discovery above, where most of the price discovery is completed within the first ten trading dates. Thus the trading probability may be initially elevated as agents with heterogenous assessments of the company trade on their assessments about mispriced assets.

We would expect the trading frequency to also exhibit cross-sectional variation, where larger and more widely held companies have a higher trading frequency. This does prove to be the case:

Figure 13 Trading frequency: variation with issue size



While this graph shows a strong effect of size, there is still a lot of unexplained variation in the trading frequency after controlling for size.

11 Conclusions

Our findings may thus be summarised as follows.

1. India's IPO market is characterised by pervasive underpricing. In our dataset, on average, the price at first listing was 105.6% above the offer price.

2. The commonest delay between issue date and listing date is 11 weeks, and it is highly variable. This delay is strongly associated with issue size, where bigger issues tend to have shorter delays. There is some evidence that the listing delay has diminished over the years, but there has been no improvement in 1995 as compared with 1994.

3. Because the listing delay is *variable*, it is incorrect to use simple averages in expressing IPO underpricing, this would be clubbing together returns obtained over different lengths of time. Because this delay is *long*, it is necessary to measure returns on IPOs in excess of returns on the market index. Hence we focus on the weekly returns on IPOs, in excess of weekly returns on the market index. We find that the average IPO underpricing comes to 3.8% per week by this metric.

4. Our examination of the time–series of monthly volume of IPOs and of monthly average underpricing reveals a lagged effect of fluctuations in the market index. The volume of IPO issues in month x is *positively* influenced by returns on the BSE Sensex between months $x - 2$ and $x - 4$ – for example, high stock market returns from 1 January to 31 March would generate a higher volume of IPOs in May. The average underpricing in month x is *positively* influenced by returns on the BSE

Sensex between months $x-5$ and $x-8$ – for example, high stock market returns from 1 January to 30 April would generate *higher* average underpricing of new listings in September.

5. The inter-company differences in underpricing are remarkably difficult to model. We find that issues with offer price above face value have much lower underpricing, but the underpricing gently increases with the offer price. Underpricing is very high amongst the smallest issues – it drops sharply in the bottom quartile by issue size and gently increases as the issue size gets larger beyond the bottom quartile. Returns on the BSE Sensex in the past impact underpricing with the same lagged relationship mentioned above. Finally, the ratio of issue size to project outlay is negatively associated with underpricing.

6. The average long-run trading frequency of IPOs is 74%, which is much worse than the A group companies, which have an average trading frequency of 94%. The trading frequency of IPOs is slightly higher after first listing, and settles down to the long-run average within the first ten days or so.

7. There is a very striking pattern of extremely good returns to new listings in the first calendar year – on average, IPOs earn 40% in excess of returns on the market index in the first 200 trading days. This is very unlike new listings on other markets in the world, and may well reflect price manipulation by promoters. This conjecture is supported by the fact that these sharp excess returns are mostly reversed in the even-shorter period of the following six calendar months. These unusual excess returns are the most pronounced for IPOs with an issue size between Rs.45 million and Rs.75 million. After this disturbance, new listings appear to behave like the market index, on average.

8. In all, the price at the close of the very first day of trading is an approximately unbiased forecast of the price 400 trading hence, barring the fluctuations in the market index.

9. We offer a new way of measuring the process of price discovery, and find that markets are strongly "learning" the correct prices in the first few days, but the price discovery process goes on to a lesser extent for as long as 1.5 calendar months. During this initial period, and especially during the first five trading days, mispriced assets are likely to exist.

12 Suggestions for further research

There is an enormous array of research problems which have yet to be addressed in the study of IPOs in general, and on India's IPO market in particular. India's IPO market is a good test-bed for empirical studies of the IPO market, given the unique nature of the market and the enormous datasets available.

The international evidence on IPO underpricing may well be vitiated in some countries by the same difficulties faced in India, i.e. the long and varying lags between issue date and listing date. We need to uniformly reexpress IPO underpricing in terms of excess returns per week and reassess the international evidence.

We need to test for the relationship between the volume of IPOs per month and lagged r_M, and between aggregate underpricing in a given month and lagged r_M, in other countries. The models M2 and M3 above both ignore time-series structure, this needs to be remedied. We need to further explore whether the budget-related seasonality in volatility affects the volume of IPOs. Within a few years, it should become clear whether these relationships in India itself are stable or a figment of this particular dataset. If they prove to be robust empirical regularities, then it is a puzzle for theorists to write models about the firms decision to do an IPO and the firms choice of offer price which can reproduce these regularities.

The entire problem of explaining the cross-section of IPO underpricing needs to be explored more thoroughly, via theoretical and empirical work – the bulk of the inter-company differences in underpricing are unexplained by our model M7. Firms are likely to resort to numerous signalling strategies in order to convey their true value to investors, we need to build smaller, specialised datasets containing information about each of these signalling strategies and test for their efficacy, after controlling for the broad regularities of underpricing as shown here. For example, many IPOs have had firm-allotment to mutual funds at a price above the offer price. This may be a valuable signal to the lay investor, that an informed investor has agreed to pay a higher price. This may hence be associated with reduced underpricing. Another research problem concerns the variable information content in prospectuses – we would expect better information disclosure to be associated with reduced underpricing.

The post-listing returns need to re-evaluated using a better benchmark than the BSE Sensex. It would be particularly useful to use size-adjusted returns in assessing post-listing returns. Further studies are needed on the cross-sectional variation of post-listing returns, over and above the variation by issue size documented here.

An important area of research on the BSE is the sources of non-trading, and its implications. These models would ideally be able to explain how the trading frequency of IPOs diminishes over the first ten days after listing.

This is likely to be related to the price discovery problem. The approach of measuring the speed of price discovery using squared residuals in an event study needs to be applied to new listings in other countries. We need to more closely model inter-company differences in the pace of price discovery, measure how it has changed over the years, and study how it is influenced by market microstructure – for example, new listings which have appeared since the start of trading on the BSE Online Trading system (BOLT) may experience faster price discovery than used to be the case before BOLT.

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