Is investor sentiment driven by IPO pricing mechanism? Evidence from India

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Abstract

We propose a weighted sentiment-index to measure investors' representativeness bias in bookbuilding vs. fixed price Initial Public Offerings (IPOs). Our sample data (1995 to 2007) span three regimes of fixed price and bookbuilding IPO pricing mechanisms in India. Consistent with behavioral IPO literature, the results show that sentiment is driven by IPO cycles. However, contrary to popular perception, sentiment is not driven by IPO pricing mechanism.

JEL Classifications: F39, G39

Keywords: IPO underpricing, bookbuilding, sentiment investors, representativeness bias.

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I. Introduction

Empirical studies document that the introduction of bookbuilding in Initial Public Offerings (IPOs) has reduced the gap in *closing price* and *issue price*, typically known as "underpricing", on first day of open market trading, (see, e.g., Cornelli and Goldrich, 2001). For this reason, the bookbuilding listing process has all but completely replaced the previously popular fixed price process and auctions worldwide. Studies also show that *IPO cycles* and *bookbuilding price adjustments* drive investor sentiment and therefore, underpricing (see e.g., Derrien, 2007; and Dorn, 2009). An upward price adjustment leads to greater sentiment, or underpricing, during *Hot IPO cycle* when the number and the size of IPOs are large, than in *Cold cycle* when they are small (see, e.g., Ljungqvist, Nanda, and Singh (LNS, 2005)). These results suggest that IPO listing process, bookbuilding price adjustments, and IPO cycles, are all proxies for investor sentiment. Baker and Wurgler (BW, 2007) propose a sentiment index model that aggregates proxies for broad investor sentiment to explain a specific market return, such as stocks with high degrees of uncertainty, or stocks that are speculative and difficult to arbitrage.

In this paper, we build on the BW model and construct a weighted sentiment index that measures a specific sentiment or representativeness bias as in Barberis, Shleifer, and Vishny (1998), in IPOs resulting from proxies, such as past IPO returns, that deviate from the fundamentals of the IPO. Using a sample data (1995-2007) of 1,501 IPOs with fixed price and bookbuilding process in India, we find that representativeness bias is not driven by pricing mechanisms but by IPO cycles. Our findings establish representativeness bias in

IPOs that does not support the point of view that bookbuilding has reduced underpricing worldwide.

The sentiment proxies in the index signify representativeness and conservatism biases as in the stock price movement model of Barberis, Shleifer, and Vishny (BSV, 1998). In the BSV model, investor's belief about a firm's earnings is in one of two states. In the first state, the investor believes the firm's earnings are mean reverting. An investor in this state will show conservatism bias and under react to important news, such as earnings announcements. In the second state, the investor believes the earnings to trend. An investor in this state ignores the laws of probability, or Bayes' Theorem, and overreacts to a series of good (bad) news he believes to be representative of a trend in price movements. As a result, there is price movement due to a news release in the second state but not in the first state. Our analysis establishes representativeness bias due to past IPO returns, bookbuilding price adjustments and IPO market cycles with relevance to pricing mechanisms. As an example, past IPO returns is not a relevant proxy during Hot IPO cycle in the bookbuilding mechanism.

The weighted method of aggregation allows proxies to adjust to pricing mechanisms. For instance, in a regression of past IPO return, controlling for other factors, the coefficient for fixed price IPOs is greater in Hot IPO cycle than in Cold IPO cycle. On the other hand, past IPO returns coefficient is found to be statistically insignificant in bookbuilding IPOs. Samdani (2009) shows that investment decisions exhibit a risk-averse pecking order in sentiment proxies in which the risk factor in past IPO returns is greater than in bookbuilding price adjustments. Following this line of reasoning, we assert that proxies for

representativeness bias are specific to the IPO pricing mechanism. However, this assertion does not imply that sentiment in one mechanism is greater than the other.

Underpricing in Initial Public Offerings (IPOs) is a persistent worldwide phenomenon, including in India, where the Bombay Stock Exchange (BSE) has the world's largest listing of equities with approximately 4,900 companies and the National Stock Exchange (NSE) is the second fastest growing exchange in the world with a listing of approximately 1,900 companies.[1] Bookbuilding and fixed price mechanisms are distinguished by regimes in India, which facilitate comparative analysis of pricing mechanisms.

A major challenge to behavioral explanation of market "anomalies", such as IPO underpricing, is to define an approach to measure sentiment. It is difficult to pin down a particular sentiment as the cause of "irrationality" in the market. Real investors and markets are too complicated to be neatly summarized by a few selected biases (Baker and Wurgler, 2007). A bottom-up approach that identifies a specific sentiment to explain a broader market is not realistic. Instead, BW propose aggregating sentiment and tracing its effects to individual stocks. The BW model uses a top-down approach i.e., a broad sentiment to explain a specific market return. In contrast, the focus in our index is on a specific sentiment for a specific market return i.e., the index measures representativeness bias in uncertain IPOs.

Samdani (2009) uses data on Indian IPOs during the 1995-2007 period to show that sentiment investors exhibit rationality in risk in sentiment proxies. Samdani associates risk

[1] World Federation of Exchanges, July 2007

in sentiment proxies to the informativeness of the proxy and shows that bookbuilding pricing information is a superior sentiment proxy to past IPO returns because of the former's relatively low information risk. The shift in sentiment proxies between pricing mechanisms in our study supports the risk-averse pecking order hypothesis in Samdani (2009).

Loughran and Ritter (2002) use a sample of 3,025 IPOs listed by Securities Data Co. from 1990 to 1998 to show issuer biases. They propose a prospect theory (Kahnemen and Tversky, 1979) explanation to why issuers don't get upset with leaving money on the table. They assert that issuers care more about the change in their wealth than about the level of their wealth. Ritter and Welch (2002) observe the influence of past performance of firms on short run IPO prices and offer behavioral explanations to IPO underpricing that is consistent with our findings of representativeness bias in fixed price but not bookbuilding IPOs in India.

Loughran and Ritter (2002) examine the first-day returns of IPOs relative to CSRP value-weighted market index returns. They find positive correlation between the first-day returns and the market index in the 15 days prior to the IPO. BW construct an investor sentiment index based on six proxies that are, trading volume as measured by NYSE turnover; the dividend premium; closed-end fund discount; the number and first-day returns on IPOs; and the equity shares in new issues. They construct a change in sentiment index that consists of changes in the six proxies. They find that their index lines up fairly well with anecdotal accounts of bubbles and crashes since 1920. Their approach to measuring sentiment in the market is to aggregate sentiment with the six proxies and then identify speculative and difficult to arbitrage stocks whose returns are influenced by sentiment investors. They find that when aggregate sentiment is high, subsequent market returns are

low. Their results support the effects of Hot and Cold IPO cycles on underpricing in our study.

BW study suggests that IPO underpricing is likely to be greater in uncertain companies than in certain companies. They differentiate uncertain companies by size, and that are speculative and difficult to arbitrage. In the absence of company and economic fundamentals, investors resort to sentiment-driven information, such as past IPO returns, for investment decisions in small and mid-cap companies. Their valuation method deviates from the company fundamentals such as the Discounted Cash Flows method. As in the BW study, we define uncertain IPOs in India as those with market capitalization below US$600M. In our analysis, all but three IPOs in the sample data are labelled as uncertain.

Ritter and Welch (2002) examine the relation between differences in issue price relative to initial price range and mean first day returns for 6,238 IPOs from 1980-2001. They find that average IPO underpricing is significantly greater (53%) when the issue price exceeds the upper limit of the initial price range. Dorn (2009) studies the German Neuer Market and finds that pre IPO sentiment according to bookbuilding parameters, such as IPO issue price relative to the price range, drive post IPO prices, or first day returns. They find that IPO issue price close to the upper limit of the price range is reflective of positive pre-IPO investor sentiment, or sentiment prior to first day of IPO trading, which leads to post-IPO investor sentiment and underpricing.

2. Hypotheses and Methodology

We determine sentiment from the presence or absence of representativeness and conservatism biases in investor sentiment proxies. We assert that sentiment proxy relevant to pricing mechanism is strongly correlated to underpricing during Hot cycles. We therefore formulate the following hypothesis

Hypothesis 1: *Hot IPO cycles exhibit representativeness bias and Cold IPO cycles exhibit conservatism bias in IPOs.*

In addition to the effect of Hot and Cold cycles on underpricing, we also test for relevance of proxies to pricing mechanism. We find that bookbuilding price adjustment is a stronger proxy of sentiment than past IPO returns. Our findings are consistent with Samdani (2009) who posits that bookbuilding proxy is preferred to past IPO returns proxy because of its relatively low risk. This implies

Hypothesis 2: *Bookbuilding price adjustment overrides past IPO returns as a sentiment proxy in Hot IPO cycle.*

The weighted index differs from the BW index in that proxies in the weighted index are aggregated with respect to the pricing mechanism. The index assigns two sets of weights to proxies. The first set of weights, or the *proxy relevance weights*, are discrete (0 and 1) where "1" indicates a relevant proxy and "0" indicates an irrelevant proxy. The objective of discrete weights is to rule out "overridden" or irrelevant proxies. if past IPO returns is irrelevant in the presence of bookbuilding proxy, it is given a *proxy relevance weight* of zero. The second set of weights, or the continuous *proxy coefficient weights* $\in$

{0,1}, measures the impact of proxies on sentiment as determined from coefficients in the regression analysis. Measurements of proxy coefficient weights are shown in the empirical analysis section of this paper.

We propose a simple empirical model that relates underpricing of the IPO due to investor sentiment *S*, to the sentiment trend from past IPO returns T and sentiment from bookbuilding price adjustment B.

$$S_{it} = \alpha + w_1 f(T_t) + w_2 f(B_i) + \mu \tag{1}$$

Where w_i is a binary relevance weight of the sentiment proxy specific to IPO pricing process. For instance, w_1 is the relevance weight for past IPO returns sentiment proxy $f(T_t)$, and w_2 is the relevance weight for bookbuilding price adjustment sentiment proxy $f(B_i)$. Functions $f(T_t)$ and $f(B_i)$ determine proxy coefficient weights from regression coefficients. Proxy relevance weights and proxy coefficient weights are calculated as follows:

$$w_1 = \begin{cases} 1 & if \quad f(U_i) \geq 0.5, \quad f(M_i) \geq 0.5 \quad and \quad f(B_i) \leq 0.5 \\ 0 & \end{cases} \tag{2}$$

$$w_2 = \begin{cases} 1 & if \quad f(U_i) \geq 0.5, \quad f(M_i) \geq 0.5 \\ 0 & \end{cases} \tag{3}$$

Where $f(M_i)$ and $f(U_i)$ represent IPO cycle function and company uncertainty function respectively. $f(x_i)$ is a continuous function between "0" and "1" where $f(x_i) \geq 0.5$ indicates that $f(x_i)$ is relevant. Therefore, $f(M_i)$ is relevant during Hot IPO cycle when $f(M_i) \geq 0.5$. Both relevance weights are irrelevant when $f(M_i) < 0.5$ indicating Cold cycle. Therefore, the return on sentiment *S* equal to zero in Eqn. 1 indicates conservatism bias. Eqn. 2 states that the necessary condition for w_1 to be relevant is in the absence of bookbuilding i.e., when $f(B_i) < 0.5$ which is the case for fixed price IPOs. We can thus assert the main argument of the paper that underpricing due to representativeness bias is most apparent for uncertain IPOs during the Hot IPO cycle independent of fixed price or bookbuilding IPO pricing mechanism.

Figure 1.a, 1.b, and 1.c show representativeness heuristic for BSV, LNS and our weighted index respectively. Figure 1.c is a graphical representation of Eqns. 1, 2 and 3.

[Figure 1]

Figure 1 illustrates that the weighted index (Figure 1.c) determines representativeness heuristic from multiple sets of proxies while the other two models measure representativeness heuristic from a single proxy. Representativeness in the BSV model (Figure 1.a) is a result of a sequence of good or bad news while representativeness in the LNS model (Figure 1.b) is due to Hot cycle. Representativeness in the weighted index is due to IPO cycle, bookbuilding price adjustment, and past IPO returns in relation to each other by weights.

In Figure 1.c, past IPO returns exhibit representativeness sentiment during Hot cycle and in the absence of bookbuilding price adjustment. Otherwise, past IPO returns exhibit conservatism bias. Bookbuilding price adjustment overrides the outcome of past IPO returns. During the Cold cycle, investors exhibit conservatism bias and the other proxies have no relevance on representativeness sentiment.

3. Data Sample and Specifics of Indian IPO market

The data source for our analysis is Primedatabase (www.primedatabase.com), a privately owned capital market data provider to most academic, government and research institutes in India and elsewhere. We look at a sample of 1501 IPOs from 1995 to 2007. The motivation for using Indian IPOs listed on Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) is the simultaneous and individual presence of both fixed price IPOs to bookbuilding IPOs, which offers a unique setting for comparative analysis of sentiment in the two mechanisms. Table 1 shows the summary statistics and characteristics of the data sample.

[Insert Table 1]

SEBI (Stock Exchange Board of India) operations

India has two primary stock exchanges where IPOs are listed. The larger BSE (Bombay Stock Exchange) has a listing of around 5000 companies as of 2006 and NSE

(National Stock Exchange) has a listing of around 1600 companies.[2] Prior to 1995, SEBI regulations only allowed for fixed pricing of IPOs. Under this regulation, the final IPO issue price could not be changed from the initial price.

In 1999, SEBI introduced bookbuilding IPO listing process. In this process, underwriters could define an initial price range, a maximum of 20% apart, for a specified period. During this period, underwriters received bids from both institutional and retail investors. Unlike in the US where the issue price can exceed the price range by 20%, the issue price in India, has to be within the initial price range. The allocation amount was partitioned as 25% to retail investors, 25% to high net-worth (non institutional) investors and 50% to institutional investors. However, for large size issues, the equity dilution through public offer is less than 25% and greater than 10%. Rule 19(2)(b) allowed for 60% of issue size to institutional investors. Although allocation partitioning could not be changed, allocation could be changed amongst investors within each partition. Retail investors were defined as those with ~US$1000 limitation on purchases of stocks.[3]

In May 2005, SEBI revised the book-building criteria with major changes to partitioning of issue allocations between smaller retail investors and high net-worth investors. The allocation partitioning was increased to 35% to retail investors and reduced to 15% to high net-worth investors. Institutional investors' allocation amount remained the same at 50% and 60% depending on the issue size. The amount that retail investors could purchase was increased to ~US$2000. In this revision, SEBI also allowed hybrid-listing

[2] From SEBI public issues document, 2007 (www.sebi.gov.in)
[3] From SEBI regulations circular document, 1999 (www.sebi.gov.in)

mechanism consisting of 25% fixed price and 75% bookbuilding mechanism.[4] The bookbuilding policies are the same in the hybrid and pure bookbuilding mechanisms.

4. Empirical Analysis

We use a standard Ordinary Least Squares (OLS) regression technique to regress first day IPO returns (underpricing) on the average of past six IPO returns along with other variables in multiple observations. We use a combination of dummy variables and cross-sectional analysis in regimes to control for endogeneity and non regime specific trends. Additionally, we use a Maximum Likelihood (ML)-Binary Probit regression technique to establish Hot cycle condition and a Two-Staged Least Squares (2SLS) regression technique to reinforce causality in some of the explanatory variables. We use institutional allocation as an instrumental variable (IV) since it is not correlated with the dependant variable in our data sample but is correlated with the *High Premium IPOs*, as determined by the investment bank, and the bookbuilding price adjustment variable. Allocation rules by SEBI allow institutional allocations to be restricted to 50% and 60% in Regime-2 and Regime-3. The difference in allocation amounts does not override bookbuilding price adjustment proxy. We use Durbin-Watson test statistics of endogeneity in our regressions. The data sample for 2SLS has 203 observations and is large enough for parametric analysis and i.i.d condition. We build a sentiment index for each IPO as per our sentiment index model. Our sentiment proxy measurements and hypotheses validation is as follows:

High Premium IPO (Hot cycle) sentiment proxy

[4] From SEBI regulations circular document, 2005 (www.sebi.gov.in)

The main objective in our analysis is to test for the significance of sentiment proxies in Hot cycles. Samdani (2009) documents a strong correlation between High Premium IPOs and Hot cycles in India. As in the study by Samdani (2009), High Premium IPOs is the high premium on face value of the IPO as established by the underwriter. Figure-2 shows the Hot cycle indicators in the three regimes.

[Insert Figure 2 here]

The statistics in Figure-2 are consistent with Hot cycle indicators in IPO literature. Of particular importance to our analysis is the High Premium IPO indicator, which is greatest during the Hot IPO cycle period (2005-2007). Figure-2 also shows High Premium IPOs during the Cold cycle period (1995-1999). The High Premium IPO indictor spans across pricing mechanism regimes and is unique to the Indian data. In Table-2, we show the results of ML-Binary Probit regression using High Premium IPOs as the binary variable.

[Insert Table 2 here]

In the Probit regression in Table-2, Regime-2 is the benchmark regime with Regime-1 and Regime-3 as dummy variables. Our data sample size is 1501 observations. The binary variable has a value of “1” High Premium IPOs and a value of “0” for Low Premium IPOs. The results show that the correlation of High Premium IPOs with the Regime-3 and the Regime-1 dummies is statistically significant with opposite signs to distinguish Hot

regime from Cold regime. The results in Table-2 and the statistics in Figure-2 establish High Premium IPOs is an indicator of the market cycle.

Institutional Allocation as an Instrumental Variable (IV)

Institutional allocation regulations were introduced in India along with bookbuilding mechanism in Regime-2 and continued in Regime-3 with some modifications. The overlap of institutional allocation with High Premium IPOs and bookbuilding price adjustment makes the institutional allocation a plausible instrumental variable (IV) for the two variables. In Table-3, we show that institutional allocation is not correlated to first-day returns (underpricing) but correlated to High Premium IPOs and bookbuilding price adjustment.

[Insert Table 3 here]

Panel-B in Table-3 shows the results of 2SLS regression technique with institutional allocation as an instrumental variable for High Premium IPOs. The strong correlation reinforces High Premium IPOs as a proxy for Hot cycle since institutional allocation options are unique to Regime-2 and Regime-3 when the IPO markets are Hot per the statistics in Figure-2. Durbin-Watson test statistic in Table-4 indicates absence of autocorrelation in the residuals.

Past IPO returns and representativeness bias

We regress the average of first-day returns of past six IPOs on first-day return of new IPO (underpricing). We argue that when investors are in the "representativeness" state, there is underpricing in IPOs and when in "conservatism" state, the IPO price is close to the issue price. Two possible explanations of underpricing in this argument are that 1) the underwriter has completely left sentiment out of IPO pricing, and 2) the underwriter has barely included it in the representative state. The second explanation may result in equally low underpricing in both states thus, making the two states indistinguishable between. However, we find that an upward trend in past six IPOs is positively correlated with underpricing in High Premium IPOs and weakly correlate in Low Premium IPOs i.e., in Hot and in Cold cycles respectively. The results of standard OLS regressions are shown in Table 4.

[Table 4]

In Table-4, we partition the data on High Premium IPOs into three regimes. Panel-A in Table-4 shows results in Regime-1 (1995-1999), when IPOs were priced using the fixed price mechanism only. During this regime, there were no large companies IPOs (> US$600million). We define High Premium IPOs (in Indian rupees*)* as the "premium on face value" of the IPO issue price as in Samdani (2009). In the absence of bookbuilding mechanism in Regime-1, the correlation between first-day returns (underpricing) of High Premium IPOs and past IPO returns is statistically significant indicating representativeness sentiment in past IPO returns.

Panel-B in Table-4 shows test results in Regime-2 (1999-2005), when bookbuilding mechanism was first introduced in India. The difference in the number of fixed price IPOs (83) and book-built IPOs (52) is relatively small. We see a statistically significant correlation in first-day returns of High Premium IPOs with both, past IPO returns and bookbuilding price adjustment, which is contradictory to our hypothesis-2. Our explanation is that investor sentiment had not fully adjusted to the newly introduced bookbuilding mechanism in India during Regime-2.

Panel-C in Table-4 shows test results in Regime-3 (2005-2007), when pricing mechanisms remained the same as in Regime-2. However, the coefficient of past IPO returns is statistically insignificant. Consistent with our explanation of results in Panel-B, we assert that investor sentiment had fully adjusted to the well establish bookbuilding mechanism in Regime-3 i.e., investor sentiment shifted away from past IPO returns and towards bookbuilding price adjustment. The results in Table-4 validate our Hypothesis-2.

Bookbuilding price adjustment and representativeness bias

We define bookbuilding sentiment as the difference in the issue price at the start of the bookbuilding process and the issue price at the end of the bookbuilding process. As in Dorn's (2009) analysis of IPOs on the Neur Market in Germany, we find that pre-IPO sentiment drives post IPO prices. The results of our standard OLS regressions in Table-4 and Table-5 show that the correlation of bookbuilding price adjustment with IPO underpricing in India is statistically significant.

[Insert Table 5 here]

The number of bookbuilding IPOs relative to fixed priced IPOs is twice the number in Regime-3 than in Regime-2. As noted earlier, the results of the two regimes in Table-4 indicate a shift in representativeness proxies from past IPO returns to bookbuilding price adjustment, which supports our Hypothesis-2.

We also use a 2SLS regression technique in Table-3 to test for causality. In Panel-A, we use institutional allocation variable as an instrumental variable for bookbuilding price adjustment. We find that the correlation between first-day IPO returns and bookbuilding price adjustment is statistically significant. Durbin-Watson test statistics indicate no correlation in the residuals in all our regressions.

Dorn (2009) documents that bookbuilding duration period, or the time between the initial price date and the issue price date, drives post-IPO prices. We do not report the test results of bookbuilding duration period in our analyses as the results are not statistically significant.

IPO uncertainty

We define uncertain stocks as those stocks that are classified as small-cap and mid-cap companies per the SEBI definition i.e., companies with market capitalization below US$600 million. In our analysis, there are only five IPOs that are classified as large-cap company stocks. As in BW, we find the correlation between uncertain stocks and IPO

underpricing to be statistically significant. Table-5 shows our empirical results in multiple regressions.

[Insert Table-5 here]

Column-1 in Table-5 shows the effect of past IPO returns (in Indian rupees) on the first-day IPO return (underpricing) of uncertain companies for all IPOs (in Indian Rupees). The results in the remaining columns include a dummy variable for High Premium IPOs that are not statistically significant, which supports our Instrumental Variable regression methodology as shown in Table-3. During Regime-1 (1995-2005), IPOs were priced using the fixed price mechanism only. There is no institutional information in Regime-1. The results with regime dummies in Table-5 are consistent with the statistics on the three regimes in India in Figure-2.

The BW model also include riskiness in their definition of uncertain securities. Our empirical results in Table-5 show that IPOs in risky industries in India, such as Information Technology industry, have considerably greater underpricing than IPOs in less risky industries, such as Textile industry. Textile industry in India is less risky because it is well established and investors have awareness of the industry. Fixed price dummy and Regime-2 dummy control for regime specific industry trends. The results in Table-4 and Table-5 affirm our Hypothesis-1 and Hypothesis-2.

5. Conclusion

Our empirical study on IPOs in India supports the hypothesis that stocks with a high degree of uncertainty, such as small-cap and mid-cap companies, are subject to stronger investor sentiment than large-cap companies. When company fundamentals are not readily available, investors exhibit a representativeness heuristic bias in Hot IPO cycles, in past IPO returns and in bookbuilding price adjustment. Investor sentiment in fixed price IPOs is driven by representativeness heuristic in past IPO returns. However, bookbuilding price adjustment overrides past IPO returns proxy indicating a shift in representativeness proxies between pricing mechanisms. In other words, past IPO returns do not always drive Hot cycles. A weighted sentiment index presented in this paper captures representativeness bias in IPOs unobserved in a sentiment index models without weights.

The assertion in this paper that sentiment is independent of IPO pricing mechanism is unique in that the data sample of Indian IPOs includes the presence of bookbuilding as well as fixed price IPOs, individually and simultaneously. Thus, the data sample provides a robust testing environment for comparative analysis of sentiment in underpricing due to pricing mechanisms while controlling for Hot and Cold IPO cycles that is difficult to establish in the US and European IPOs. The results in the analysis contradict the general perception that the replacement of fixed price mechanism with the bookbuilding mechanism has reduced underpricing. In this regard, the paper contributes to the behavioural IPO literature.

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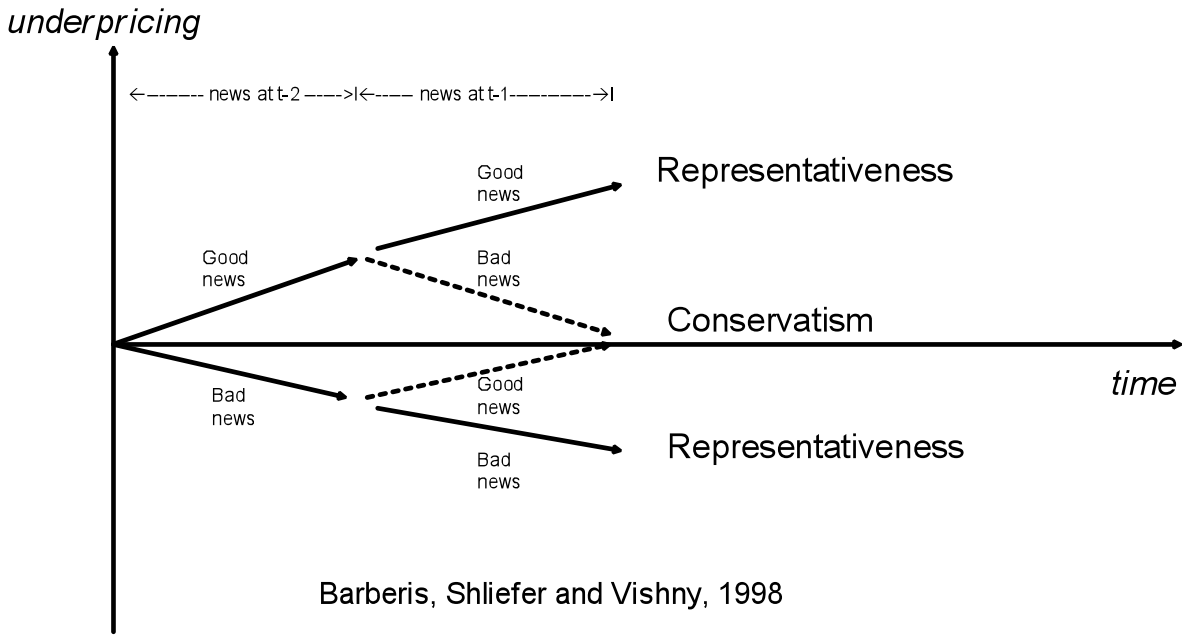


Figure 1.a

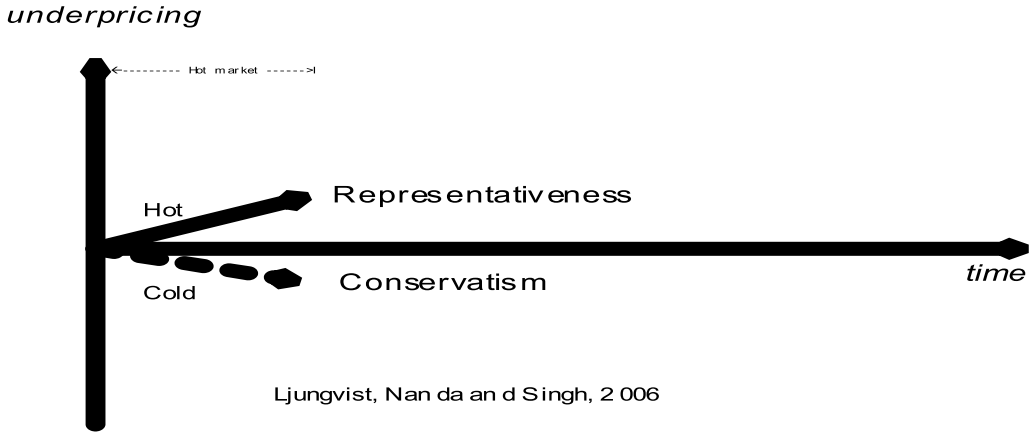


Figure 1.b

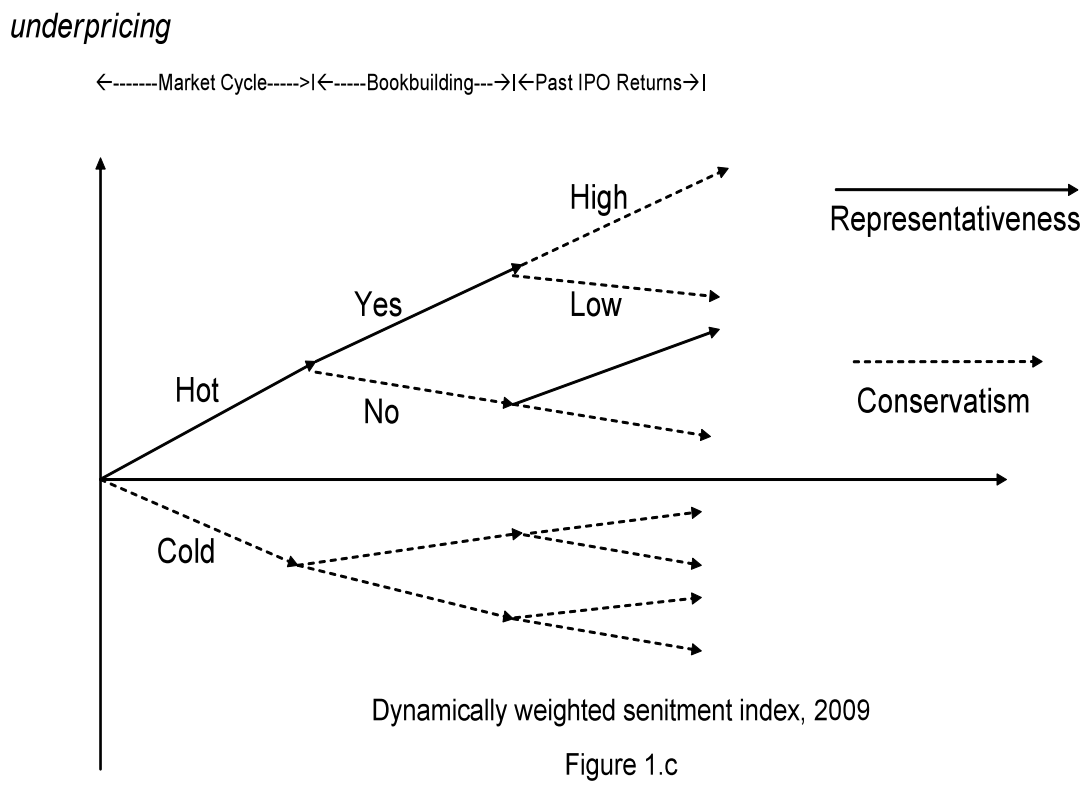
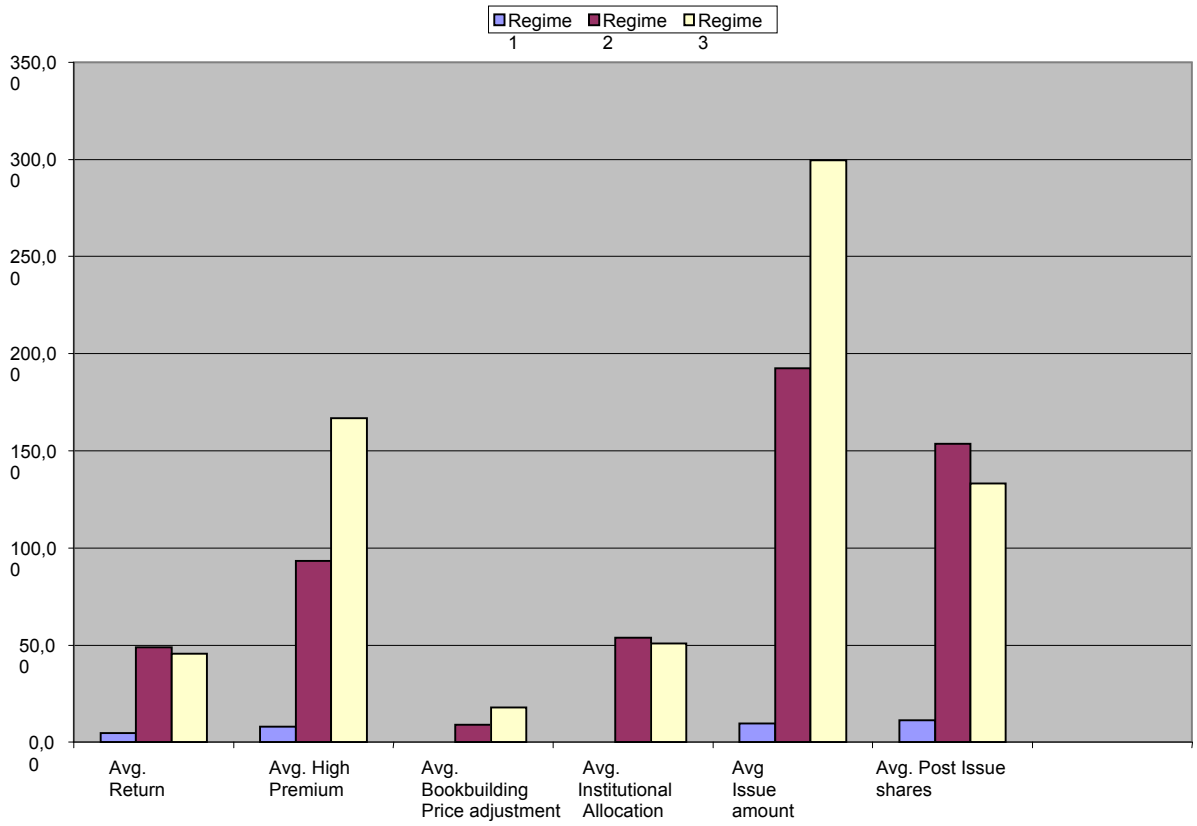


Figure 1.c

In Figure 1, 1.a (Barberis, Shleifer and Vishny, 1998) and 1.b (Ljungqvist et al., 2007) are comparisons to our model 1.c (weighted sentiment index, 2009). In figure 1.a, representativeness bias above the horizontal axis is due to good news on earnings followed by another good news. Bad news followed by bad news is below the horizontal axis. In figure 1.b, Hot cycle is above the horizontal axis and Cold cycle is below the axis. Figure 1.c shows the affect of a combination of three factors i.e., market cycle, bookbuilding price adjustment and past IPO returns, on representativeness bias.

Figure 2: Hot cycle indicators in the three regimes (1995–1999, 1999–2005, 2005-2007)



This graph compares average returns (Rs.), average underwriter valuation (High Premium IPOs in Rs.), average bookbuilding adjusted price (bookbuilding price adjustment in Rs.) and average institutional allocation (%), average issue amount (Rs. 10million) and average post issue number of shares (1million) amongst the 3 regimes. In order to accommodate all categories in one graph, the scale on the y-axis has a different representation for each category. Regime-1, the first bar in each group, is absent in average bookbuilding price adjustment and average institution allocations, which were introduced in Regime-2, and Regime-3. Regime-3, the third bar in each group, has the highest combined averages in all six groups. These bars indicate Hot cycle conditions consistent with the IPO literature. Not surprisingly, Regime-3 indicates highest Hot cycle of the three periods.

Table 1.a Characteristics of data sample

	Past IPO returns (Rs. per share)	Bookbuilding Price (Rs.)	Issue amount (Rs. Million)	Institutional allocation (%)	High Premium IPOs (Rs. per share)
Mean	12.92342	21.40884	557.4001	52.02998	31.73225
Median	3.458333	15.00000	34.00000	50.00000	0.000000
Maximum	403.4917	150.0000	91875.00	76.50000	1090.000
Minimum	-57.83333	0.000000	7.500000	9.500000	0.000000
Std. Dev.	35.91797	11.29584	3778.804	10.38721	90.81183
Observations	1501	181	1501	203	1501

Table 1.b Summary statistics of data sample

	Number of IPOs		
	Regime 1 (1995-1999)	Regime 2 (1999-2005)	Regime 3 (2005-2007)
All IPOs	1206	135	160
Fixed priced IPOs	1206	83	31
Bookbuilding IPOs	0	52	129
High Premium IPOs	298	95	159
Low Premium IPOs	908	40	1
Large IPOs (>US$600M)	0	2	3
Institutional allocation	0	80	123
Information technology industry	32	49	18
Pharmaceutical industry	68	10	5
Financial services industry	341	3	6
Textile industry	120	3	16

Table 1 provides descriptive statistics on the variables used in our study. A total of 1501 IPOs from 1995 to 2007 are used in our analyses. *Past IPO returns* is the average of six most recent IPO returns. *Large company IPOs*, *institutional allocation* information and *book-built IPOs* are exclusive to Regime 2 and Regime 3. *High Premium IPOs* are those IPOs with positive issue price premium over face value. *Low Premium IPOs* have zero premium. *Large IPOs (>US$600million)* is based on SEBI definition of large IPO.

Table 2 Maximum Likelihood (ML) - Binary Probit regression method of High Premium IPOs (Hot cycle proxy) with past IPO returns in the three regimes.

Binary variable: High Premium IPOs	
Past IPO returns	0.00 (0.19)
Regime 1 (dummy)	**-1.25** **(0.00)**
Regime 3 (dummy)	**1.82** **(0.00)**
Intercept	0.56 (0.00)
Pseudo-adjusted R^2	0.22
Observations	1501

p-values in parentheses. Chi-square goodness of fit: 0.35

Table 2 shows the results of ML regression of binary variable, underwriter valuation, with past IPO returns in different regimes. Regime 2 is the benchmark regime. The objective of this regression is to establish High Premium IPOs as a proxy for Hot cycle. Past IPO returns are not correlated to High Premium IPOs while regimes are strongly correlated to High Premium IPOs.

Table 3 2SLS regressions of IPO returns on High Premium IPOs and bookbuilding price information.

Dependent variable: First-day IPO returns	
Panel A	
Instrumental variable: Institutional allocation	
Past IPO returns	-0.03 (-0.20)
Bookbuilding price adjustment	**3.64** **(4.40)*** **
Intercept	-14.90 (-0.90)
Adjusted R^2	0.37
Observations	203

The symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Durbin-Watson statistic: 1.38

Dependent variable: First-day IPO returns	
Panel B	
Instrumental variable: Institutional allocation	
Past IPO returns	0.19 (1.04)
High Premium IPOs	**0.47** **(3.78)*** **
Intercept	-37.23 (-1.54)
Adjusted R^2	0.16
Observations	203

The symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Durbin-Watson statistic: 1.22

Table 3 is a Two-Stage Least Squares regression of IPO returns on bookbuilding price adjustment (Panel A) and High Premium IPOs (Panel B) using institutional allocation amount as an instrumental variable. The outputs from the two regressions are consistent with the outputs from our standard OLS regressions. Thus, our results further reinforce High Premium IPOs and bookbuilding price adjustment as drivers of IPO underpricing. Durbin-Watson statistics are 1.38 for Panel A and 1.22 for Panel B. The results are within the acceptable level of test for autocorrelation.

Table 4 Standard OLS regressions of IPO returns with past IPO returns & book-building-adjusted price in Hot cycles in the three regimes.

Panel A (High Premium IPOs in Regime 1 [1995-1999])	
Dependent variable: First-day returns	
Past IPO returns	**1.52** **(6.33)*** **
Bookbuilding price adjustment	-
Fixed price (dummy)	-
Intercept	-0.28 (-0.12)
Adjusted R^2	0.12
Observations	298

The symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Durbin-Watson statistic: 3.05.

Panel B (High Premium IPOs in Regime 2 [1999-2005])	
Past IPO returns	**0.99** **(4.73)*** **
Bookbuilding price adjustment	**2.59** **(3.96)*** **
Fixed price (dummy)	38.33 (1.05)
Intercept	-33.99 (-1.26)
Adjusted R^2	0.28
Observations	113

The symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Durbin-Watson statistic: 1.33.

Panel C (High Premium IPOs in Regime 3 [2005-2007])	
Past IPO returns	0.05 (0.30)
Bookbuilding price adjustment	**3.42** **(9.84)*** **
Fixed price (dummy)	33.71 (1.70)
Intercept	-23.26 (-1.80)
Adjusted R^2	0.41
Observations	141

The symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Durbin-Watson statistic: 1.84

Table-4 presents the results of tests for representativeness sentiment due to past IPO returns and book-building-adjusted prices for high underwriter valuation (positive premium on face value) of IPOs in the three regimes in India.

Table 5 Standard OLS regression of IPO underpricing with representativeness heuristic proxy variables.

Dependent Variable:	First-day IPO return			
	(1)	(2)	(3)	(4)
Past IPO returns	0.36	0.67	0.70	-0.06
	(7.31)***	(7.86)***	(7.85)***	(-0.38)
Bookbuilding price adjustment	2.66	2.17	2.51	3.75
	(17.65)***	(5.54)***	(6.34)***	(7.70)***
High Premium IPOs		0.05	0.10	-0.11
		(0.90)	(1.80)	(-1.61)
Fixed price (dummy)			38.55	38.41
			(3.05)***	(1.15)
Large company (dummy)			-63.76	-10.74
			(-1.48)	(-0.22)
Technology industry (dummy)			38.19	66.64
			(2.67)**	(2.93)**
Textile industry (dummy)			-4.00	-12.23
			(-0.30)	(-0.43)
Pharmaceutical industry (dummy)			5.65	30.36
			(0.33)	(0.87)
Financial industry (dummy)			10.51	37.90
			(0.76)	(0.93)
Regime 3 (dummy)			-15.74	1.57
			(-1.32)	(0.09)
Institutional allocation				1.21
				(1.15)
Intercept	1.49	-6.82	-40.50	-74.86
	(0.83)	(-1.29)	(-3.09)***	(-1.23)
Adjusted R^2	0.24	0.30	0.33	0.40
Observations:	1501	545	545	197

The symbols ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Durbin-Watson statistic: 2.04, 1.98, 2.12 and 1.30 respectively.

Table 5 presents regressions for all observations. The dependent variable is *first-day IPO return* (in Indian rupees), which is the difference in the closing price on first-day of trading in the secondary market and the final issue price of the IPO share. The pre-IPO sentiment parameter is the *bookbuilding price adjustment* (issue price – lower range of initial price in Indian rupees). We did not include bookbuilding initial price date and issue price date duration (in number of days) in our regression since the results are not statistically significant. The benchmark time period for the regression in column-4 is Regime-2 (1999-2005) for bookbuilding IPOs with institutional allocation (%) information only. *High Premium IPOs* variable represents those companies with positive premium on face value. There are a total of 545 companies with positive premium as shown in column-2 and column-3. The difference between column-3 and coulumn-4 is that the former includes all bookbuilding IPOs and the latter includes bookbuilding IPOs with *institutional allocation* information.