Is it Heterogeneous Investor Beliefs or Private Information that Affects Prices and Trading Volume?

Sugato Chakravarty
Purdue University
812 West State Street/Matthews Hall
West Lafayette, IN 47906-1262
USA
Phone: +1 (765) 494-6427
Email: sugato@purdue.edu

&

Rina Ray (contact author)
Norwegian School of Economics and Business Administration
Helleveien 30
NO – 5045 Bergen
Norway
Phone: + 47 (55) 95 95 03
Email: rina.ray@nhh.no

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Abstract

A large fraction of the behavioral finance literature is based on a "disagreement" model, an important component of which is heterogeneous priors. Heterogeneous priors usually rely on some form of public information. While some investors may be especially skillful in "interpreting" public information and arriving at heterogeneous priors, public information can also trigger private signals. Once private information is introduced into the system, to effectively test such models of heterogeneous priors, the empiricist has to address the "joint behavior" of price and trading volume. In this paper we make such an attempt. Using a new dataset from India, we pit heterogeneous priors against private information to test the explanatory power of such heterogeneous priors. Our measure of heterogeneous priors is based on *abnormal* order data submitted by institutions, high net worth individuals and retail investors for a sample of Indian IPOs. Our measure of private information is the probability of informed trade (PIN) commonly used in market microstructure literature and computed from high frequency transaction data. While we find that private information dominates heterogeneous priors in explaining trading volume, heterogeneous priors measure dominates imbalance in trading frequency or net buy, i.e. the difference between buy and sell trades. Further, heterogeneous priors affect prices significantly through this trading imbalance. The price impact of our heterogeneous belief measure could be interpreted either as a behavioral bias or as an information processing, and analyzing, cost.

The literature on market anomalies that attempt to disprove the efficient market hypothesis is quite large and growing. The efficient market hypothesis suggests that all public and private information about an asset has already been incorporated in the publicly traded price. Hence, a trader should not be able to predict future return of an asset using any factor other than the risk associated with the asset. The implication is that any trading profit based on private information should be ruled out. Empirically, however, a series of event studies and factor pricing models have predicted future returns both in cross-section and in time series.

Hong & Stein (2006), for example, argue that the theoretical literature on anomalies or, more generally, behavioral finance, have progressed on two major directions. The first is on “limits to arbitrage” – which suggests that market frictions such as transaction cost, short selling constraints etc. prevent rational arbitrageurs from completely eliminating any possible mispricing in the market. The second strand focuses on “disagreement” models. The underlying mechanisms of these models span, among others, gradual information flow, limited attention span and heterogeneous priors. They argue that any asset pricing model, either rational or behavioral, has to address the “joint behavior of price and trading volume”. Yet, very little effort has been made in the anomalies literature to do so. In this paper, we are specifically interested in studying if heterogeneous priors, beliefs or expectations of different classes of agents affect trading volume and asset prices.

Miller (1977) was the first to provide a model of heterogeneous beliefs and prices. He argued that in equilibrium, asset prices are a weighted average valuation of two classes of agents in the market – the optimists and the pessimists. Hence, when short selling constraints exist, for instance, immediately after an IPO, prices reflect only the opinion of the optimists because the pessimists cannot sell short. In the long run, such constraints are relaxed and prices go down.

Diether, Malloy, Scherbina (2002) use the dispersion of analysts’ forecasts as a proxy for heterogeneous beliefs and show that a portfolio of stocks with the highest dispersion in forecasts underperforms in the future. Boehme, Danielsen and Sorescu (2006) use the level of short interest as a proxy for short selling constraints and provide evidence that both heterogeneous expectations and short selling constraints are necessary conditions and neither is sufficient for over-valuation. Both these works use United States data. Additionally, Chang, Cheng & Yu (2006) argue that these two earlier works use imperfect proxies for short selling constraints. These authors use data from the Hong Kong stock exchange to analyze the price impact for stocks that are added to a list of equities authorized for short selling. They find that short selling constraints result in overvaluation and such overvaluation is accentuated when investor beliefs are highly dispersed. In their paper, however, they use equity prices ex-post in order to obtain a proxy for heterogeneous expectations.

Our paper differs from these studies on several counts. First, we are able to analyze the impact of heterogeneous beliefs on price and volume simultaneously. Miller (1977) is not a suitable model to do so because it is a static model. If one class of agents does not disagree further after the initial time period relative to the other class, there would be no trading in his model. Hence, we use Harrison and Kreps (1978) as the basic model where even rational traders are willing to pay more for an asset for the option to sell it at a higher price in the future relative to the other (perhaps less rational) traders who are willing to pay even more.

Second, we are able to construct an ex-ante proxy for heterogeneous expectations among three classes of investors using Indian primary market data. Indian market data is better suited than data from United States or other capital markets because this data allows us to establish ex ante heterogeneous priors of the agents. By contrast, transactions data in the US do not allow us to look separately at the orders of retail, high net worth individuals and institutional investors and to construct a proxy for heterogeneous priors.[1] Thus, the idea of constructing an ex ante measure of heterogeneous expectations based on the trades of distinct trader types is not possible with the transactions data pertaining to the US markets commonly available for research purposes. Additionally, we argue the agents in our sample are more likely to trade based on their priors because of incentive alignments. Unlike in the extant studies where heterogeneous

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While data sets such as Plexus and Abel/Noser provide institutional trading data, and while transactional data sets like TAQ provide intraday transactions data, it is not advisable to try and merge these data sets together to try and infer the behavior of institutions and non institutional individual investors simultaneously.

priors are proxied by the dispersion in analysts' forecasts or where an ex-post measure of heterogeneous priors are inferred based on traded price, in our sample the heterogeneous prior measure is computed from the *order* data submitted by the investors. Therefore, our Indian data allow us to establish a most direct link between heterogeneous priors and trading volume as well as with prices.

Third, using intra-day data and a methodology from the market-microstructure literature, we are able to conclude whether our proxy for heterogeneous beliefs can explain price or trading volume once private information has been controlled for.[2] Once we control for private information, the residual impact, if any, of the factor representing heterogeneous beliefs can be thought of either as a behavioral bias or an information analyzing/processing cost. In case the residual impact is economically or statistically insignificant, such findings may challenge the notion that heterogeneous beliefs impact asset prices and trading volume.

The rest of the paper is organized as follows. Section 2 presents the institutional details about IPOs and book-building in India where our sample comes from. Section 3 discusses the data and sample construction. The empirical analysis including methodology, key variable construction and primary findings are reported in section 4. Section 5 concludes.

2. Institutional details about primary market and book-building in India:

Indian primary market uses both fixed price and book-building method. Although the latter is called book-building, the process is a modified Dutch auction where the IPO book manager has the option to set the offer price at or below the market clearing price. The allocation proportion and, hence, shares reserved among three different categories of investors, i.e. institution, non-institution (primarily high-net

2 Using US data Chemmanur and Hu (2009) provide a detail analysis of how informed institutions are relative to retail investors at the primary market. In our study private information advantage by institutions, if any, is only part of the analysis.

worth individuals) and retail are pre-specified.[3] Throughout this paper, the term non-institution (or NII) and high-net-worth individuals (henceforth HNI) are used interchangeably.

Only in case of undersubscription in one of these categories, the book manager can redistribute the excess shares from that category to the other two and such redistribution is done in proportion to the original allocation of the other two categories. Hence, if the original allocation rule for institution, HNI and retail categories were 50:15:35 respectively and the HNI category is undersubscribed, then the unallocated or excess shares from the HNI category will be distributed between the institutions and retail investors in 50:35 proportion.

Prior to December 2005, the book managers could use a discretionary allocation mechanism only for the shares reserved for the institutions. The allocation for the other two categories was in proportion to the demand. Since then, the book-manager is required to allocate shares in proportion to the demand even for the institutions.

The order book for the IPO is electronic open book usually managed by the Bombay Stock Exchange (BSE) and/or the National Stock Exchange (NSE), the two national stock exchanges of India. While BSE is the older of the two exchanges, NSE has a higher trading volume and market capitalization.

2.1 Bidding

The preliminary prospectus for IPOs in India contains either a floor price (low filing price) or a price range bound by a floor and a cap (high filing price). All IPOs after September 2003 (all but 13 IPOs in the sample) specify a filing range. The price range can be 20% of the expected price at most and can be updated while book-building continues. The electronic book is kept open for a minimum of three and a maximum of seven business days. In case the price range is updated, the book is kept open for another three business days. The bidders are required to place their bids at or above the floor price or within the price range including the floor and the cap. They can also revise their bid at any time until the book closes. Each bid is time stamped in this open book bidding system.

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3 Institutions are also referred to as Qualified Institutional Buyers or QIB and Non-Institutions as NII.

Bidders are classified into three categories - retail individual investors (RII), non-institutional investors (NII) and qualified institutional buyers (QIB). NIIs are also known as high net worth individuals (HNI). QIBs include commercial banks, mutual funds, and foreign institutional investors, venture capital funds including foreign VCs, insurance companies and pension/retirement funds. Retail investors are individuals who bid for shares worth INR 100,000 (approximately 2,200 USD) or less for a specific IPO and differ from non-institutional investors primarily on the basis of order size. In addition to the high net-worth individuals, non-institutional investors also include Hindu Undivided Families, non-resident Indians and corporations that do not belong to the financial services industry.

Retail and non-institutional bidders are required to deposit 100% value of their bid in an escrow account at the time of bidding or revising existing bids. Institutional buyers are required to deposit only 10% of their bid-value since September 2005. Prior to this date, institutional investors were not required to pay any deposit when they submitted their orders. Retail investors can also bid at "cut-off" price, where the cut-off price is determined by a method similar to a Dutch auction. The role of the lead underwriter or Book Running Lead Manager (BRLM) is somewhat different in India than in the US. In India book manager does not bear the inventory risk associated with half of the IPO shares as the retail and non-institutional investors pay cash advance for their orders. With respect to these shares, the book manager acts mostly as an administrator.

2.2 Allocation:

The latest allocation rule across the RII:NII:QIB categories are 35:15:50. This was revised from the prior allocation rule of 25:25:50 valid until April, 2005.[4] . Unallocated shares from one of the undersubscribed categories may be redistributed to the other two categories on a proportional basis. For instance, if the retail category is unsubscribed and the other two are oversubscribed, then out of 100 unallocated shares from retail category, 77 should go to the institutional category and 23 to the non-

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On two occasions as much as 75% and 45% of the shares have been reserved for the institutional (QIB) and retail (RII) investors respectively.

institutional category.[5] If the non-institutional category does not have enough demand for all 23 shares but the institutional category does, then the leftover from the 23 shares should be distributed to the institutional category.

Bidders are required to have a brokerage account while bidding for any IPO that raises more than 100 million INR (2.2 million USD), essentially for all IPOs because the minimum capital raised was 5 million USD in the sample. Once the price and allocation is determined, a statutory public announcement is made showing the price and quantity allocated for each category and order size. Within each size bucket, allocations are proportional to bid size for all class of investors including QIBs. Before October 2005, however, QIB allocation was discretionary.

BRLM publishes an advertisement providing details of bids, oversubscription, basis of allotment etc. in an English and Hindi National daily as well as one Regional language daily circulated at the place where the IPO issuer is registered. In addition, the bidders are eligible to receive a confirmation within 15 days from the closure of the book in case they have received an allocation. All credits to the brokerage account of the bidders, and refunds in case of oversubscription, are made within 15 days through the registrar. The IPO starts trading within seven days of finalization of the issue, usually three weeks after the book closes. For a more detailed discussion on primary market and book-building in India please see Bubna and Prabhala (2006).

3. Data and sample construction:

Following regulatory changes, Indian firms started raising capital using the "book-building" method of IPOs towards the end of 2000. Hence, the first IPO in our data is from October 2000. We terminate the sample at September 2007 because the NSE could provide us with intraday data only until the end of that month when we received the data from them in June 2008. We restrict our analysis only to book-building IPOs from our analysis for two reasons. First, the demand data is less informative for

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$$\frac{100 \square 50}{50 \square 15} \approx 77$$

the fixed price IPOs, i.e. only quantity demanded is revealed at a single pre-specified price. Second, for the fixed price IPOs, demand from HNIs and institutions are frequently combined; this makes it difficult to construct a clean measure of heterogeneous belief vital to the current study.

All the bid and allocation data for this paper comes from Prime Database. Prime Database is the main source of primary market data in India and they provide information to academic institutions, institutional investors and the media. Information on the IPO underwriters come from the prospectus. Secondary market price, trading data after the IPO and market index data come from the archives of NSE and BSE, the two leading stock exchanges in India. Intraday order data for computing trading frequency, volume and probability of informed trade (PIN) come from the NSE. We obtain data on short term risk free rate from the Reserve Bank of India, India's central bank.

We begin with an initial sample containing all 207 book-building IPOs from October 2000 to September 2007 as identified by the NSE on its website. We exclude two firms that canceled their IPOs after the book-building period. We also eliminate 12 firms for which we do not have price information because they did not start trading at the NSE on the IPO date. We do not have order book information for another eight firms and exclude those as well. After these eliminations, we are left with 185 observations. Another five firms are lost because we do not have trading volume data or intraday price data for these firms even though they started trading at the NSE on the IPO date. We removed another 14 firms because of missing or incomplete order book data and our inability to compute the elasticity of demand, an important control variable in the literature. Hence, final sample consists of 159 firms for which we have the complete set of information.

3.1. Summary Statistics:

The average (median) IPO in our sample raised 97 (23) million USD. Thus, the representative IPO firm in our sample is smaller than its US counterpart. The smallest firm in the sample raised only 5 million USD while the largest raised 2.25 billion USD.

Return at the closing of first day of trading on average (median) for these IPOs on the national stock exchange (NSE) was 28.3 % (18.4%). Bombay stock exchange (BSE) had similar returns – 29.1% (18.5%). Most of the trading activity took place at the NSE and the shares were turned over on average (median) 1.6 (1.2) times.[6] The average (median) turnover when the BSE trading volume was included was 2.7 (2.0). These numbers are comparable to first day returns and trading volume in the USA. Filing range for the IPOs were about 13% of the offer price compared to the 20% range typically found in the USA. The average (median) price revision was 4.8% (6.3%) from the initial price indication.

4. Methodology and Empirical analysis

4.1 Methodology:

Harrison and Kreps (1978) argues that in an incomplete and/or imperfect market where investors can not take unrestricted long or short equity positions and may not be able to create an initial portfolio with which they will be happy forever. They argue that the right to sell the dividend stream at a future date and the possibility of the market reopening at a future date may create a *speculative bubble*. The *speculative behavior* that creates *bubble* is originated because trading possibility and right to resell an asset makes investors overpay in anticipation that some other investors will pay even more for the asset. This kind of behavior will not occur if the investors were forced to hold the asset in perpetuity and there need to be more than one period remaining. In addition, if all investors were homogeneous, then the expectation that some other investors will pay even more for the asset at a future date, goes away. Our set up is consistent with the kind of world Harrison and Kreps outlined. First, due to rationing, investors do not have a perfect portfolio. Second, they are heterogeneous in terms of their investment needs.[7] Finally,

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Turnover is computed as: total volume at the first day of trade / shares offered at IPO.

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We do not have any direct way to establish that the investors in our study have different expectations other than using their order data.

there is more than one period remaining and investors are likely to trade in the secondary market after the initial allocation of shares in the primary market.

In Harrison and Kreps (1978) investors are divided into a finite number of classes. Members of each class are homogeneous and they are infinitely wealthy as a class and are risk-neutral. All investors have the same set of information but members of different class may arrive at different subjective probability assessment based on that information. They use an example to demonstrate how a *speculative bubble* can occur.

They their example there are two classes of investors denoted by subscript i. Each class believes that the only relevant information for assessing probability of future economic events or state is the most recent dividend d_t where $\{d_1, d_2, \ldots d_T\}$ follows a stationary Markov chain with state space (0, 1). Further q_i (d, d') are the transition probability assessed by investor class i from state d to d'. Then they provide a specific numerical example where investor classes 1 and 2 have different matrix for transition from state 0 to state 1[8]. Based on their respective transition matrices members of each class at state d compute the present value of the future dividends and arrive at a different value.

In Harrison and Kreps (1978) at state 0, class 1 investors are more optimistic about transition to state 1 than class 2 investors. In contrast, class 2 investors are optimists about receiving dividends at a future date once state 1 occurs and a dividend has been declared. Class 1 investors have a more pessimistic view about dividend prospects beginning at state 1 but they can not sell short based on their belief. By construction, class 2 investors assess a higher value for expected future dividend based on their transition matrix irrespective of current state even though both classes have the same discount rate. Because class 1 investors are aware of the valuation of class 2 investors the market is not in equilibrium. A class 1 investor can buy stock in state 0 at a price even higher than the state 0 valuation of a class 2 investor (which is higher than the state 0 valuation of a class 1 investor) with the intention of selling it to class 2 investors at state 1 the first time transition to state 1 occurs. In other words, in setting a price for

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Each class is convinced that it knows the actual transition matrix.

the asset at state 0, class 1 investors have taken into account the beliefs of investors belonging to another class. Thus, the asset value is not longer the discounted value of future dividend and the opportunity to trade and realize a future capital gain creates a possibility that there no longer exist an objective "intrinsic value" for the asset.

To provide a direct empirical test to Harrison and Kreps (1978) becomes somewhat challenging. First, the authors concede in their concluding remarks that once the assumption of perfect foresight is dropped and private information is introduced into the system, things get more complicated.[9] In addition several researchers suggest that public information may not be that easily interpreted, can trigger private signals and some investors are specially skillful in interpreting public information and hence public and private information may not be completely uncorrelated, e.g. Kim and Verrecchia (1994, 1997), Vega (2006). Then the investors need to analyze price and trading volume to figure out what other investors know and a heterogeneous priors model may not be testable on its own without incorporating private information in the system.

Hence, in our empirical model, we hypothesize that the returns and trading volume are expressed as a function of heterogeneous expectations, public and private information and other control variables:

$$Return = f\,(HE_{primary}, \text{ public information, private information, } X)$$

$$Trading\ Volume = f\,(HE_{primary}, \text{ public information, private information, } X)$$

where X is a vector of control variables

Following the standard practice in IPO literature, we use market return two weeks prior to first day of trading as a proxy for public information.[10]

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Some critiques argue that agents arriving at different subjective probabilities based on the same public information in itself is "private information."

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For example, see Lowry and Schwert (2004), among others.

The hypotheses to be tested are given below (stated as the null):

H_1: The proxy for heterogeneous investor beliefs or dispersion does not affect prices in the secondary market after the IPO.

H_2: The proxy for heterogeneous investor beliefs or dispersion does not affect trading volume in the secondary market after the IPO.

H_3: Investors (retail) ignore adverse selection problems in their post-IPO trading decision.

We assume that institutional investors are informed, while HNIs can be informed at a cost and retail investors are uninformed.

4.2. Key variable construction

4.2.1. Proxy for private information

Private information is one of the key independent variables in our analysis. We use the probability of an informed trade (PIN) measure developed by Easley and O'Hara (1992) as a proxy for private information. For a detailed discussion of the empirical application of the PIN measure please see Easley, Kiefer, O'Hara, and Paperman (1996) and Easley, Keifer, O'Hara (1997). Table 1 reports the summary statistics for the PIN measure. For our sample the average (median) PIN is 0.065 (0.045).

4.2.2. Proxy for heterogeneous beliefs or heterogeneous expectations or dispersion

The key independent variable for the regression is heterogeneous belief or dispersion. We construct our proxy for heterogeneous expectations (HE) as below. Following Harrison and Kreps (1978), we assume that each investor within the retail, institutional and high net worth individual investor category has a representative belief aggregated in the actual demand or order data for that category. Next, we predict the expected demand or oversubscription for each category of investors based on the following model:

Oversubscription$_j$ *= f (total number of bidders, public information, private information, issue size, institutional allocation mechanism)*

where

j = QIB, Retail, HNI

QIBs are qualified institutional buyers, HNIs are non-institutional investors and retail are the retail investors.

We expect a positive relation between number of bidders and oversubscription and a negative relation between issue size and oversubscription because of possible rationing. In general, the literature reports a positive relation between positive public news and demand for IPO shares, for example, Loughran and Ritter (2002), Lowry and Schwert (2004). We also expect to see higher demand when the institutional allocation mechanism is more transparent (under "Auction" regime). Private information should be positively related to informed investor demand and unrelated to uninformed investor demand.

Assuming institutional investors and perhaps even HNIs are more sophisticated and presumably take advantage of the adverse selection problem rather than being taken advantage of, ideally we expect to see a positive relation between private information and oversubscription for these two categories. We assume that retail investors are less sophisticated and unaware of the adverse selection problem and hence expect no relation between private information and retail oversubscription. The critical assumption made here is in case of large retail oversubscription resulting in excessive rationing, retail investors will attempt to buy more shares the IPO firm once trading begins at secondary market. It follows from Harrison and Kreps (1978) that on occasion institutions and possibly even HNIs would be willing to increase their demand for IPO shares such that the market clearing price is above the true value of the IPO shares even when these investors are perfectly rational. This will happen only when there are enough retail investors willing to trade with the institutions and HNIs in the secondary market and pay even more for these shares. As private information problem worsens, however, the degree of oversubscription by retail investors should fall.

The model was estimated in sample. Due to our small sample size, we are unable to do out of sample test at this point. After estimating the predicted oversubscription for institution, HNI and retail investor categories, we compute the deviation in oversubscription for each of the three categories.

$$Dev_j = Oversubscription_j - Oversubscription_{j(predicted)}$$

$$Oversubscription_j = \frac{Demand_{p,j}}{Supply_{p,j}}$$

Where

p = clearing price for book-building IPOs

j = QIB, Retail, HNI

Heterogeneous expectations is then the square root of the sum of squared distance between any pair-wise investors classes:

$$HE_{Primary} = \sqrt{(Dev_{QIB} - Dev_{Retail})^2 + (Dev_{Retail} - Dev_{HNI})^2 + (Dev_{HNI} - Dev_{QIB})^2}$$

We argue that this measures of heterogeneous prior includes the order submission dynamics among and the potential future trading strategy by the three classes of investors. This combined measure of heterogeneous beliefs is also easy to use. On the other hand, it is possible that this measure is noisy. For instance, it is conceivable that disagreement between any two of the three classes of investors may drive the results and this measure would not be able to indicate which two of the three classes of investor beliefs translate into trading and price movement. Therefore, we also use the three components of the pairwise heterogeneous beliefs measure described above separately as shown below [11]:

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HE_{QIBR} is equivalent to abs(Dev_{QIB}-Dev_{Retail})

$$HE_{QIBR} = \sqrt{\left(Dev_{QIB} - Dev_{Retail}\right)^2}$$

$$HE_{RHNI} = \sqrt{\left(Dev_{Retail} - Dev_{HNI}\right)^2}$$

and

$$HE_{HNIQIB} = \sqrt{\left(Dev_{HNI} - Dev_{QIB}\right)^2}$$

This measure may be less noisy than the combined measure of heterogeneous prior described earlier. At the same time, it is also possible that these three sets of measure fails to capture the important interaction among the three classes of investors by leaving out one of the three classes as an explanatory variable any given time.[12]

In addition, we propose a third set of measures for heterogeneous beliefs where *DispRHNI* is the dispersion or heterogeneous belief between retail and non-institutional investors. Similarly, *DispRQIB* and *DispHNIQIB* are the heterogeneous beliefs between a representative retail and institutional investor pair and between a non-institutional and institutional investor pair respectively. The dispersion in beliefs between the two classes of investors is calculated by comparing the raw oversubscription for these two investor categories. Oversubscription is defined as demand at IPO offer price or higher price divided by the supply for each category as well as for the IPO as described in the previous page.

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Our combined measure of heterogeneous priors may be analogous to the transcript of a three way conference call involving three parties while our pairwise measure may be analogous to a document that combines the transcripts from three conversations between party 1 and 2, 2 and 3 and 3 and 1 on the same subject.

Dispersion is computed such that it becomes a positive number. For instance, if the category oversubscription for retail investors is 10 and for non-institutional investors is 22, then the dispersion in beliefs are computed as follows:

$$DispRHNI_1 = abs(22 - 10) = 12$$

or, $\log(1+DispHNI_1) = 1.11$

This proxy for dispersion uses the raw oversubscription data which is measured with respect to the expected allocation of shares for each category and not with respect to any common denominator. For instance, if 35% and 15% of the IPO shares are reserved for the retail and non-institutional investors respectively then an oversubscription ratio of 10 for retail categories and 22 for non-institutional investors translate into the following oversubscription ratio with respect to the total shares offered in the IPO:

Retail = 10 · 0.35 = 3.5

Non-institutional investors = 22 · 0.15 = 3.3

If we use these adjusted oversubscription ratios, we obtain the following additional measure of dispersion:

$$DispRHNI_2 = abs(3.5 - 3.3) = 0.2$$

4.2.2.1 Oversubscription – what drives it

Table 1 provides the summary statistics for demand and allocation for all three classes of investors. Average (median) retail investors demanded shares worth USD 940 (926) and received allocation for shares valued at USD 251 (140). In contrast, average (median) HNI demand for shares was for 251.0 (142.6) thousand USD and allocation received was for 24.3 (13.9) thousand USD. Finally, on average (median) institutions demanded shares worth 5.75 (2.73) million USD and were allocated 567.7 (247.0) thousand dollars worth of shares. This resulted in an average (median) oversubscription of 13.2 (7.3), 36.1 (14.6) and 25.5 (12.7) for retail, HNI and institutions respectively.

Table 2 reports the results from the regressions to predict oversubscription for the three classes of investors. Our prior was that all else being equal, an increase in the number of investors in each class will increase demand or oversubscription for that class. Consistent with this prior, we find that increasing the number of institutions by one standard deviation(155 institutions) results is an increase in oversubscription by 33 times. In comparison, one standard deviation increase in the number of HNI applications (1519) and retail bidders (262743 applicants) results in an increase in oversubscription by 52 and 16 times respectively. Total number of bidders by itself explains more than 60% variability for institutional and retail oversubscription and about 50% variability in the HNI oversubscription.[13] This result is also consistent with the assumption that none of the three investor classes face any binding wealth constraint and that collectively they are infinitely wealthy.

Also note that we have included the probability of informed trading (PIN) in this regression. Recall that our measure of heterogeneous beliefs as described is based on residual (actual - predicted) oversubscription by the three classes of investors. In order to test our hypothesis, our primary objective is to compare the explanatory power of heterogeneous beliefs measure against that of private information. Hence, we need to orthogonalize our measure of heterogeneous prior against our PIN measure. This is done by working with the residual oversubscription that is not contaminated by PIN.

Table 2 also suggests that private (and asymmetric) information reduces demand by HNIs. One standard deviation increase in probability of informed trading is associated with a reduction in the quantity of shares that HNIs demand by 25% of their allocation. This implies that HNIs are quite sophisticated and are aware of adverse selection problems. Thus we are able to reject the null for the third

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Please note that the third, sixth and the ninth regression in table 2 are therefore misspecified for omitting this critical variable and shown to demonstrate the explanatory power of this variable.

hypothesis that "investor ignore adverse selection problem in their post-IPO trading decision" for the HNIs.

In contrast, one standard deviation increase in the probability of informed trading is associated with an increase in the quantity of shares demanded by retail investors by 17% of their allocation. This does not necessarily imply that retail investors are less sophisticated and unaware of the adverse selection problem they face. This may be an artifact of reverse causality. It is plausible that institutions observe the retail demand or oversubscription prior to trading begins and the order flow in the post-IPO trading and the high probability of informed trade is an effect of the excess retail subscription. Note that demand by the institutional investors is not affected by private information.

Finally, we assume that all investors have the same public information and include a commonly used proxy in the IPO literature for public information which is market return in the two weeks prior to the date on which bookbuilding ends.

Ex-ante, we expect retail investors to overweigh the public information proxy and their demand should be uncorrelated with private information proxy. In contrast, institutional investor demand should be uncorrelated with public information proxy and positively related with the private information proxy. HNI demand can mimic the demand by retail or institutional investors depending on whether the HNIs have invested in information acquisition and analysis of such information. We observe that only retail investors tend to overweight public information in submitting their demand. Hence, we confirm that that retail investors are less informed as argued in the literature while the same can not be said about the HNIs. We also control for issuer size, as proxied by the capital raised, another measure of firm specific public information used in IPO literature.

Prior to December 2005, the book managers could use a discretionary allocation mechanism only for the shares reserved for the institutions. The allocation for the other two categories were in proportion to the demand. After that date the book-manager is required to allocate shares in proportion to the demand even for the institutions. We identify the IPOs after this date with an indicator variable "Auction" which takes a value of 1 if the IPO is after this date and 0 otherwise. From table 2 we observe that when the institutional allocation mechanism became more transparent as a result of removing discretionary allocation authority from the IPO book manager after December 2005, institutional and HNI demand increased by 57% and 89% of their respective share allocation.

4.2.2.2. Heterogeneous beliefs or expectations – what drives it

We hypothesize that heterogeneous expectations increases with the number of bidders The explanation is simple and intuitive; when the number of investors are small, initially there is less disagreement because each investor has one opinion about the true value of the asset and such opinion is more likely to be unique. It may be easy to have consensus when the numbers are small and opinions become fractious and disparate when the number of participants increase and opinion about true value of the asset diverges. This kind of behavior is frequently observed in social settings.   In fact that is one reason why some companies prefer individual investors as shareholders rather than institutions.

We compute pairwise heterogeneous belief or dispersion measure by taking the difference between the residual oversubscription for each pair of investor classes obtained from regressions shown in table 2. For instance, to obtain the heterogeneous expectations measure between institutions and retail investors, for each observation, we subtract the residual from model 4 in table 2 from that of model 1. Similarly, for the heterogeneous expectations measure between HNI and retail investors (retail investors and institutions), we subtract the residual from model 7 (model 1) in table 2 from that of model 4 (model 7) .

We need to eliminate the possibility that our dispersion or heterogeneous expectations measures are related to the oversubscription for one of the two or even three classes of investors and to avoid the multicollinearity problem that may arise from using both oversubscription ratio as well as the proxies for dispersion as independent variables in our empirical analysis. Hence, for our main analysis, we use the residual values for dispersion obtained from the following regression:

$$DispRQIB_i = \kappa_0 \square \kappa_1 \square Oversubscription_i \square \xi_i$$

where

$$Oversubscription_i = \frac{S_{supply_i}}{S_{demand_i}}$$

where the subscript denotes the ith IPO.

In other words, we orthogonalize this measure one more time against the categorywise oversubscription for the three classes of investors as shown in table 3. The residuals from model 1, 3 and 5 of these regressions are used as the measure of heterogeneous belief between the respective pair of investor classes.

Table 3 shows that oversubscription or excess demand by institutions is positively related only to the pairwise heterogeneous belief measure involving its own class, i.e. between the institution and HNIs and institutions and retail investors. An increase in excess demand by institutions equivalent to its aggregate share allocation is associated with 29% (36%) increase in heterogeneous beliefs as proxied by excess demand differential between institutions and HNI (institutions and retail investors) that can not be explained by other factors.

In contrast, excess demand by HNIs affects the heterogeneous belief measure not only involving its own class but also that of the unrelated classes, i.e. between institutions and retail investors. An increase in excess demand by HNI equivalent to its aggregate share allocation is associated with 54% increase (75% decline) in heterogeneous beliefs as proxied by excess demand differential between HNI and retail investors (institutions and HNI) respectively that cannot be explained by other factors. In addition, increase in excess demand by HNI equivalent to its aggregate share allocation is associated with 23% decline) in heterogeneous beliefs between institutions and retail investors that can not be explained by other factors.

Finally, excess demand by retail investors affects the heterogeneous belief measure partially involving its own class and also that of the unrelated classes, i.e. institutions and HNI. An increase in excess demand by retail investors equivalent to its aggregate share allocation is associated with 47% decline in heterogeneous beliefs as proxied by excess demand differential between HNI and retail investors that can not be explained by other factors. In contrast, such increase in excess demand has no impact on heterogeneous beliefs between institution and retail investors and inflates the heterogeneous beliefs between institutions and HNI by 39%.

In addition, dropping the retail oversubscription from the "Dispersion: Institution to HNI" in model 6 of table 7 reduces the explanatory power of the model by more than 25%. Similarly, not including HNI oversubscription in "Dispersion: Institution to Retail" regression (model 9) reduces the explanatory power of the model by more than 30%

It also appears that as an investor class HNIs do not demonstrate "herding" behavior in their order submission while the retail investor class and institutions herd together and oversubscribe certain IPOs. Hence, excess demand by retail investors get offset by matching excess demand by institutions while the contrarian order submission strategy by the HNIs widens the demand differential between institutions and HNIs. In summary, while the impact of excess demand on heterogeneous expectations was as predicted for the institutions it is not so for the other two classes of investors. It is possible that all three classes of investors adjust their demand based on the demand of the other two investor classes, which is publicly available information.

4.2.2. Dependent variables

For testing our main hypotheses, the dependent variable in the first regression is initial or first day return at the close of the first trading day and is computed relative to the IPO offer price, i.e. $Day\ 1\ Return = (P_{day1close} / P_{offer}) - 1$. Closing prices are obtained from the archives of BSE and NSE. If the IPO starts trading at the BSE and the NSE then initial return is the average of the returns of these two exchanges.

The dependent variable in the second regression is the total trading volume at the first day of trading divided by the number of shares offered at the IPO.

The empirical models to test our first and second hypotheses take the following general form and are estimated using OLS regressions:

$$Day\ 1\ Return_i = \beta_0 + \beta_1 DispRHNI_i + \beta_2 DispRQIB_i + \beta_3 DispHNIQIB_i + \beta_4 Control_i + \varepsilon_i$$

$$Turnover_i = \alpha_0 + \alpha_1 DispRHNI_i + \alpha_2 DispRQIB_i + \alpha_3 DispHNIQIB_i + \alpha_4 Control_i + \omega_i$$

If β_1, β_2, β_3 and α_1, α_2, α_3 are significantly different than zero then the first two nulls will be rejected and we will confirm that heterogeneous beliefs affect prices and trading volume, respectively. If α_1, β_1 and α_2, β_2 are equal to or smaller than α_3, β_3 then the third null will be rejected and we will confirm that retail investors do not ignore the adverse selection problem while trading with institutions and HNIs. Please recall that we assumed institutional investors to be informed, while HNIs can be informed at a cost and retail investors are uninformed. Based on the institutional set-up, we take short selling constraint as given and assume that institutional investors are informed, retail investors are not and the high net worth individuals can be informed after incurring a cost.

Please note that while we show pairwise heterogeneous beliefs measure in the equations presented above, we report results using both the pairwise measures as well as the combined measures presented earlier. As discussed earlier, we anticipate that our measure of heterogeneous belief that combines the relevant information from all three classes of investors will dominate the performance of pairwise measures. While this combined single measure heterogeneous beliefs is easy to use, it is possible that this measure is noisy. For instance, it is conceivable that disagreement between any two of the three classes of investors may drive the results and this measure would not be able to indicate which two of the three classes of investor beliefs translate into trading and price movement. In addition, we are not able to test our third hypothesis using the combined measure and hence need to use the pairwise measure.

The Pearson correlation table in the appendix shows that our heterogeneous prior measures, i.e. the residuals from the regressions in table 3 has no correlation with IPO oversubscription and low or negative correlation with other control variables.

4.2.3. Elasticity of demand and other control variables

Elasticity of demand is the proxy for dispersion or heterogeneous belief suggested by Cornelli & Goldrich (2003). The descriptive statistics in table 1 suggests that demand elasticity depends on the estimation point. Elasticity is computed at one tick above the minimum price, one tick below the maximum price and over the entire filing range. Tick size is the distance between two adjacent and valid limit prices. Elasticity over the entire price range is much lower than elasticity measured around the offer price (not reported) and at the minimum price. This is expected because of the endogenous choice of final offer price around the point of sharpest change in demand elasticity. Hence, we use the elasticity over the filing range as a control variable.

We do not use any firm spec0ific variable as control other than size because the three groups of investors have access to the same information for each IPO.[14] We use expected proceeds from the IPO to control for any systematic preference for firm size that may exist among different classes of investors. We also control for market condition around the IPO as well as any upward adjustment in the offer price to control for "partial price adjustment effect" overall demand for the IPO shares.

4.3. Heterogeneous beliefs and prices in the primary market

If heterogeneous beliefs inflate prices of risky assets in the secondary market, how do managers adjust offer prices in the primary market in response to heterogeneous beliefs? When managers have a

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It is possible that three classes of investors may weigh the firm specific variables differently. In that case it is plausible that these variables affect returns and turnover differently.

long decision horizon, we expect them to adjust offer prices downward because in the long run beliefs will converge and prices will decline.

The results are reported in table 4. In response to an increase in total oversubscription by 100% of the shares offered (one standard deviation), issuers increase the final offer price by 11% (28%). Our measure of dispersion does not affect IPO offer price. On the other hand, elasticity, the proxy for dispersion or heterogeneous belief suggested by Cornelli & Goldrich (2003) influences the offer price. One standard deviation increase in elasticity is associated with 1.8% reduction in the offer price. These results generally conform to previous findings in IPO literature. Please note that this regression does not include PIN measure as we need trading data to compute PIN.

4.5. Joint behavior of prices and volume in the secondary market

We assume than institutional investors have superior information. Therefore, we anticipate that retail investors will be less willing to trade in the secondary market when the dispersion of belief is large between the institutional and retail investors. Retail investors get to observe the demand of the institutional investors before trading begins in the secondary market. While high net worth individuals can acquire high quality information at a cost, they are assumed to be less informed than the institutional investors. As a result, we should observe fewer trades when large dispersion in valuation exists between institutional and retail investors. This can be characterized as the adverse selection problem.

Table 4 presents the first stage regression where return (price) and trading volume (share turnover) is estimated simultaneously. This table suggest that at the NSE one standard deviation or 47% increase in return results in an increase in trading volume equivalent to 2.4 times of shares offered at IPO. When we include BSE in our study, one standard deviation or 50% increase in return results in an increase in trading volume that is equivalent to 2.3 times of shares offered at IPO. An increase in trading volume of one standard deviation or 1.6 (2.5) times the shares offered in the IPO at NSE (NSE+BSE) results in 74% (76%) increase in the first day return.

In table 5 we find similar strong results when we use trading frequency as an alternative measure for trading intensity. Trading frequency is defined as log (number of buy trades) – log (number of sell trades) where the buy and sell initiated trades are classified using the Lee-Ready algorithm. In other words, if an order executes above (below) the midpoint of the last quoted bid and ask price, we classify that trade as a "buy" ("sell"). This table shows that one standard deviation (47%) increase first day return is associated with an increase in net buy orders that are about one third standard deviation or 50% higher than predicted otherwise. Similarly, one standard deviation increase in trading or net buy frequency results in 16% higher first day return. We have the trading frequency data only from the NSE and unable to include the BSE results in the table.

4.6. Trading volume in the secondary market - heterogeneous beliefs or private information

Panel A of table 6 addresses the question whether heterogeneous prior affects trading volume once private information has been controlled for. The answer is no. The p-values associated with our measure of heterogeneous belief is higher than 0.05 and the explanatory power of the model remains the same once we exclude the proxy for heterogeneous prior from the regressions. In contrast, one standard deviation increase in private information results in 18% lower share turnover at NSE and 25% lower turnover when trading at both BSE and NSE are considered. Removing the proxy for private information also decreases the explanatory power of the models by more than 20%. Using pairwise dispersion measures instead of the combined measure yields almost identical results (panel B table 6).

In unreported results (available upon request) we observe that if we did not analyze return and trading simultaneously and did not include our PIN measure for private information, share turnover during the first-day of trading is significantly reduced from the baseline turnover of 1.4 (1.7) in the entire sample (after the regulatory shock) when dispersion between institutional and retail investors is high. One standard deviation increase in the residual dispersion between these two groups of investors results in 14% lower turnover for the entire sample and 24% after the regulatory shock. These results may indicate that the adverse selection problem affects trading volume (turnover) and is consistent with Foster and Vishwanathan (1991). In other words, retail investors are aware of the adverse selection problem and apprehensive about trading against the institutional (assumed informed) investors.

In table 7, we try to assess the impact of heterogeneous beliefs on trading frequency (or frequency of buy trades – frequency of sell trades) instead of trading volume. This table does not support the idea that a high or low frequency of institutional, HNI or retail investor base influences trading frequency on the first day in any manner. More surprisingly, we do not observe that private information is driving trading frequency. In contrast, we find that it is heterogeneous beliefs that's driving the trading frequency. Specifically, for those IPOs where heterogeneous belief is in the highest quintile, for every sell trade, we observe 2.53 buy trades. In addition, heterogeneous belief from the model reduces the explanatory power by 25% . This contradicts the results we find in panel A of table 6.

4.5.1 . Which investors trade more

Evidence provided by Aggarwal (2003) from a US study suggests that institutional investors tend to trade or flip their shares more frequently relative to the retail investors in the first two days after the IPO. In our dataset we find that HNIs are the most frequent traders following an IPO and both institutions and retail investor classes have longer investment horizon than HNIs. For those IPOs where the number of institutional and retail investors are in the highest quintile or Q5 (among all IPOs) total share turnover decreases by 30% and 36% respectively, relative to the rest of the IPOs. From regression 4 in panel A of table 6 we observe that for those IPOs, where the number of institutional and retail investors are in the lowest quintile or Q1, the total share turnover increases by 31% and 28% respectively . Using pairwise dispersion measures instead of the combined measure yields almost identical results (panel B of table 6).

4.6 . Price in the secondary market - heterogeneous beliefs or private information

In the last section we observed that our private information proxy, PIN, affect trading volume but heterogeneous expectations do not. Panel A of table 8 addresses the question whether PIN or heterogeneous beliefs affect returns at the first day of trading. Here, the results go in favor of our heterogeneous prior. For those IPOs where heterogeneous prior is in the highest quintile, return is 16.5% higher on the first day trading. Our heterogeneous beliefs measure increases the explanatory power of the model by 5%. We also notice that for those IPOs where number of HNI investors are among the highest quintile, the return is about 25% - 28% higher after controlling for other factors. Thus, it is the HNI and not the institutional investors who appear to be informed.

Panel B in table 8 uses the pairwise measures of heterogeneous beliefs instead of the combined measure. We observe that the return is primarily driven by the differences in opinion between the institution and the retail class. Surprisingly, the results go against the theoretical prediction. We expected to see when the heterogeneous belief is low or investors are in agreement, returns should also be low. Instead we observe 18% - 22% higher return for those IPOs where heterogeneous prior between institution and retail investor class is in the lowest quintile. We argue that using the pairwise measures of heterogeneous priors ignores the important interaction among the three classes of investors and that the pairwise measure is simply unable to capture the dynamics between the HNI, institutions and retail investors. Thus it ends up providing counterintuitive results. Please note that for the rest of the empirical analysis, we have been able to produce qualitatively similar results when we substituted the combined measure with the pairwise measures.

Table 9 reports results similar to panel A of table 8 but uses the return is orthogonalized against trading frequency instead of trading volume or turnover. For those IPOs where differences in opinion is the greatest, first-day return is about 25% higher and the dispersion variable adds more than 10% explanatory power.

4.7. Portfolio performance

If investors from all categories systematically oversubscribe all IPO, then all three portfolios should have very similar return. The only way one portfolio can win (lose) over another is by avoiding the losers (winners). To check this, we create three basic portfolios for each of the retail, HNIl and institutional investor categories. We compute the return of a naïve (uninformed) investor from each of the three classes who submits an order for equal dollar value for each of these IPOs. In other words, if her endowment is for W dollars and the number of IPOs are I, she submits an order for W/I dollars for each of these IPOs. She is a price taker and if she is representing an institution she always bids at the high filing price for the IPO.

Results in table 10 suggests that if an uninformed institution equally weights all the IPOs and distributes its endowment equally among all IPOs, it will earn a return of - 4.84%. The corresponding numbers for HNI and retail investors are - 2.59% and - 4.12% respectively. This result is not consistent with Rock (1986) model which suggests that in equilibrium uninformed investors earn zero return on IPOs as all category of uninformed investors earn negative return.

4.8. Policy implications - discretionary vs. proportional allocation

The arguments for discretionary allocation of IPO shares are superior price discovery and more efficient pricing. In this section we compare first day return before and after the regulatory change that eliminated discretionary allocation of IPO shares for institutional investors.

After the regulatory change, IPOs on average had a 2.7% lower first day return. This difference is statistically significant. If we eliminate the first 13 IPOs that were undersubscribed to a large extent and hence had negative or relatively low return (an average of 6%), then the difference becomes even starker. Eliminating early IPOs increases the average return of the rest of the IPOs before the change to 39.3%, or 8.2% higher than the average return after the change. While a causal inference between regulation and IPO underpricing may not be drawn based on the current methodology, it is worth noting that the average daily and monthly market returns were much higher between October 2005 to September 2007 or after the regulatory change relative to before such change took place.

A similar before and after comparison for each portfolio indicates several new results. First, employees as a class are able to avoid the risky IPOs, but mutual funds and insurance companies are not. The conclusion is mutual funds and insurance companies may not have any specific skills to avoid losing

IPOs and much of their early success could be attributed to the discretionary allocation system. So, if mutual funds and insurance companies are worse off under more transparent allocation mechanism, which of investors are better off?

Among institutional investors, performance of the foreign institutional investors now becomes second best only after the VC. This is true irrespective of whether we compare raw return, Sharpe ratio or Sortino ratio. In addition, banks and financial institutions start performing better than before and this is true for both raw return and risk adjusted return. Mutual funds and insurance companies on the other hand perform considerably poorly on both respects.

4.9. Robustness Check

The results remain very similar when we include "price improvement", the most important variable in IPO literature in explaining first day return. Price improvement is defined as ($P_{offer\ -}$ / $P_{midpoint\ of\ the\ initial\ filing\ range}$) -1. When we add this variable in our model, another 13 firms in the early part of the sample were dropped because those firms did not specify a filing range and only specified a minimum offer price and hence had missing information for price improvement. Our results do not change for this smaller sample of 146 firms – price improvement is neither significant at 10% level nor does it add anything to the explanatory power of the model.

We obtain identical results when we redefine share turnover, our measure for trading volume as [total volume at the first day of trade / (shares offered at IPO – shares under lock up)]. The results also remain qualitatively similar if we use the alternative measures of dispersion such as $DispRHN_1$ and $DispRHNI_2$ described in section 4.2.2.. In addition, we also use a third measure where we first normalize the oversubscription ratio for each category of investors for each IPO with the standard deviation of the oversubscription ratio for each category among all IPOs. The results remain qualitatively similar .

5. Conclusion

Miller (1977) predicts that heterogeneous beliefs inflate short-term prices in the secondary market when short selling constraint exists. In a dynamic setting, when trading is possible among these heterogeneous agents, the impact of heterogeneous beliefs needs to be analyzed in combination with the adverse selection problem where some traders may have private information. Using a new dataset from India we find that private information affect trading volume. One standard deviation increase in private information results in 18% lower share turnover at the first day of trading. Failure to incorporate private information in the regressions reduces the explanatory power of the models by more than 20%.

If we use trading frequency or the difference between buy and sell trades (net buy) instead of share turnover as a measure of trading volume, opposite results emerge. We do not observe that private information is driving trading frequency. In contrast, we find that it is heterogeneous belief that's driving the trading frequency. Specifically, for those IPOs where heterogeneous belief is in the highest quintile, for every sell trade, we observe 2.5 buy trades. In addition, dropping our heterogeneous belief measure from the model reduces the explanatory power by 25%. Thus, it appears that trading volume is driven by private information while trading frequency or net buy trades are driven by heterogeneous beliefs.

The higher frequency of buy trades associated with above average level of heterogeneous beliefs do translate into higher returns. For those IPOs where heterogeneous prior is in the highest quintile, return is 17% to 25% higher on the first day trading. Heterogeneous belief measure increases the explanatory power of the model by 5%. Thus, we conclude that heterogeneous belief indeed enhance trading imbalance and results in significantly higher first day return. This price impact of our heterogeneous belief measure could be interpreted either as behavioral bias or information processing and analyzing cost.

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Table 1. Descriptive Statistics

Proceeds are computed by multiplying the offer price with the number of shares offered and converting to US dollar using the average exchange rate between the date the book closes and the IPO starts trading. *Return* = $(P_{closing} / P_{offer}) - 1$ where $P_{closing}$ and P_{offer} are the closing price at the first day of trade and the IPO offer price, respectively. *Price adjustment is* $(P_{offer} / [(P_{high\ price} + P_{low\ price})/2] - 1)$. Filing range is: $(P_{high\ price} - P_{low\ price}) / P_{offer}$. *Retail oversubscription* is defined as: *[total demand of shares from retail investors at offer price and above / shares sold at the IPO · retail allocation %]*. Oversubscription for other class of investors are defined likewise. *Retail demand* by each bidder is defined as *aggregate demand at or above offer price / number of valid bidders*. *Retail allocation* to each bidder is defined as *aggregate allocation to retail investors / number of retail bidders that received allocation*. Demand and allocation for other class of investors are defined likewise. *Elasticity* is $[(Q_{high\ price} - Q_{low\ price})/\{(P_{high\ price} - P_{low\ price})/(P_{high\ price} + P_{low\ price})/2\}]$ *where Q is quantity demanded*. *Turnover* is computed as: *[total volume at the first day of trade / shares offered at IPO]*. *PIN* is probability of informed trade (detail on page 10).

Variables	No Of Obs	Mean	Median	Std Dev	Min	Max
Proceeds, mil INR	185	4235	1001	11612	213	91875
Proceeds, mil USD	185	97	23	267	5	2250
Initial Return, NSE %	185	28.3	18.4	47.1	-48.2	241.0
Initial Return, Average %	185	29.1	18.5	50.0	-46.5	340.0
Turnover, NSE	180	1.6	1.2	1.6	0.0	10.9
Turnover, Total	180	2.7	2.0	2.5	0.0	12.6
Offer Price, INR	185	205	144	191	10	1100
Price Adjustment, %	185	4.8	6.3	4.9	-14.9	9.1
Filing Range, % of offer price	172	13.3	13.7	3.7	3.8	31.3
Oversubscription	185	24.5	14.8	27.2	0.9	153.9
Retail	185	13.2	7.3	17.6	0.0	136.8
High net worth individuals	185	36.1	14.6	49.9	0.0	307.0
Institutional	185	25.5	12.7	31.6	0.2	169.0
Allocation to each bidder, USD						
Retail	183	251	140	292	9	2346
High net worth individuals	183	24322	13910	36350	1670	344900
Institutional	182	567664	246894	1147292	28010	11705000
Demand by each bidder, USD						
Retail	183	940	926	340	1	2346
High net worth individuals	183	250972	142567	297314	3750	2239400
Institutional	182	5747366	2728583	8142771	262000	59900000
Elasticity						
One tick above the minimum price	166	12.3	0.6	41.4	0.0	419.8
Over the filing range	166	1.0	0.2	2.1	0.1	20.5
PIN	172	0.065	0.045	0.071	0.486	0.001

Table 2. Predictive Regression - Oversubscription for the Three Classes of Investors

This table shows number of bidders as the key determinats of oversubscription for the IPOs in the sample. Dependent variable *Retail Oversubscription* is defined as: *[total demand of shares from retail investors at offer price and above / shares sold at the IPO · retail allocation %]*. Oversubscription for other class of investors are defined likewise. *No of Bidders* is *log (No of retail bidders + No of institutional bidders + No of HNI bidders)*. *PIN* is probability of informed trade (detail definition is on page 10). *Institutional Allocation: Auction* takes the value of 1 since December 2005 and 0 otherwise. *Market Return in Prior Two Weeks* is *$[(P_{-1} / P_{-10}) -1]$* where P_{-1} *and* P_{-10} are the *closing prices for S&P CNX 500*, the leading index for the 500 largest companies traded in the National Stock Exchange (NSE) in India for the day before and 10 trading days before the IPO date, respectively. *Issue size* is log *(1+ proceeds in million USD)*.

Variable	Institutional Oversubscription			Retail Oversubscription			HNI Oversubscription		
No of Bidders (log)	1.038***	1.052***		0.805***	0.757***		0.991***	1.015***	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
PIN	-0.793		-3.989*	2.452***		-7.422***	-3.634**		-6.275**
	(0.286)		(0.015)	(0.000)		(0.000)	(0.008)		(0.003)
Institutional Allocation: Auction	0.567***	0.477***	0.192	0.142	-0.069	-0.665**	0.887***	0.920***	-0.734*
	(0.000)	(0.000)	(0.460)	(0.122)	(0.268)	(0.002)	(0.000)	(0.000)	(0.027)
PIN · Institutional Allocation: Auction	-2.023		-3.049	-1.904		0.456	-2.536		-2.802
	(0.118)		(0.287)	(0.052)		(0.848)	(0.290)		(0.443)
Market Return in Prior Two Weeks	-0.114	0.371	5.384*	1.726*	1.463*	4.443*	2.668	3.692*	6.400*
	(0.907)	(0.694)	(0.012)	(0.0191)	(0.043)	(0.012)	(0.136)	(0.041)	(0.019)
Issue Size	-0.352***	-0.346***	0.239**	-0.708***	-0.702***	-0.264***	-0.855***	-0.810***	-0.086
	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.398)
Intercept	5.511	5.264	-2.292	7.838	8.477	8.496	14.544	13.098	5.348
	(0.000)	(0.000)	(0.184)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.016)
No Of Obs	170	182	171	183	170	171	170	183	171
Adjusted R^2	0.838	0.838	0.209	0.876	0.873	0.253	0.633	0.601	0.149

Table 3. Pairwise Heterogeneous Expectations or Dispersion Measure

This table shows the influence of oversubscription by HNI, institutions and retail investors on the alternative pairwise measure of heterogeneous prior. The dependent variable *Heterogeneous Expectations: HNI to Retail* or HE_{HNIR} is defined as $\sqrt{(}\ Dev_{HNI} - Dev_{Retail}\ )$ where Dev_{Retail} is $oversubscription_{Retail} - oversubscription_{Retail(predicted)}$ from table 2. $Oversubscription_{Retail}$ is defined as: *[total demand of shares from retail investors at offer price and above / shares sold at the IPO· retail allocation %]* and $oversubscription_{Retail(predicted)}$ is obtained from model 4 in table 2. Dev_{HNI} is obtained likewise. *Heterogeneous Expectations: Institution to HNI* and *Heterogeneous Expectations: Institution to Retail* are obtained in a similar manner. *PIN* is probability of informed trade (detail definition is on page 10). *Institutional Allocation: Auction* takes the value of 1 since December 2005 and 0 otherwise.

Variable	Heterogeneous Expectation: HNI to Retail			Heterogeneous Expectation: Institution to HNI			Heterogeneous Expectation: Institution to Retail		
Oversubscription: Institutions	0.054 (0.403)	0.016 (0.800)		0.289*** (0.000)	0.312*** (0.000)	0.285*** (0.000)	0.355*** (0.000)	0.341*** (0.000)	0.221*** (0.000)
Oversubscription: HNI	0.539*** (0.000)	0.556*** (0.000)	0.568*** (0.000)	-0.744*** (0.000)	-0.754*** (0.000)	-0.497*** (0.000)	-0.232*** (0.000)	-0.228*** (0.000)	
Oversubscription: Retail	-0.466*** (0.000)	-0.495*** (0.000)	-0.497*** (0.000)	0.392*** (0.000)	0.410*** (0.000)		-0.036 (0.607)	-0.043 (0.524)	-0.227*** (0.000)
PIN	1.170 (0.209)			-0.689 (0.540)			0.273 (0.713)		
Institutional Allocation: Auction	0.116 (0.449)	0.179 (0.115)	0.188 (0.079)	-0.363 (0.051)	-0.402** (0.003)	-0.384** (0.007)	-0.244* (0.046)	-0.200* (0.026)	-0.105 (0.240)
PIN · Institutional Allocation: Auction	1.821 (0.255)			-1.117 (0.563)			0.969 (0.447)		
Intercept	-0.813 (0.000)	-0.600 (0.000)	-0.592 (0.000)	0.733 (0.002)	0.605 (0.001)	0.836 (0.000)	-0.126 (0.410)	-0.066 (0.567)	-0.033 (0.781)
No Of Obs	169	169	169	170	170	170	169	169	169
Adjusted R^2	0.403	0.388	0.392	0.353	0.36	0.293	0.211	0.215	0.148

Table 4. Simultaneous Estiamtion of Return and Turnover at the First Day of Trade

This table estimates the return and share turnover simultaneously.The dependent variables are the share turnover and the return at the first day of trading. *Turnover at NSE = [log(1+total volume at the first day of trade at NSE / shares offered at IPO)]*. *Return at NSE* is defined as $(P_{closing} / P_{offer}) - 1$ where $P_{closing}$ and P_{offer} are the closing price at NSE at the first day of trade and the IPO offer price, respectively. In the second set of regressions *Total Turnover = NSE turnover + BSE (Bombay Stock Exchange) turnover* where *turnover at BSE* is defined analogous to turnover at NSE. *Total Return* = $[(Return_{NSE} + Return_{BSE}]/2$ where return at BSE is defined analogously to the return at NSE. While arbitrage opportunity between the two exchanges may exist at the opening of the first day of trade, none exists at the close.

	NSE		Total	
Variable	Turnover	Return	Turnover	Return
Turnover		0.476***		0.302***
		(0.000)		(0.000)
Return	0.526***		0.452***	
	(0.000)		(0.000)	
Intercept	0.672	-0.109	0.976	-0.043
	(0.000)	(0.072)	(0.000)	(0.554)
No Of Obs	176		182	
Adjusted R^2	0.246		0.132	

Table 5. Simultaneous Estiamtion of Return and Trading Frequency at the First Day of Trade

This table estimates the return and trading frequency simultaneously. The dependent variables are the *trading frequency* and the *return* at the first day of trading. *Trading Frequency = log (number of buy trades) – log (number of sell trades).* If an order executes above (below) the midpoint of the last quoted bid and ask price, we classify that trade as a "buy" ("sell") following Lee-Ready algorithm. *Return* is defined as $(P_{closing} / P_{offer}) - 1$ where $P_{closing}$ and P_{offer} are the closing price at the first day of trade and the IPO offer price, respectively. These are computed only for the National Stock Exchange (NSE) as we do not have high frequency data from the Bombay Stock Exchange.

	NSE	
Variable	Trading Frequency	Return
Trading Frequency		1.020***
		(0.000)
Return	0.115***	
	(0.000)	
Intercept	0.005	0.245
	(0.715)	(0.705)
No Of Obs	176	
Adjusted R^2	0.112	

Table 6. Share Turnover (Orthogonalized against Day 1 Return) and Heterogeneous Expectations

This table shows how heterogeneous expectations affect share turnover. The dependent variables are the *share turnover at NSE* and *total share turnover* orthogonalized against the day 1 return. *Turnover* at NSE = *[log(1+total volume at the first day of trade at NSE / shares offered at IPO)]. Total Turnover = NSE turnover + BSE (Bombay Stock Exchange) turnover.* Our primary measure of Heterogeneous Expectations = $\sqrt{[(Dev_{QIB} - Dev_{Retail})^2 + (Dev_{Retail} - Dev_{HNI})^2 + (Dev_{HNI} - Dev_{QIB})^2]}$ where Dev_{Retail} is $oversubscription_{Retail} - oversubscription_{Retail(predicted)}$. $Oversubscription_{Retail}$ is defined as: *[total demand of shares from retail investors at offer price and above / shares sold at the IPO· retail allocation %]* and $oversubscription_{Retail(predicted)}$ is obtained from model 4 in table 2. Dev_{HNI} and Dev_{QIB} are obtained likewise.
Q1 and Q5 denote the lowest and highest quintile. *PIN* is probability of informed trade (detail definition is on page 10). *Institutional Allocation: Auction* takes the value of 1 since December 2005 and 0 otherwise. *Total oversubscription* is defined as: *[total demand of shares by all investors at offer price and above / shares sold at the IPO]. Elasticity is* $[(Q_{high\ price} - Q_{low\ price})/\{(P_{high\ price} - P_{low\ price})/(P_{high\ price} + P_{low\ price})/2\}]$ *where Q is quantity demanded. Market Return in Prior Two Weeks is* $[(P_{-1} / P_{-10}) - 1]$ *where* P_{-1} *and* P_{-10} *are the closing prices for S&P CNX 500, the leading index for the 500 largest companies traded in the National Stock Exchange (NSE) in India for the day before and 10 trading days before the IPO date, respectively. Heterogeneous Expectations: HNI to Retail* or HE_{HNIR} is defined as $\sqrt{(Dev_{HNI} - Dev_{Retail})}$ where Dev_{Retail} is $oversubscription_{Retail} - oversubscription_{Retail(predicted)}$ from table 2. $Oversubscription_{Retail}$ is defined as: *[total demand of shares from retail investors at offer price and above / shares sold at the IPO· retail allocation %]* and $oversubscription_{Retail(predicted)}$ is obtained from model 4 in table 2. *Heterogeneous Expectations: Institution to HNI* and *Heterogeneous Expectations: Institution to Retail* are obtained in a similar manner.

Panel A. Turnover (Orthogonalized against Day 1 Return) and Combined Heterogeneous Expectations or Dispersion

Variable		Turnover					
		NSE			Total		
Heterogeneous Expectations	Q1	-0.087		-0.099	-0.122		-0.111
		(0.278)		(0.256)	(0.203)		(0.293)
	Q5	0.057		0.020	0.046		0.033
		(0.482)		(0.820)	(0.638)		(0.756)
PIN		-2.734***	-2.800***		-3.543***	-3.632***	
		(0.000)	(0.000)		(0.000)	(0.000)	
Institutional Allocation: Auction		0.232*	0.186	0.286**	0.312*	0.259*	0.406***
		(0.028)	(0.061)	(0.001)	(0.014)	(0.031)	(0.000)
PIN · Institutional Allocation: Auction		-1.125	-0.873		-1.158	-0.869	
		(0.322)	(0.436)		(0.397)	(0.519)	
No of Bidders: Institution	Q1	0.279**	0.270*	0.232*	0.305*	0.294*	0.236
		(0.009)	(0.011)	(0.043)	(0.017)	(0.021)	(0.090)
	Q5	-0.226*	-0.238*	-0.226	-0.302*	-0.316*	-0.300*
		(0.041)	(0.031)	(0.064)	(0.024)	(0.018)	(0.037)
No of Bidders: HNI	Q1	-0.012	-0.027	0.101	0.047	0.026	0.158
		(0.907)	(0.799)	(0.367)	(0.714)	(0.839)	(0.236)
	Q5	-0.150	-0.143	-0.105	-0.200	-0.189	-0.104
		(0.309)	(0.331)	(0.511)	(0.261)	(0.286)	(0.568)
No of Bidders: Retail	Q1	0.228	0.263*	0.025	0.283*	0.324*	0.019
		(0.055)	(0.024)	(0.834)	(0.048)	(0.020)	(0.899)
	Q5	-0.257*	-0.252*	-0.174	-0.359*	-0.357*	-0.278
		(0.045)	(0.048)	(0.203)	(0.021)	(0.021)	(0.084)
Total Oversubscription		0.281***	0.277***	0.289***	0.335***	0.330***	0.336***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Elasticity over the price range		-0.027	-0.025	-0.037*	-0.031	-0.029	-0.045*
		(0.099)	(0.121)	(0.037)	(0.114)	(0.137)	(0.034)
Market Index Return in the 2 weeks before IPO		-0.707	-0.632	-0.229	-1.240	-1.175	-0.658
		(0.246)	(0.294)	(0.920)	(0.092)	(0.106)	(0.413)
Intercept		0.197	0.225	-0.261	0.386	0.412	0.064
		(0.168)	(0.109)	(0.692)	(0.026)	(0.015)	(0.713)
No Of Obs		159	159	159	159	159	159
Adjusted R^2		0.457	0.457	0.351	0.489	0.488	0.366

Panel B Turnover (Orthogonalized against Day 1 Return) and Pairwise Dispersion

Variable		Turnover NSE			Turnover Total		
Heterogeneous Expectations: Institution to Retail	Q1	0.032		-0.060	0.005		-0.097
		(0.730)		(0.542)	(0.961)		(0.417)
	Q5	-0.013		0.054	-0.023		0.089
		(0.881)		(0.578)	(0.830)		(0.449)
Heterogeneous Expectations: Institution to HNI	Q1	0.020		0.161	0.044		0.240
		(0.870)		(0.216)	(0.765)		(0.128)
	Q5	-0.032		-0.080	-0.069		-0.115
		(0.759)		(0.478)	(0.583)		(0.398)
Heterogeneous Expectations: HNI to Retail	Q1	-0.068		-0.035	-0.047		0.010
		(0.480)		(0.733)	(0.683)		(0.935)
	Q5	0.105		-0.014	0.140		0.016
		(0.369)		(0.907)	(0.318)		(0.916)
PIN		-2.913***	-2.800***		-3.765***	-3.632***	
		(0.000)	(0.000)		(0.000)	(0.000)	
Institutional Allocation: Auction		0.226*	0.186	0.306***	0.311*	0.259*	0.444***
		(0.038)	(0.061)	(0.001)	(0.017)	(0.031)	(0.001)
PIN · Institutional Allocation: Auction		-0.815	-0.873		-0.750	-0.869	
		(0.499)	(0.436)		(0.604)	(0.519)	
No of Bidders: Institution	Q1	0.332**	0.270*	0.269*	0.375**	0.294*	0.288
		(0.004)	(0.011)	(0.028)	(0.006)	(0.021)	(0.050)
	Q5	-0.261*	-0.238*	-0.236	-0.340*	-0.316*	-0.295*
		(0.023)	(0.031)	(0.057)	(0.013)	(0.018)	(0.044)
No of Bidders: HNI	Q1	-0.095	-0.027	0.009	-0.068	0.026	0.043
		(0.415)	(0.799)	(0.938)	(0.625)	(0.839)	(0.762)
	Q5	-0.058	-0.143	0.013	-0.080	-0.189	0.023
		(0.714)	(0.331)	(0.941)	(0.675)	(0.286)	(0.908)
No of Bidders: Retail	Q1	0.293*	0.263*	0.077	0.362*	0.325*	0.070
		(0.016)	(0.024)	(0.532)	(0.013)	(0.020)	(0.634)
	Q5	-0.253*	-0.252*	-0.193	-0.356*	-0.357*	-0.286
		(0.050)	(0.048)	(0.162)	(0.022)	(0.021)	(0.076)
Total Oversubscription		0.275***	0.277***	0.274***	0.325***	0.330***	0.316***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Elasticity over the price range		-0.024	-0.025	-0.036*	-0.027	-0.029	-0.045*
		(0.154)	(0.121)	(0.042)	(0.175)	(0.137)	(0.035)
Market Index Return in the 2 weeks before IPO		-0.511	-0.632	-0.055	-1.025	-1.175	-0.439
		(0.416)	(0.294)	(0.936)	(0.175)	(0.106)	(0.593)
Intercept		0.181	0.225	-0.063	0.361	0.412	0.027
		(0.248)	(0.109)	(0.694)	(0.056)	(0.015)	(0.888)
No Of Obs		159	159	159	159	159	159
Adjusted R^2		0.449	0.457	0.343	0.483	0.488	0.366

Table 7. Trading Frequency and Heterogeneous Expectations

This table shows how heterogeneous expectations affects trading frequency. The dependent variable is *Trading Frequency = log (number of buy trades) – log (number of sell trades).* If an order executes above (below) the midpoint of the last quoted bid and ask price, we classify that trade as a "buy" ("sell") following Lee-Ready algorithm. *Heterogeneous Expectations* = $\sqrt{[(Dev_{QIB} - Dev_{Retail})^2 + (Dev_{Retail} - Dev_{HNI})^2 + (Dev_{HNI} - Dev_{QIB})^2)}$ where Dev_{Retail} is $oversubscription_{Retail} - oversubscription_{Retail(predicted)}$. $Oversubscription_{Retail}$ is defined as: *[total demand of shares from retail investors at offer price and above / shares sold at the IPO· retail allocation %]* and $oversubscription_{Retail(predicted)}$ is obtained from model 4 in table 2. Dev_{HNI} and Dev_{QIB} are obtained likewise. Q1 and Q5 denote the lowest and highest quintile. *PIN* is probability of informed trade (detail definition is on page 10). *Institutional Allocation: Auction* takes the value of 1 since December 2005 and 0 otherwise. *Total oversubscription* is defined as: *[total demand of shares by all investors at offer price and above / shares sold at the IPO]. Elasticity is* $[(Q_{high\ price} - Q_{low\ price})/\{(P_{high\ price} - P_{low\ price})/(P_{high\ price} + P_{low\ price})/2\}]$ *where Q is quantity demanded. Market Return in Prior Two Weeks* is $[(P_{-1} / P_{-10}) - 1]$ where P_{-1} *and* P_{-10} are the *closing prices for S&P CNX 500*, the leading index for the 500 largest companies traded in the National Stock Exchange (NSE) in India for the day before and 10 trading days before the IPO date, respectively.

Variable		Trading Frequency		
		NSE		
Heterogeneous Expectations	Q1	-0.044		-0.044
		(0.127)		(0.126)
	Q5	-0.071*		-0.078**
		(0.016)		(0.008)
PIN		-0.329	-0.351	
		(0.144)	(0.125)	
Institutional Allocation: Auction		-0.348	0.030	0.014
		(0.391)	(0.400)	(0.607)
PIN · Institutional Allocation: Auction		-0.040	-0.415	
		(0.949)	(0.308)	
No of Bidders: Institution	Q1	0.002	0.002	-0.004
		(0.963)	(0.959)	(0.919)
	Q5	0.046	0.049	0.047
		(0.269)	(0.221)	(0.241)
No of Bidders: HNI	Q1	-0.031	-0.040	-0.018
		(0.424)	(0.302)	(0.629)
	Q5	-0.035	-0.030	-0.032
		(0.505)	(0.577)	(0.542)
No of Bidders: Retail	Q1	0.048	0.043	0.022
		(0.253)	(0.305)	(0.582)
	Q5	-0.032	-0.045	-0.016
		(0.484)	(0.333)	(0.718)
Total Oversubscription		-0.021	-0.022	-0.020
		(0.118)	(0.111)	(0.147)
Elasticity over the price range		-0.014*	-0.015*	-0.015**
		(0.014)	(0.013)	(0.009)
Market Index Return in the 2 weeks before IPO		0.602**	0.524*	0.663**
		(0.006)	(0.018)	(0.009)
Intercept		0.106	0.084	0.075
		(0.039)	(0.099)	(0.121)
No Of Obs		146	146	146
Adjusted R^2		0.135	0.102	0.116

Table 8. Day 1 Return (Orthogonalized against Share Turnover) and Heterogeneous Expectations

This table shows the impact of heterogeneous expectations on price. The dependent variable is the first day return orthogonalized against share turnover. *Turnover = [log(1+total volume at the first day of trade / shares offered at IPO)]*. *Return at NSE* is defined as $(P_{closing} / P_{offer}) - 1$ where $P_{closing}$ and P_{offer} are the closing price at NSE at the first day of trade and the IPO offer price, respectively. *Average Return at BSE and NSE* = $[(Return_{NSE} + Return_{BSE}]/2$ where return at BSE is defined analogously to the return at NSE. While arbitrage opportunity between the two exchanges may exist at the opening of the first day of trade, none exists at the close. Our primary measure of Heterogeneous Expectations = $\sqrt{[(Dev_{QIB} - Dev_{Retail})^2 + (Dev_{Retail} - Dev_{HNI})^2 + (Dev_{HNI} - Dev_{QIB})^2]}$ where Dev_{Retail} is $oversubscription_{Retail} - oversubscription_{Retail(predicted)}$. $Oversubscription_{Retail}$ is defined as: *[total demand of shares from retail investors at offer price and above / shares sold at the IPO· retail allocation %]* and $oversubscription_{Retail(predicted)}$ is obtained from model 4 in table 2. Dev_{HNI} and Dev_{QIB} are obtained likewise.

Q1 and Q5 denote the lowest and the highest quintiles, respectively. *PIN* is probability of informed trade (detail definition is on page 10). *Institutional Allocation: Auction* takes the value of 1 since December 2005 and 0 otherwise. *Total oversubscription* is defined as: *[total demand of shares by all investors at offer price and above / shares sold at the IPO]*. *Elasticity is* $[(Q_{high\ price} - Q_{low\ price})/\{(P_{high\ price} - P_{low\ price})/(P_{high\ price} + P_{low\ price})/2\}]$ *where Q is quantity demanded. Market Return in Prior Two Weeks is* $[(P_{-1} / P_{-10}) - 1]$ *where* P_{-1} *and* P_{-10} *are the closing prices for S&P CNX 500, the leading index for the 500 largest companies traded in the National Stock Exchange (NSE) in India for the day before and 10 trading days before the IPO date, respectively. Heterogeneous Expectations: HNI to Retail* or HE_{HNIR} is defined as $\sqrt{(Dev_{HNI} - Dev_{Retail})}$ where Dev_{Retail} is $oversubscription_{Retail} - oversubscription_{Retail(predicted)}$ from table 2. $Oversubscription_{Retail}$ is defined as: *[total demand of shares from retail investors at offer price and above / shares sold at the IPO· retail allocation %]* and $oversubscription_{Retail(predicted)}$ is obtained from model 4 in table 2. *Heterogeneous Expectations: Institution to HNI* and *Heterogeneous Expectations: Institution to Retail* are obtained in a similar manner.

Panel A Day 1 Return (Orthogonalized against Turnover) and Combined Heterogeneous Expectations or Dispersion

Variable		Return at NSE			Average Return at BSE and NSE		
Heterogeneous Expectations	Q1	-0.083		-0.089	-0.070		-0.129
		(0.228)		(0.194)	(0.272)		(0.113)
	Q5	0.165*		0.170*	0.133		0.101
		(0.029)		(0.024)	(0.056)		(0.254)
PIN		0.052	0.258		-0.489	-0.324	
		(0.965)	(0.829)		(0.653)	(0.768)	
Institutional Allocation: Auction		-0.074	-0.139	-0.003	-0.120	-0.173	0.020
		(0.483)	(0.188)	(0.967)	(0.224)	(0.075)	(0.805)
PIN · Institutional Allocation: Auction		1.776	1.805		2.577	2.605	
		(0.273)	(0.157)		(0.086)	(0.089)	
No of Bidders: Institution	Q1	0.003	0.005	-0.004	0.001	0.003	0.034
		(0.980)	(0.959)	(0.966)	(0.987)	(0.972)	(0.775)
	Q5	-0.037	-0.051	-0.040	-0.045	-0.056	-0.121
		(0.700)	(0.599)	(0.675)	(0.605)	(0.524)	(0.269)
No of Bidders: HNI	Q1	-0.020	-0.036	-0.010	-0.061	-0.075	-0.044
		(0.841)	(0.722)	(0.918)	(0.513)	(0.422)	(0.703)
	Q5	0.274*	0.286*	0.285*	0.257*	0.267*	0.288*
		(0.034)	(0.030)	(0.027)	(0.031)	(0.027)	(0.043)
No of Bidders: Retail	Q1	0.117	0.165	0.130	0.102	0.142	0.121
		(0.326)	(0.165)	(0.271)	(0.351)	(0.192)	(0.382)
	Q5	0.141	0.152	0.094	0.146	0.155	0.077
		(0.218)	(0.191)	(0.392)	(0.168)	(0.147)	(0.541)
Total Oversubscription		0.139***	0.131***	0.137***	0.161***	0.154***	0.209***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Elasticity over the price range		-0.021	-0.024	-0.024	-0.021	-0.023	-0.031
		(0.380)	(0.323)	(0.306)	(0.346)	(0.299)	(0.266)
Market Index Return in the 2 weeks before IPO		2.721**	2.905***	2.538***	2.757***	2.906***	2.774***
		(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Price Improvement		-0.160	-0.200	-0.035	-0.326	-0.359	-0.528
		(0.812)	(0.772)	(0.957)	(0.601)	(0.570)	(0.499)
Intercept		-0.499	-0.434	-0.480	-0.518	-0.465	-0.612
		(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
No Of Obs		146	146	146	146	146	151
Adjusted R^2		0.428	0.404	0.426	0.504	0.489	0.393

Panel B **Day 1 Return (Orthogonalized against Turnover) and Pairwise Dispersion**

Variable		Return at NSE			Average Return at BSE and NSE		
Heterogeneous Expectations: Institution to Retail	Q1	0.218^{**}		0.236^{**}	0.182^{*}		0.207^{*}
		(0.010)		(0.004)	(0.018)		(0.037)
	Q5	-0.023		-0.026	-0.038		-0.074
		(0.772)		(0.737)	(0.593)		(0.422)
Heterogeneous Expectations: Institution to HNI	Q1	-0.063		-0.088	-0.032		-0.108
		(0.567)		(0.413)	(0.747)		(0.403)
	Q5	0.042		0.060	-0.016		-0.011
		(0.649)		(0.508)	(0.848)		(0.917)
Heterogeneous Expectations: HNI to Retail	Q1	0.137		0.132	0.164^{*}		0.130
		(0.109)		(0.121)	(0.036)		(0.203)
	Q5	0.023		0.051	0.009		0.010
		(0.822)		(0.614)	(0.921)		(0.932)
PIN		0.540	0.258		0.108	-0.324	
		(0.648)	(0.829)		(0.921)	(0.768)	
Institutional Allocation: Auction		-0.120	-0.139	-0.094	-0.153	-0.173	-0.082
		(0.265)	(0.188)	(0.193)	(0.121)	(0.075)	(0.319)
PIN · Institutional Allocation: Auction		0.820	1.805		1.636	2.605	
		(0.615)	(0.274)		(0.273)	(0.089)	
No of Bidders:Institution	Q1	0.044	0.005	0.040	0.051	0.003	0.077
		(0.671)	(0.959)	(0.695)	(0.588)	(0.972)	(0.531)
	Q5	-0.027	-0.051	-0.034	-0.033	-0.056	-0.131
		(0.778)	(0.599)	(0.717)	(0.705)	(0.524)	(0.239)
No of Bidders:HNI	Q1	0.051	-0.036	0.060	-0.002	-0.075	0.009
		(0.624)	(0.722)	(0.562)	(0.984)	(0.422)	(0.937)
	Q5	0.167	0.286^{*}	0.166	0.165	0.267^{*}	0.201
		(0.223)	(0.030)	(0.223)	(0.189)	(0.027)	(0.190)
No of Bidders: Retail	Q1	0.128	0.165	0.143	0.114	0.142	0.157
		(0.274)	(0.165)	(0.219)	(0.286)	(0.192)	(0.254)
	Q5	0.140	0.152	0.111	0.144	0.155	0.070
		(0.218)	(0.191)	(0.310)	(0.167)	(0.147)	(0.582)
Total Oversubscription		0.159^{***}	0.131^{***}	0.159^{***}	0.177^{***}	0.154^{***}	0.228^{***}
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Elasticity over the price range		-0.029	-0.024	-0.031	-0.027	-0.023	-0.034
		(0.217)	(0.323)	(0.178)	(0.210)	(0.299)	(0.219)
Market Index Return in the 2 weeks before IPO		2.624^{***}	2.905^{***}	2.468^{***}	2.682^{***}	2.906^{***}	2.754^{***}
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Price Improvement		-0.175	-0.200	-0.164	-0.226	-0.359	-0.573
		(0.799)	(0.772)	(0.806)	(0.719)	(0.570)	(0.473)
Intercept		-0.553	-0.434	-0.519	-0.580	-0.465	-0.623
		(0.001)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
No Of Obs		146	146	146	146	146	151
Adjusted R^2		0.437	0.404	0.439	0.523	0.489	0.398

Table 9. Day 1 Return (Orthogonalized against Trading Frequency) and Heterogeneous Expectations

This table shows the impact of heterogeneous expectations on price. The dependent variable is the first day return orthogonalized against trading frequency. *Trading Frequency = log (number of buy trades) – log (number of sell trades). Return at NSE* is defined as $(P_{closing} / P_{offer}) -1$ where $P_{closing}$ and P_{offer} are the closing price at NSE at the first day of trade and the IPO offer price, respectively. *Average Return at BSE and NSE* = $[(Return_{NSE} + Return_{BSE}]/2$ where return at BSE is defined analogously to the return at NSE. While arbitrage opportunity between the two exchanges may exist at the opening of the first day of trade, none exists at the close. Our primary measure of Heterogeneous Expectations = $\sqrt{[(Dev_{QIB} – Dev_{Retail})^2 + (Dev_{Retail} – Dev_{HNI})^2 + (Dev_{HNI} – Dev_{QIB})^2)}$ where Dev_{Retail} is $oversubscription_{Retail} – oversubscription_{Retail(predicted)}$. $Oversubscription_{Retail}$ is defined as: *[total demand of shares from retail investors at offer price and above / shares sold at the IPO· retail allocation %]* and $oversubscription_{Retail(predicted)}$ is obtained from model 4 in table 2. Dev_{HNI} and Dev_{QIB} are obtained likewise. Q1 and Q5 denote the lowest and the highest quintiles, respectively. *PIN* is probability of informed trade (detail definition is on page 10). *Institutional Allocation: Auction* takes the value of 1 since December 2005 and 0 otherwise. *Total oversubscription* is defined as: *[total demand of shares by all investors at offer price and above / shares sold at the IPO]. Elasticity is* $[(Q_{high\ price} - Q_{low\ price})/\{(P_{high\ price} - P_{low\ price})/(P_{high\ price}+ P_{low\ price})/2\}]$ *where Q is quantity demanded. Market Return in Prior Two Weeks is* $[(P_{-1} / P_{-10}) -1]$ *where* P_{-1} *and* P_{-10} *are the closing prices for S&P CNX 500, the leading index for the 500 largest companies traded in the National Stock Exchange (NSE) in India for the day before and 10 trading days before the IPO date, respectively.*

Variable		Return at NSE		
Heterogeneous Expectations	Q1	-0.069		-0.075
		(0.331)		(0.291)
	Q5	0.257**		0.249**
		(0.001)		(0.002)
PIN		-1.507	-1.163	
		(0.216)	(0.356)	
Institutional Allocation: Auction		-0.030	-0.112	0.076
		(0.784)	(0.314)	(0.291)
PIN · Institutional Allocation: Auction		2.042	1.993	
		(0.222)	(0.144)	
No of Bidders: Institution	Q1	0.147	0.157	0.147
		(0.154)	(0.144)	(0.154)
	Q5	-0.179	-0.196	-0.171
		(0.068)	(0.055)	(0.080)
No of Bidders: HNI	Q1	0.013	0.005	0.015
		(0.900)	(0.961)	(0.887)
	Q5	0.197	0.210	0.216
		(0.137)	(0.128)	(0.102)
No of Bidders: Retail	Q1	0.191	0.244	0.183
		(0.120)	(0.052)	(0.133)
	Q5	0.057	0.078	0.037
		(0.626)	(0.523)	(0.744)
Total Oversubscription		0.265***	0.255***	0.261***
		(0.000)	(0.000)	(0.000)
Elasticity over the price range		-0.025	-0.031	-0.026
		(0.308)	(0.217)	(0.285)
Market Index Return in the 2 weeks before IPO		1.705***	1.991***	1.697***
		(0.003)	(0.001)	(0.002)
Price Improvement		0.054	0.014	0.246
		(0.938)	(0.984)	(0.718)
Intercept		-0.782	-0.685	-0.859
		(0.001)	(0.128)	(0.001)
No Of Obs		146	146	146
Adjusted R^2		0.443	0.394	0.444

Table 10. Allocation Weighted Return of a Naïve Investor

This table shows the expected return of a representative uninformed investor from the three classes. The naïve investor bids an equal amount of her wealth for each IPO and earns a return that is a function of the allocation she receives in each IPO.

Variable	Institution	HNI	Retail
Portfolio Size, USD	567665	24322	239
Allocation Weighted Portfolio Size at IPO	279557	20686	378
Allocation Weighted Portfolio Size at the Close of the First Trading Day	266021	20150	362
Allocation Weighted Return	-4.84%	-2.59%	-4.12%
No Of Obs	182	182	183