Relative effectiveness of signals in IPOs in Indian Capital markets

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Abstract

IPO by a firm calls for assessment of potential agency problems and associated costs by the outside investors. The potential conflict of interest problems between insiders and outsiders could be very high in countries with weak corporate governance mechanisms like India. Theoretically it could be argued that there are quite a few signals related to the firms in the IPO context and available to the investors, which could be used by them to assess the quality of firms. Based on cross-sectional data of 1243 IPOs in Indian markets during 1993-95 period, we find that the under-pricing (or realized excess returns), inside equity and pre-public offer firm reservations made for institutions and mutual funds explain the extent of oversubscription across IPOs. The type of agency appraising the project and presence or absence of foreign financial and/or technical collaborators fail to explain the extent of oversubscription across IPOs. In addition, we find that subscription rate rather than realized initial returns as dependent variable sheds more light on the effect of signals in a *fixed-price open offer* IPO process characterized by listing with considerable lag.

Key Words: Corporate Governance, Signals in IPO markets, Indian IPO markets

JEL Classification: G32, Financing Policy: Capital and Ownership structure

I. Introduction

Recent theoretical and empirical research in Corporate Finance have focussed on the variations in corporate governance mechanisms across countries as determinants of observed differences in financial structure of firms and capital market characteristics across countries[1]. The comprehensive survey work of Shleifer & Vishny (1997) accelerated the works related to several of the issues raised in their article, including the puzzle of "Finance without Governance". The puzzle relates to as to how the firms in countries with weak corporate governance mechanism are able to raise equity from outside minority investors. Given the nature of equity contract, Shleifer & Vishny (1997) argue that the costs of protecting outside investors from insiders and through complex capital structures are not trivial even in countries with relatively strong governance mechanisms. The puzzle of existence of outside equity without governance deepens further considering the empirical evidence that equity markets are active and firms rely heavily on outside equity in developing countries [Singh (1995)], wherein the corporate governance mechanisms to protect outside investors are the weakest. In response to this puzzle, there have been recent theoretical models [Fluck (1998), Gomes (2000), and Myers (2000)] developed to explain the existence of outside equity without governance. While in the models of Fluck and Myers, some primitive controls are assumed with outside investors (to dismiss the insiders and to takeout proportionate share of assets anytime respectively); in the dynamic model of Gomes, the insiders are able to credibly signal and bind themselves to the outside investors through high inside equity.

In this study, our motivation has been to empirically investigate the complex set of signals available to the outside investors at the time of IPOs by firms, which might allow them to credibly infer the quality of firms/ insiders. Though the effectiveness of such signals by itself in the IPO context may have limitation in explaining existence of outside equity without governance due to substantial under-pricing as well as heavy over-subscription observed at times[2] in Indian capital markets, yet we believe the unraveling of importance of such signals might be key to understand and explain the puzzle of finance without governance. Besides the plausible importance of signals by firms in explaining "outside equity" without governance, there exists a long-standing tradition of research on use of signals by the firms while coming out with IPOs. This paper is also a natural extension of an earlier work by us [Pandey & ArunKumar (2001)] testing the significance of inside equity in explaining cross section of investors' response (over-subscription) across IPOs. Besides extending the work to include more variables, other than inside equity, which could be a credible signal; we also examined the methodological issues related to using subscription rate as dependent variable and specification of model. In this paper, we discuss and test relative advantage of using subscription rate or oversubscription as a dependent variable as compared to under-pricing (realized excess initial returns), which has been commonly used as dependent variable in other studies. We also report the results in case under-pricing is used as dependent variable. The data set used in the earlier work has been expanded to include other proxy variables as signals besides inside equity. The paper is organized in five sections. In Section II, we briefly review the literature and the research questions, which

[1] See La Porta et al. (1999), Demirguc-Kunt & Maksimovic (1998).

[2] If the problems are severe due to weaknesses in corporate governance mechanisms and institutional framework, then the evidence of outsiders having confidence in a new firm and higher than offer price valuation in the after-market, undermines the importance of corporate governance as a major concern of the outsiders and capital markets.

have motivated this research. In Section III, we discuss the methodological issues related to use of over-subscription as the dependent variable. In Section IV, the findings and results, along with research design and methodology used are presented. Finally in Section V, we conclude by summarizing the results and their implications.

II. IPOs and Signals

In this section of the paper, our objective is limited to review theoretical and empirical works which may have bearing on laying the emphasis on the cross-sectional differences across firms coming to IPO markets, which could act as credible signals to the investors to infer the quality of firms and the insiders. We have not attempted to review the literature encompassing the research motivated by the issues related to corporate governance and outside equity without governance, which have been covered recently by Gomes (2000), Myers (2000) and earlier more extensively by Shleifer & Vishny (1997). Just as inside equity could possibly be an effective signal [Gomes (2000)], there are other possible voluntary choices made by the firms and their insiders, which are costly and therefore could be credible enough to support existence of outside equity. The use of signaling by the firms coming out with IPOs has already been in the literature. Allen & Faulhaber (1989), Welch (1989), and Grinblatt & Hwang (1989) modeled the under-pricing by firms as a signal following a dynamic strategy in which the firms follow-up IPO with a seasoned equity offering. Under pricing in IPOs allows them to fetch higher prices in seasoned offering(s). The empirical evidence pre-dominantly has been against the hypothesized relationship between under-pricing and subsequent seasoned issues [Garfinkel (1993), Jegadeesh, Weinstein & Welch (1993), and Michaely & Shaw (1994)]. In addition to recent work of Gomes (2000) in the context of finance without governance, Leland & Pyle (1977) had earlier modeled the inside equity as a signal to indicate their private valuations. Downes & Heinkel (1982) found that the firms with higher inside equity attracted higher valuations. It was critiqued later by Ritter (1984) as the high inside equity implies lower agency costs and therefore, would result in higher valuations.

The role of the underwriter /merchant banker itself has been seen as that of certifying agent or a signal. Beatty & Ritter (1986), Booth & Smith (1986), Smith (1986), and James (1992) have argued on these lines. Later, Chemmanur & Fulgheri (1994) demonstrate in a multi-period model that it is possible for underwriters to develop reputation by accurately pricing issues. Empirically, Carter & Manaster (1990), and Michaely & Shaw (1994) provide evidence in support of this hypothesis. The auditors [Titman & Trueman (1986)], venture capitals [Barry, Muscarella, Peavy & Vetsuypens (1990), and Megginson & Weiss (1991)], and commercial banks [James & Weir (1990)] have also been seen in a similar role to explain the under-pricing/initial returns across IPOs.

In the context of weak corporate governance framework, i.e., lack of legal / institutional protection of outside equity investors, in addition to these signal some other signals can be thought of as credible. Even the presence of foreign financial collaborator could mitigate the unbridled agency problems in such context. As long as the foreign collaborator does not collude, his monitoring provides potentially an effective signal to outside investors. He performs a role not very different than that of venture capitalist. On the other hand, it is possible to argue that most of the time the collaborations are not costly enough to provide any effective monitoring. If the costs in acquiring stake are neutralized through gains on royalty, equipment, technology transfer fee etc., the signal

can be mimicked easily by even low quality insiders. Technical collaborations, by their very nature, are likely to be even less effective compared to financial collaborations. As pointed out earlier that a large number of IPOs in India are for mobilization of funds for projects being undertaken. In a large number of cases, the projects were requiring other sources of fund (loan/debt) and were appraised by the lending entity. Sometimes even if additional funding is not required, the firms would voluntarily get the projects appraised. The type and quality of the appraiser also could be a signal, if we allow for reputational capital of the appraising agency.

In the Indian context for the two-year period covered in the study (1st April 1993 to 31st March 1995), the process followed was not based on book building[3]. Outside US, *fixed-price open offers* without *Green shoe provisions* have been common in countries such as UK, Hong Kong & Singapore [Kang (1995)]. The offer price was determined much in advance (2-3 months) before the issue as the offer document with offer price was submitted to the regulator (Securities & Exchange Board of India, SEBI) and investors could invest only at the offer price. If the issue was oversubscribed, the allocation was made through drawl of lottery and both the probabilities and amount of allocation were biased in favor of smallest investor. The listing after issue closed was usually after 3-5 months, after compiling applications, allotment process and issue of physical shares. Given these lag and allotment rules, the initial returns strictly speaking are the valuation differences between a segment of market and wider market. Kang (1995) finds in an empirical study of 147 IPOs spread over 1986-1992 period that IPOs with greater allocation bias favoring small investors in Hong Kong also had relatively higher first-day returns and were mostly under-priced. He argues that fixed-price offerings impose greater risks for underwriters and hence the offer price are set lower compared to other underwriting methods/ IPO process such as book-building. Despite implications for level of under-pricing, one advantage that *fixed-price open offer process* offers for research is that the level of investor response (over-subscription) also becomes available as an attribute for study. Controlling for under-pricing / initial returns, any of the signals hypothesized above can be tested for their significance in explaining the over-subscription. The methodological issues related to use of this variable are discussed elsewhere in the paper.

In the process of initial offering of shares followed in India, firm reservations[4] were made to institutional investors and mutual funds as well on the same offer price. These reservations also are a plausible signal indicating the quality of firm or insiders, as monitoring by them, even if they are minority shareholders, is likely to be more effective than dispersed shareholders. The firm reservation for institutional investors and mutual funds is unlike ex-post share allocation bias in their favor in US, as in Benveniste & Wilhelm (1990). The firm reservations were made much before the fixed-price public-offer and were disclosed in the offer document and therefore, could be a credible signal.

In a similar vein, the asset characteristics of the firm could be a credible signal. If a firm has large proportion of its assets, which are fungible and are not specific to the firm, then the quality of IPO is likely to be low. While it is difficult to characterize the assets of an IPO firm, one would expect the financial services and trading firms to be viewed suspiciously by the investors.

[3] Since then, the book-building process for IPOs has been allowed, proportionate allotment rule introduced for mandatory (10% of the total) fixed price portion of offer.

[4] The actual allotment was contingent on successful completion of offering.

III. Methodological Issues

A. Initial Returns or Over-subscription

The under-pricing of IPOs is a well-known and extensively documented empirical reality worldwide. Loughran, Ritter & Rydqvist (1994), and Ibbotson & Ritter (1995), in their reviews, have also compiled the various hypotheses advanced to explain under-pricing of IPOs. In order to evaluate the effect of any firm or IPO related attribute as signal, the under-pricing (initial returns on listing) has been used as dependent variable in the studies cited above. With the *fixed-price open offer* process of IPOs followed during the period under study in India, both the under-pricing and over-subscription are measurable as response to any signal. In case of instantaneous IPO process, they are equivalent measures as well because the under-pricing will linearly determine over-subscription. Strictly, the under-pricing refers to the difference between "unobserved" fair market price at the time of offer even though it is measured ex-post. If the lag between IPO process and after-market is not substantial, the measured initial returns are conveniently thought of as "under-pricing". Clearly, the initial returns are also expected to be highly correlated as well [Chemmanur (1993), Beaty & Ritter (1986)] if the over-subscription captures the quality and/or pricing of an IPO[5]. To the extent, over-subscription completely specifies the quality of firm/IPO or realized initial returns completely specify true under-pricing; no other signal would have any significant explanatory power in explaining either of these two. In other words, any other signal would fail to explain the realized initial returns if over-subscription captures the effect of all signals. Similarly, the over-subscription would not be explained by any other signal if the realized return were a perfect proxy for "true" expected return. This is empirically testable by using both the variables as dependent variable alternately. Our intuition behind using over-subscription as dependent variable in Indian context was motivated by the fact that realized initial returns, as measure of true expected initial returns, are measured with considerable lag and might be noisy enough to induce investors to rely on other signals as well while subscribing to the issue.

The realized initial returns are only available variable as a proxy for true expected initial returns. Since the realized initial returns are measured with considerable lag, the substantial change in information set induces measurement errors in using realized initial returns. Even if the measurement errors were unbiased, their use would result in downward bias and inconsistency in coefficients of cross-sectional OLS regression. The variance of these errors is expected to be positively related to the time lag between IPO process and listing. With the considerable delay in listing in India during the period under study, the results are expected to be weak. The measurement problem remains irrespective of using over-subscription or initial returns as dependent variable[6]. In the other markets having fixed-price open offer process, the subscription rate or over-subscription has not been used frequently[7]. If subscription rate is viewed as indicator of quality, then it is determined ex-post (after the completion of IPO) and that presumably might have been the reason why studies have not used it extensively. However, as a dependent variable, the timing of determination is not relevant. Eventually we contrast the results with under-pricing as dependent variable with various signals and over-

[5] Similarly, the investor response (over-subscription) is also expected to be positively related to initial returns as proxy of "true" expected initial returns.

[6] Though measurement errors in independent variable(s) make estimates of regression unbiased.

[7] Very few, studies including the one by Kang (1995) have used subscription rate, which has also used it as independent variable proxying for IPO quality.

subscription as independent variables as it allows us to infer empirically whether subscription rate/over-subscription captures IPO quality better or whether realized returns capture true expected returns better.

B. Choice of period

The next methodological issue faced in the study was the choice of period of study. In India, the office of Controller of Capital Issues (CCI) under Ministry of Finance controlled the pricing as well as issue of equity by firms till 1993, in case the firms wanted public financing of equity. Besides acting as a regulator, the control on pricing by CCI was a reflection of the widespread use of price and output controls by the Government till economic reforms started in 1991. After 1993, Securities & Exchange Board of India (SEBI), an independent regulator started regulating the public equity financing (including IPOs). Initially, its role included vetting of offer documents but the pricing was left to the firm subject to qualification criteria laid out in the regulation which were not very restrictive for firms earning profits in the past few years. SEBI continued vetting the offer documents till March 1995, after which it stopped vetting of offer documents amidst controversy surrounding a high-priced seasoned equity offering. In that specific case, it came out that SEBI officials had allowed the guidelines to be violated. After 1995, the IPO activity slowed down considerably. Even though IPOs continued for a while, the mal-practices in form of self-dealing in the secondary market and IPOs primarily being made to rig the prices in the secondary market through circular trading became common[8]. As a result, the genuine investor response also receded and the IPOs were made only to get the stock listed, even if it meant insiders indirectly investing their own money.
The collapse of IPO markets was followed by the withdrawal of vetting of offer document by SEBI. It can be argued that both CCI and SEBI, as regulators, might have been "screening" institutions controlling the quality of firms approaching the market. As CCI was also controlling pricing of issues, the under-pricing prevailing then might have been manifestation of conservative valuations and prices forced by the CCI. We therefore have limited this study to a two-year period coinciding with abolition of price controls of CCI and existence of relatively active IPO market, i.e., after SEBI's withdrawal. Despite eliminating firms whose IPOs were not initially listed at BSE, we still had data from 1243 IPOs, which is an evidence of hectic activity in the IPO market during the period.

IV. Empirical Tests of significance of signals in Indian IPO markets

A. Data-set and Variables used in the study

As in an earlier study [Pandey & ArunKumar (2001)], we used the data taken from PRIME database for various IPOs made during the two-year period of April 1993- March 1995. Since the database included all primary issues, it was screened for IPOs and only those IPOs, which were listed on BSE (Bombay Stock Exchange, the largest exchange in India at that time) within 6 months from the close of offer date, were considered. The screening criterion of restricting the sample to BSE listed IPOs was due to ease of getting reliable price information on the exchange's web-site (www.bseindia.com) & other databases such as PROWESS of Center for monitoring Indian Economy (CMIE). This screening resulted in 1243 IPOs listed on BSE during the period, out of 1959 issues[9] reported in the database.

[8] It is difficult to establish that such practices were going on. Few such cases were detected by SEBI, but markets as well as the media were abuzz with such rumors/stories.
[9] Prime database has all primary issues including issues of convertible debt, rights issues and preference shares.

Unlike the previous study, in which we tested the significance of inside equity in explaining the investor response, in this study we used various variables, for which data was available and which could be considered as potential signal. Inside equity, firm reservations made for the mutual funds and institutions, type of appraising agency, presence of financial and technical collaborators could be potential signals or the variables on which data was available and have been used. The quality of merchant bankers in Indian context is difficult to ascertain, as the industry was too nascent during the period under study. However, the all India financial institutions and commercial banks in that order can be though more credible as a class. Similar problems arise in assigning quality to the collaborating entities in case of financial and technical collaborations. In case of former, we adopted classification by class (bank/ all India financial institution/ state level financial institution/ private/ none) and in case of latter, just the presence/ absence. The description of various variables used in the study is given in Table 1. The variables EXCESRET and OVERSUB denote under-pricing (or realized excess initial returns) and the investors' response and were used as dependent variables independently, with the other one being independent variable. The reason for doing the same has been discussed in the previous section.

The measure of realized excess returns (EXCESRET) was calculated as the return on listing adjusted for market returns during the corresponding period:

EXCESRET =

$$\frac{\{\text{Listing Price- Offer Price}\}}{\text{Offer Price}} - \frac{\{\text{Market Index on listing day- Market Index on offer day}\}}{\text{Market Index on offer day}}$$

BSE Sensitive Index consisting of 30 high capitalization stocks was used as proxy for market returns for adjustment.

B. Regression Model Specification

Over-subscription as Dependent Variable

The following specifications were used to investigate the effect of IPO related signals on the subscription rate or over-subscription:

$$OVERSUB = \beta_0 + \beta_1 EXCESRET + \sum_k \beta_K OTHER_K + \varepsilon \qquad (1)$$

Where the β_I (I= 0,1,..11) are regression parameters to be estimated; ε is a normally distributed random error term; and $OTHER_k$ are signals related to IPO quality.

As argued earlier, we expect a positive relationship between the investor response (OVERSUB) and realized initial returns (EXCESRET) to the extent, the initial returns ex-post reflect true expected returns. Kang (1995) has reported the same in his study of IPOs in Hong Kong.

The level of inside equity has been found to signal IPO quality or a determinant of realized initial returns. In addition to Downes & Heinkel (1982) & Leland & Pyle (1977), a

positive relation between realized returns (EXCESRET) and inside equity (INEQ) is hypothesized in the literature to the extent subscription rate (OVERSUB) does not capture entirely the quality of IPO [Grinblatt & Hwang (1989), Szewezyk, Tsetsekos & Varma (1992)]. Kang (1995) in his study however, reports no significant relationship between inside equity and realized returns after controlling for subscription rate. In our model however, we expect the relationship between subscription rate (OVERSUB) and inside equity (INEQ) to be positive without any qualification for obvious reasons.

Size of an issue has been used often as a variable reflecting the IPO quality; larger the size lesser is the uncertainty about IPO quality. We have used issue size as the proxy for the same. Since the sampling distribution of issue size exhibits excessive variability, we have log-transformed the issue size (SIZE) as has been done in studies by Kang (1995), Beatty & Ritter (1986), and McGuinness (1992).

As discussed earlier, firm reservations made for institutional investors (RESV) as a variable could signal the quality of an issue and we expected a positive relationship with the dependent variable. Similarly, we expect positive association of dependent variable with presence of foreign financial or technical collaboration (DUMMYFC or DUMMYTC) and with presence of all-India financial institution (DUMMYI) as project appraising agency. Given the difficulty of reputation-based rankings, *a-priori* we do not expect any association of dependent variable with any other type of appraising agency (DUMMYB, DUMMYS, DUMMYP). Due to poor asset-specificity of financial service and trading firms, we expect positive association between subscription rate and other types of firms (DUMMYIND). We also expect negative intercept reflecting the quality of issues from financial sector /trading firms or without any appraisal or collaboration.

Realized Initial Returns as Dependent Variable

The following specifications were used to investigate the effect of IPO related signals on the realized excess initial returns:

$$EXCESRET = \beta_0 + \beta_1 OVERSUB + \sum_k \beta_K OTHER_K + \varepsilon \qquad (2)$$

Where the β_l (l= 0,1,..11) are regression parameters to be estimated; ε is a normally distributed random error term; and $OTHER_k$ are signals related to IPO quality.

Though this is commonly used specification in IPO related studies, we would expect the effect of signals ($OTHER_k$) only to the extent it has not been captured by subscription rate (OVERSUB). If indeed subscription rate reflects all other characteristics of the firm/IPO quality, we expect no association between dependent variable and all other independent variables except subscription rate (OVERSUB). There is no basis of expecting any relationship after controlling for subscription rate. Existence or otherwise of any such relationship has to seen empirically to speculate further.

C. Sample Characteristics

During the period under study, the realized excess initial returns in IPOs were very high at aprrox. 68%. This is high in comparison to 15.3% in US, 12.0% in UK, 11.1% in Germany and 32.5% in Japan as compiled in Ibbotson & Ritter (1995). However in the

table compiled by them, under-pricing or initial returns in countries like Brazil (78.5%), Korea (78.1%), and Malaysia (80.3%) are even higher. The comparisons are also difficult as the samples studied in developed markets span longer time-period besides substantial differences in the process followed for IPOs across countries. In Indian context, a study by Shah (1995) reports even higher realized excess returns of about 90%. His sample covers in addition to the period covered in this study, IPOs from 1991 onwards. We restricted our study to a narrower window as till 1993, the regulator priced the issues as pointed out elsewhere. Large under-pricing seen in Indian IPO market could also be due to considerable time lag between IPO completion and listing as the investors may require compensation for having illiquid holding in a risky asset if they are subsequently allotted shares.

The distribution of both the subscription rate as well as realized initial returns across IPOs is skewed to the left indicating a large number of IPOs didn't have very large subscription rate and high realized returns, while a few had very large subscription rate and very high realized returns. Since the database consists of completed issues only, the minimum subscription rate was 1 with maximum being 117 times. Though not shown in the table, 225 IPOs resulted in negative realized excess returns with minimum being negative excess returns of over -110% (adjusting for market returns). The maximum realized excess return on the other hand was as high as 1455%. Given the high variability and skewed distribution of variables EXCESRET & OVERSUB, we also tested their log-transformations. The inside equity also was fairly large with median at 44%. This needs to be interpreted keeping in mind the minimum prevalent regulatory requirement of 25%. On an average, a reasonably large portion (28-29%) of the offer was reserved for institutional investor and mutual funds. The number of IPOs of firms with foreign financial or technical collaboration was 7.3% and 16.7% of the total respectively. A large proportion of IPOs was with projects appraised by Banks (27%), All-India financial institutions (23%), Private financial firms (21%) or State-level financial institutions (9%). IPOs from financial services and trading firms also were only 16.7% of all IPOs.

D. OLS Regression Results

Over-subscription as Dependent Variable

Table 3 reports the OLS regression results with over-subscription rate as the dependent variable. The realized return, inside equity, firm reservations made for institutional investors and the intercept all have significant explanatory power in explaining investors' response or over-subscription across IPOs and all the signs are as hypothesized. Only the coefficient associated with dummy variable –DUMMYFC, indicating IPOs of firms with foreign financial collaboration has unexpected negative sign. A look at the raw data suggests that these collaborations were more concentrated in the industries of aquaculture, textile, food products and chemicals. A plausible reason for the negative sign might be the quality of collaboration or low quality of issues in these industries for which the dummy variable is acting as proxy.

The adjusted $R^{2,}$ is low at 0.331 compared to other studies explaining cross-sectional variation in initial returns, despite using similar model specification and lesser number of variables [Kang (1995) reports 0.6 in his study of Honk Kong IPOs]. This could be due to several plausible reasons. The use of subscription rate as dependent variable could

have resulted in inappropriate model specification. This is not the case as we later show that using realized returns does not increase the explanatory power of the regression. Alternatively, the severe measurement error associated with using realized initial return as proxy for true expected returns due to large time lag, could be the reason for poor explanatory power. Another reason could be use of inappropriate functional form. Using semi-log model specification with log transformation of dependent variable, subscription rate (OVERSUB) and independent variable, realized excess return (EXCESRET) improves the adjusted R^2 somewhat, as can be seen in Table 3A, without changing the significance of other coefficients.

Over-subscription as Dependent Variable (Semi Log specification)

Observing large variation and skewed distribution of subscription rates and realized returns, we also tested an alternative semi log model of the form:

$$\text{Ln (OVERSUB)} = \beta_0 + \beta_1 \text{ Ln (EXCESRET)} + \Sigma \beta_K \text{ OTHER}_K + \varepsilon \qquad (3)$$

Where the β_I (I= 0,1,..11) are regression parameters to be estimated; ε is a normally distributed random error term; and OTHER_k are signals related to IPO quality. Since in the earlier model specification, the realized excess returns could have been negative, the price relatives were used to compute Ln (EXCESRET) as:

Ln (EXCESRET) = Ln (Price on Listing/ Offer Price)- Ln (Index at Listing/ Index at Offer)

Table 3A reports the results with the semi-log model specification [equation (3)]. While the explanatory power of regression model improves in term of adjusted R^2 to 0.39 as opposed to 0.33 with linear specification, the realized excess returns, inside equity and firm reservations made to the institutional investors continue to be significant variables explaining investors' response to firms' IPOs. The only change is in the significance level of intercept, which drops considerably and becomes insignificant. These results suggest that realized initial returns as a proxy for true expected returns do not completely explain the investors response and if conceptually the only determinant of investors' response are true expected returns, then the signals such as inside equity and reservations for institutional investors are positively correlated with measurement error.

Realized Initial Returns as Dependent Variable (Linear and semi-log specification)

Table 4 reports results based on equation (2) as model specification using conventionally used realized initial excess return as dependent variable. The use of realized excess return has been obviously important to researchers as the interest in the IPO studies has been motivated by well-documented anomaly of their "under-pricing", i.e., substantially high initial excess returns. As argued earlier, use of realized excess return, as dependent variable in the fixed-price open offer IPO process, to test the effectiveness of signals is problematic. In case the subscription rate already reflects the quality of an IPO or the effect of all other signals as would be expected, then any other signal/ firm-specific attribute is not likely to be significant in explaining cross-sectional variations across IPOs. The results seem to vindicate this intuition.

The subscription rate remains significant in explaining high realized returns but all other signals found significant earlier are not significant. The subscription rate seemingly captures all aspects of quality to determine ex-post realized returns except the inherent

"under-pricing" of IPOs and size. Though insignificant, the signs of some of the variables are interesting. In case of inside equity, the sign is consistent with existing studies. In case of firm reservation made to institutional investors, the sign is consistent with the argument that the IPO if sold to institutional investors need to be under-priced less. The OLS estimates of the model are characterized by a large positive and significant intercept. It indicates that firms need to under-price. It is also consistent with a large negative intercept with the model earlier, indicating that investors will invest in IPOs only if other signals and under-pricing are favorable. Despite realized initial returns being measured when all other variables are known (unlike the previous model where the realized returns get determined much after the subscription rate), the overall explanatory power of the model in term of adjusted R^2 is relatively lower.

The only other variable, which is significant in explaining the realized excess returns, is size. The results indicate that large issues need to be relatively less under-priced.

Table 4A reports the results of OLS regression of semi-log equation form of the specification of the form:

$$\text{Ln (EXCESRET)} = \beta_0 + \beta_1 \text{ Ln (OVERSUB)} + \sum_k \beta_K \text{ OTHER}_K + \varepsilon \qquad (4)$$

Where the β_I (I= 0,1,..11) are regression parameters to be estimated; ε is a normally distributed random error term; and OTHER_k are signals related to IPO quality, as in the previous specifications.

The change in model from linear to semi-log specification does not affect the base results except improving the overall explanatory power in term of adjusted R^2 (from .298 to .341) and making dummy associated with manufacturing firms' IPOs significant in explaining realized initial excess returns.

To summarize, the regression results are consistent with- (1) "under-pricing" in IPOs, which is lesser for larger-sized and manufacturing sector issues; (2) investor response to an issue gets explained by inside equity and firm reservations made to the institutional investors before the offer as signals in additional to realized returns; (3) the signals explaining investor response in turn might be significant, to the extent the realized excess returns are measured with errors or alternatively, independent signals of IPO quality; and (4) the investors' response measured through subscription rate as dependent variable seems to account for IPO quality comprehensively.

E. Robustness of Results

Omitted variables, IPOs at par

As our primary interest was in exploring the determinants of investors' response across IPOs, we subjected the semi-log model specification [specified in equation (3)] for checking the robustness of results. We were however severely constrained by data availability for some of the variables we would have liked to include. Since considerable time had elapsed, the prospectus availability was not easy. Variables reflecting the quality of firm and insiders, such as age, profitability in the past, dividend track-record etc.; are only available from the prospectus for firms coming with IPOs. These variables could be important in explaining the investor response or under-pricing, but have not

been included in the analysis by us. Model mis-specification due to omitted variables remains weakness in our results, though we used issues at par as proxy for firm's profit and age history. The regulations in India have been always liberal in allowing very young and start-up firms to bring their IPOs. The regulator (Securities & Exchange Board of India, SEBI) allowed such firms to bring-out their IPOs, but such firms (or for that matter firms not having 3 years track-record of profits/dividends) were allowed to come with IPOs at par (i.e., at the face value of shares implying at same price as insiders). Out of a total of 1243 issues analyzed, 842 IPOs were made at par indicating a large number of IPOs by very young firms. We included another dummy variable (DUMMYPRM) in our previous specification as one of the quality variable in equation (3) & (4) to test whether the relationships remain significant. The variable took a value of 1 in case an IPO was made at a premium and 0 in case the IPO was at par. Table 5 & 6 report the effect of including the dummy variable for premium issues.

In case of over-subscription, the coefficient of the dummy variable is significant and has the expected sign. Since the issues at premium are from relatively older firms with a track record, one would expect positive association between investor response and the dummy variable and negative association between excess initial returns and the dummy variable. The effect of par issues also results in the size variable and intercept in the regression unexpectedly changing their sign and becoming significant at 5%. The explanatory power of the regression, in terms of adjusted R^2 improves very marginally (from 0.390 to 0.407).

In case of realized excess returns, the par issues seem to have higher initial excess returns implying less under-pricing by firms with profit track record, the issues at premium being proxy for the same. This is reflected in significant negative relationship between LNEXCESRET and DUMMYPRM. Like in previous case, there is a change in other variables' significance, with inside equity becoming significant and size becoming insignificant in explaining initial excess returns.

The inclusion of the dummy variable for par issues does not affect the baseline results with respect to role of inside equity and firm institutional reservations in explaining subscription rate across issues. However, the effect of size on the "under-pricing" is replaced by the less "under-pricing" by relatively older firms. Similarly, the subscription or investor response also is significantly positive for such older firms despite less "under-pricing".

Multi-Collinearity

Even though the classical manifestation of high R^2 was not present, the pair-wise zero-order correlation coefficients across independent variables are reported in Table 7. The maximum correlation of 0.47 is between size and dummy variable, DUMMYPRM, indicating that premium issues were of a larger size in the sample. The next highest correlation of 0.406 was also observed between the same dummy variable and inside equity. Other correlation coefficients, though significant, were below +/- 0.32.

Heteroskedasticity, advantage to semi-log specification

In order to check for presence of heteroskedasticity, we used White's test-statistic on both linear and semi-log specification. In both the cases, the null hypothesis of homoskedasticity was rejected at 5% significance with chi-squared statistics of 364.20 & 88.25 (degrees of freedom = 54) respectively. In linear specification of the model, the error terms are highly correlated with the realized excess returns. While performing White's procedure, the test-statistic remains at a very high 256.08 in case of linear specification but drops to acceptable 16.16 (degrees of freedom = 12) in case of semi-log specification, if cross product and square terms are dropped from auxiliary regressions. With the semi-log specification, the error terms do not seem to be related to the explanatory variables and the marginal heteroskedasticity indicated by White's statistics could as well be due to model mis-specification. Using Breusch-Pagan-Godfrey test for heteroskedastic variance being positively related to independent variables, the chi-squared statistics of 14.50 (degree of freedom =12) in case of semi-log specification accepts the null hypothesis of homoskedasticity at 5% significance level.

Influential Observations

In order to check for the results being driven by influential observations, we estimated the parameters of equation (3) after ordering the sample on subscription rate and realized excess returns and after dropping 100 IPOs at both the ends separately. All the 4 variables, viz., inside equity, firm reservations, size and dummy variable for premium issues remain significant.

To summarize, the results seem fairly robust despite the possibility of having omitted variables, which could be the cause for model mis-specification. In any case, there is no theoretical guidance available to include any particular set of variables in trying to explain the subscription rate or investor response except the under-pricing. We would have liked to include some more measures of the quality of investment bankers, financiers, age of the firm etc., but were constrained by difficulty of getting data. The question of stability of the results across time-periods also remained untouched by us.

V. Findings and further research

Our objective in the study of IPOs in India, an emerging market, was to test the significance of some of the firm specific or IPO process related attributes in explaining the investor response and well documented under-pricing across IPOs. In case these attributes or signals are seen as credible enough by the investors, they may also help in explaining at least partially the puzzle of "outside equity". In the process of this analysis, there were other issues as well. Firstly, whether the under-pricing itself will not influence the investor response, if under-pricing is significantly independent of the signals and attributes being analyzed. A somewhat related issue is- if the subscription rate or investor response subsumes the IPO or firm quality, one would not expect the realized excess returns, *ex post*, to be explained by any other signal or attribute. Led by these arguments, we tested the significance of some of the theoretically as well as popularly cited attributes of firm or the IPO in explaining subscription rate.

Our results indicate that inside equity, firm reservations made to institutional investors before the offer and realized excess returns significantly explain the investor response /subscription rate. Similarly, the issues made at premium (allowed by the regulator to only profitable firms) also affect subscription significantly. We did not find any significant relationship between subscription rate and type of project appraising agency involved by

the firm and presence of foreign technical and financial collaborators. Unlike subscription rate, under-pricing by firms was completely explained by subscription rate except for firms with profitable track record (IPOs at premium) or for manufacturing firms. Such issues were comparatively less under-priced.

Our results show that subscription rate is an important variable for any study on IPOs in Indian context, where the IPO process followed was fixed-price open offer process. Traditionally IPO studies have focussed on under-pricing / realized initial returns.

Though we performed usual tests for robustness, the stability of the results across different time-periods needs to be empirically tested. Similarly, refinement in some of the attributes used by us and inclusion of more such attributes and signals would shed more light on the information processing by investors to infer IPO quality in contexts, where their interests are in any case very weakly protected. Now in India, firms can use both fixed-price open offer and book-building processes. This has also led to the possibility of empirically assessing the relative differences in the importance of the firm or IPO specific attributes. The results of such studies and the insights related to information processing by investors/ markets, besides improving academic understanding, could also be possibly used to strengthen the institutional and regulatory framework for IPOs. A key issue facing emerging markets is to evolve regulatory framework for IPOs recognizing weak corporate governance and making maximum use of information processing abilities of the market itself.

Table 1. Dependent & Independent Variables

Variable	Dependent/ Independent	Description
OVERSUB	D/I*	Number of times the issue was subscribed, Number of shares applied for divided by number of shares on offer.
EXCESRET	D/I*	Realized excess returns on listing, percentage returns on listing (listing price-offer price)/offer price, adjusted for market returns using BSE sensitive Index.
INEQ	I	Inside Equity, measured as % age of total post-offer number of shares held by insiders.
SIZE	I	Size of Issue, log-transformed offer size in tens of million (a crore) in Rupees.
RESV	I	Firm Reservations made in favor of institutional investors and mutual funds measured in percentage of the total offer size.
DUMMYB	I	Dummy variable; takes value of 1 if a Bank has appraised IPO related project other wise 0.
DUMMYI	I	Dummy variable; takes value of 1 if an all-India Financial Institution has appraised IPO related project other wise 0.
DUMMYS	I	Dummy variable; takes value of 1 if a state level Financial Institution has appraised IPO related project other wise 0.
DUMMYP	I	Dummy variable; takes value of 1 if any private sector Financial Institution has appraised IPO related project other wise 0.
DUMMYFC	I	Dummy variable; takes value of 1 if the firm has any foreign financial collaboration other wise 0.
DUMMYTC	I	Dummy variable; takes value of 1 if the firm has any foreign technical collaboration other wise 0.
DUMMYIND	I	Dummy variable; takes value of 1 unless the firm is in financial services or trading, in which case it is 0.

***** Used alternately as Dependent variable.

Table 2. Sample Characteristics: 1243 IPOs

Continuous Variables	Mean	Median	Standard Dev.
Times subscribed (OVERSUB)	10.10	4.35	14.64
Realized excess returns (EXCESRET)	69.79%	39.16%	115.23%
Post-issue Inside Equity (INEQ)	47.00%	44.00%	14.89%
Log of offer size (SIZE)	5.80	5.70	0.75
% of offer reserved for FIs/MFs (RESV)	29.77%	28.57%	20.42%

Nominal Variables	Number of IPOs
Appraised by Banks (DUMMYB)	336
Appraised by National FIs (DUMMYI)	290
Appraised by State FIs (DUMMYS)	115
Appraised by Others (DUMMYP)	258
Financial Collaboration (DUMMYFC)	91
Technical Collaboration (DUMMYTC)	208
Financial & Trading Firms (DUMMYIND)	208

Table 3. OLS Regression results with linear specification: N-1243

OVERSUB as dependent variable

Variables	Estimates of Coefficients	Std. Error	t-statistics	Significance level
Intercept	-6.864	3.337	-2.057*	.040
Realized Excess Returns (EXCESRET)	6.271	.305	20.559**	.000
Inside Equity (INEQ)	14.612	2.486	5.879**	.000
Log of issue size (SIZE)	.134	.500	.267	.789
Institutional investors' reservations (RESV)	11.530	1.830	6.299**	.000
Projects appraised by Banks (DUMMYB)	1.760	1.097	1.605	.109
Project appraised by all-India FI s (DUMMYI)	.900	1.159	.777	.437
Project appraised by state FI s (DUMMYS)	-.364	1.460	-.250	.803
Project appraised by other firms (DUMMYP)	1.518	1.148	1.323	.186
Firms with foreign financial collaborations (DUMMYFC)	-.669	1.520	-.439	.661
Firms with foreign technical collaborations (DUMMYTC)	1.038	1.076	.965	.335
Manufacturing firms (DUMMYIND)	.505	1.002	.504	.614

R^2 = 0.337, Adj. R^2 = 0.331, F-statistic = 56.835 (significant at 1%)

* Significant at 5%

** Significant at 1%

Table 3A. OLS Regression results with semi-log specification: N-1243

LNOVERSUB as dependent variable

Variables	Estimates of Coefficients	Std. Error	t-statistics	Significance level
Intercept	-.091	.261	-.350	.726
Log of Realized Excess Returns (LNEXCESRET)	1.253	.055	22.584**	.000
Inside Equity (INEQ)	1.482	.194	7.622**	.000
Log of issue size (SIZE)	0.009	.039	.220	.826
Institutional investors' reservations (RESV)	0.981	.143	6.840**	.000
Projects appraised by Banks (DUMMYB)	0.069	.086	.810	.418
Project appraised by all-India FI s (DUMMYI)	-0.011	.091	-.121	.903
Project appraised by state FI s (DUMMYS)	-0.083	.114	-.729	.466
Project appraised by other firms (DUMMYP)	0.048	.090	.535	.593
Firms with foreign financial collaborations (DUMMYFC)	-0.003	.119	-.025	.980
Firms with foreign technical collaborations (DUMMYTC)	0.108	.084	1.286	.199
Manufacturing firms (DUMMYIND)	0.104	.078	1.323	.186

R^2 = 0.395, Adj. R^2 = 0.390, F-statistic = 73.164 (significant at 1%)

** Significant at 1%

Table 4. OLS Regression results with linear specification: N-1243

EXCESRET as dependent variable

Variables	Estimates of Coefficients	Std. Error	t-statistics	Significance level
Intercept	1.399	.267	5.249**	.000
Over-subscription (OVERSUB)	.041	.002	20.559**	.000
Inside Equity (INEQ)	.216	.209	1.061	.289
Log of issue size (SIZE)	-.183	.040	-4.582**	.000
Institutional investors' reservations (RESV)	-.190	.150	-1.267	.205
Projects appraised by Banks (DUMMYB)	-.028	.089	-.321	.748
Project appraised by all-India FI s (DUMMYI)	.092	.093	.985	.325
Project appraised by state FI s (DUMMYS)	-.013	.118	-.106	.916
Project appraised by other firms (DUMMYP)	-.012	.093	-.129	.897
Firms with foreign financial collaborations (DUMMYFC)	.110	.121	.909	.363
Firms with foreign technical collaborations (DUMMYTC)	.037	.087	.428	.669
Manufacturing firms (DUMMYIND)	-.144	.081	-1.783	.075

R^2 = 0.304, Adj. R^2 = 0.298, F-statistic = 48.979 (significant at 1%)

* Significant at 5%

** Significant at 1%

Table 4A. OLS Regression results with Semi-log specification: N-1243

LNEXCESRET as dependent variable

Variables	Estimates of Coefficients	Std. Error	t-statistics	Significance level
Intercept	.511	.112	4.562**	.000
Log of Over-subscription (LNOVERSUB)	.234	.010	22.584**	.000
Inside Equity (INEQ)	-.006	.086	-.068	.946
Log of issue size (SIZE)	-.068	.017	-4.087**	.000
Institutional investors' reservations (RESV)	-.059	.063	-.928	.354
Projects appraised by Banks (DUMMYB)	-.014	.037	-.371	.710
Project appraised by all-India FI s (DUMMYI)	.039	.039	.987	.324
Project appraised by state FI s (DUMMYS)	.000	.049	.001	.999
Project appraised by other firms (DUMMYP)	.007	.039	.178	.859
Firms with foreign financial collaborations (DUMMYFC)	.051	.051	1.106	.269
Firms with foreign technical collaborations (DUMMYTC)	.006	.036	.155	.877
Manufacturing firms (DUMMYIND)	-.088	.034	-2.591*	.010

R^2 = 0.346, Adj. R^2 = 0.341, F-statistic = 59.302 (significant at 1%)

* Significant at 5%

** Significant at 1%

Table 5. Effect of par issues on Over-subscription (semi-log specification: N-1243)

LNOVERSUB as dependent variable

Variables	Estimates of Coefficients	Std. Error	t-statistics	Significance level
Intercept	.704	.290	2.427*	.015
Log of Realized Excess Returns (LNEXCESRET)	1.292	.055	23.444**	.000
Inside Equity (INEQ)	.877	.217	4.044**	.000
Log of issue size (SIZE)	-.107	.043	-2.489*	.013
Institutional investors' reservations (RESV)	1.057	.142	7.440**	.000
Projects appraised by Banks (DUMMYB)	.060	.085	.711	.977
Project appraised by all-India FI s (DUMMYI)	.014	.089	.162	.872
Project appraised by state FI s (DUMMYS)	-.084	.113	-.747	.455
Project appraised by other firms (DUMMYP)	.031	.089	.356	.722
Firms with foreign financial collaborations (DUMMYFC)	.062	.118	.525	.600
Firms with foreign technical collaborations (DUMMYTC)	.126	.083	1.518	.129
Manufacturing firms (DUMMYIND)	.073	.077	.944	.346
IPOs at premium (DUMMYPRM)	.438	.073	5.976**	.000

R^2 = 0.412, Adj. R^2 = 0.407, F-statistic = 71.934 (significant at 1%)

** Significant at 1%

* Significant at 5%

Table 6. Effect of par issues on Excess Initial Returns (semi-log specification: N-1243)

LNEXCESRET as dependent variable

Variables	Estimates of Coefficients	Std. Error	t-statistics	Significance level
Intercept	.107	.125	.852	.394
Log of Subscription rate (LNOVERSUB)	.239	.010	23.444**	.000
Inside Equity (INEQ)	.268	.094	2.867**	.004
Log of issue size (SIZE)	-.010	.019	-.524	.600
Institutional investors' reservations (RESV)	-.107	.062	-1.710	.088
Projects appraised by Banks (DUMMYB)	-.010	.036	-.266	.790
Project appraised by all-India FI s (DUMMYI)	.025	.038	.650	.516
Project appraised by state FI s (DUMMYS)	.001	.048	.034	.973
Project appraised by other firms (DUMMYP)	.014	.038	.368	.713
Firms with foreign financial collaborations (DUMMYFC)	.026	.051	.515	.607
Firms with foreign technical collaborations (DUMMYTC)	-.004	.036	-.132	.895
Manufacturing firms (DUMMYIND)	-.071	.033	-2.131*	.033
IPOs at premium (DUMMYPRM)	-.213	.031	-6.782**	.000

R^2 = 0.370, Adj. R^2 = 0.364, F-statistic = 60.181 (significant at 1%)

** Significant at 1%

* Significant at 5%

Table 7. Pair-wise Zero-order Correlation among Independent Variables

		LNEXRET	INEQ	SIZE	RESV	DUMMYB	DUMMYI	DUMMYS	DUMMYP	DUMMYFC	DUMMYTC	DUMMYIND	DUMMYPRM
LNEXRET	Correlation	1.000	.160	-.167	.165	-.049	.056	-.048	-.015	.066	.054	-.076	-.123
	Sig. (2-tailed)	.	.000	.000	.000	.085	.048	.091	.606	.020	.059	.007	.000
INEQ	Correlation	.160	1.000	.019	.048	-.194	.142	-.141	-.113	.046	.038	-.074	.406
	Sig. (2-tailed)	.000	.	.511	.092	.000	.000	.000	.000	.102	.178	.009	.000
SIZE	Correlation	-.167	.019	1.000	-.314	.015	.116	-.095	.037	.073	.082	.148	.470
	Sig. (2-tailed)	.000	.511	.	.000	.602	.000	.001	.191	.010	.004	.000	.000
RESV	Correlation	.165	.048	-.314	1.000	-.040	.168	-.021	-.009	.126	.112	.033	-.225
	Sig. (2-tailed)	.000	.092	.000	.	.161	.000	.454	.761	.000	.000	.249	.000
DUMMYB	Correlation	-.049	-.194	.015	-.040	1.000	-.336	-.194	-.311	.010	-.006	.006	-.044
	Sig. (2-tailed)	.085	.000	.602	.161	.	.000	.000	.000	.731	.834	.834	.120
DUMMYI	Correlation	.056	.142	.116	.168	-.336	1.000	-.176	-.282	.122	.186	.222	.022
	Sig. (2-tailed)	.048	.000	.000	.000	.000	.	.000	.000	.000	.000	.000	.435
DUMMYS	Correlation	-.048	-.141	-.095	-.021	-.194	-.176	1.000	-.163	-.047	-.039	.121	-.084
	Sig. (2-tailed)	.091	.000	.001	.454	.000	.000	.	.000	.097	.169	.000	.003
DUMMYP	Correlation	-.015	-.113	.037	-.009	-.311	-.282	-.163	1.000	-.007	-.054	.006	.012
	Sig. (2-tailed)	.606	.000	.191	.761	.000	.000	.000	.	.812	.057	.826	.679
DUMMYFC	Correlation	.066	.046	.073	.126	.010	.122	-.047	-.007	1.000	.503	.118	-.055
	Sig. (2-tailed)	.020	.102	.010	.000	.731	.000	.097	.812	.	.000	.000	.052
	Sig. (2-tailed)	.020	.102	.010	.000	.731	.000	.097	.812	.	.000	.000	.052
DUMMYTC	Correlation	.054	.038	.082	.112	-.006	.186	-.039	-.054	.503	1.000	.195	-.033
DUMMYTC	Correlation	.054	.038	.082	.112	-.006	.186	-.039	-.054	.503	1.000	.195	-.033
	Sig. (2-tailed)	.059	.178	.004	.000	.834	.000	.169	.057	.000	.	.000	.249
	Sig. (2-tailed)	.059	.178	.004	.000	.834	.000	.169	.057	.000	.	.000	.249
DUMMYIND	Correlation	-.076	-.074	.148	.033	.006	.222	.121	.006	.118	.195	1.000	.065
DUMMYIND	Correlation	-.076	-.074	.148	.033	.006	.222	.121	.006	.118	.195	1.000	.065
	Sig. (2-tailed)	.007	.009	.000	.249	.834	.000	.000	.826	.000	.000	.	.022
	Sig. (2-tailed)	.007	.009	.000	.249	.834	.000	.000	.826	.000	.000	.	.022
DUMMYPRM	Correlation	-.123	.406	.470	-.225	-.044	.022	-.084	.012	-.055	-.033	.065	1.000
DUMMYPRM	Correlation	-.123	.406	.470	-.225	-.044	.022	-.084	.012	-.055	-.033	.065	1.000
	Sig. (2-tailed)	.000	.000	.000	.000	.120	.435	.003	.679	.052	.249	.022	.
	Sig. (2-tailed)	.000	.000	.000	.000	.120	.435	.003	.679	.052	.249	.022	.

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