



**Development Research Group Studies  
2013 - 14**

Securities and Exchange Board of India



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## Foreword

Research activities help facilitate the understanding of the multiple economic uncertainties that lie ahead. Sound research backed by relevant primary and secondary data sources assist any policy making body in carrying out its activities, especially under challenging times. Additionally, research activities contribute in knowledge sharing, dissemination of information and developing an interface with academics.

One of the three mandates of Securities and Exchange Board of India (SEBI) is development of the securities market. Moreover, SEBI Act, 1992 mandates SEBI to conduct research pertaining to various functions of the securities market. In this regard, extensive policy research is necessary to analyze the existing policies, as well as to suggest new policy alternatives. The Department of Economic and Policy Analysis (DEPA) of SEBI has been entrusted with the job of carrying out research on securities market, preparation of concept papers / background papers and giving research feedback on current issues.

Therefore, recently, SEBI has taken an initiative - Development Research Group (DRG). The objective of DRG is to conduct policy oriented research which calls for in-depth study on various subjects to examine policy impacts, to compare the Indian scenario with international best practices and to provide analytical and advisory inputs to the SEBI Board. DRG aims to undertake extensive policy research to analyze the existing regulatory policies from an academic perspective as well as to suggest new policy alternatives, essentially on subjects contributing clarity and solutions to challenges faced by SEBI.

As a part of this initiative in the silver jubilee year of SEBI, four studies were taken up under DRG-I, catering to different segments of the securities market, viz, 1) Foreign Investments in Government Bond Market, 2) Earnings Management in India, 3) Impact of increased derivatives trading on price discovery process and 4) Penetration of Mutual Funds in India. The publication of the present volume is the culmination of DRG-I. This publication is expected to be useful for researchers, policymakers, financial market participants, and analysts interested in securities market.

The studies are undertaken by the Department of Economic and Policy Analysis (DEPA) in collaboration with the external experts/academicians. The intensive and dedicated efforts of the external experts and the officers who were associated with them for completing the studies and publishing the same, deserve high appreciation. I am sure that the studies will be valuable for the researchers, academicians as well as policymakers and will promote academic debates as well as contribute to better policy making.

May 19, 2014

**U.K. Sinha**  
Chairman, SEBI



# CONTENTS

|    |   |    |
|----|---|----|
| 1. | <b>Foreign Investment in Indian Government Bond Market</b>                    | 1  |
|    | <i>Ila Patnaik, Sarat Malik, Radhika Pandey, Prateek</i>                      |    |
| 2. | <b>Earnings Management in India</b>   | 14 |
|    | <i>Ajit D., Sarat Malik, Vimal Kumar Verma</i>                                |    |
| 3. | <b>Impact of Increased Derivatives Trading on the Price Discovery Process</b> | 31 |
|    | <i>Banikant Mishra, Sarat Malik, Laltu Pore</i>                               |    |
| 4. | <b>Penetration of Mutual Funds in India - Opportunities and Challenges</b>    | 50 |
|    | <i>Rajesh Chakrabarti, Sarat Malik, Sudhakar Khairnar, Aadhar Verma</i>       |    |



# Foreign Investment in the Indian Government Bond Market

Ila Patnaik\*

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Prateek

*A country witnesses currency exposure when locals hold a large amount of unhedged foreign currency denominated debt. However, India's capital controls continue to be guided by concerns about debt and its maturity, rather than its currency denomination. Even though there is foreign appetite for rupee denominated debt, India has placed many restrictions on foreign investment in rupee denominated bonds. These include caps on the total as well as limits by investor class, maturity and issuer and have been implemented through a complicated mechanism for allocation and reinvestment. This paper presents the logic and rationale for why these restrictions fail to meet the objectives of economic policy today. It recommends removal of quantitative restrictions on foreign holding of Indian rupee denominated debt and suggests ways to move to a more efficient framework.*

## 1. Introduction

In 1991, India embarked on integration into the world economy through trade and capital account liberalisation measures. A key idea behind the early decontrol measures was that debt inflows were dangerous and hence strong restrictions need to be placed on debt flows. Restrictions were imposed to shift the composition of capital flows away from debt to non-debt creating inflows and regulate external commercial borrowings, especially short-term debt. As a consequence, while the framework for foreign investment, both for FDI, and for portfolio flows, is relatively liberal, India has a number of restrictions on debt.

Over the past decade, the global thinking on debt flows has changed. The macroeconomic and financial

instability in emerging markets following the crises of the late 1990s has led to increased efforts in these countries to develop local currency denominated bond markets as an alternative source of debt financing for the public and corporate sectors.

As the report of the Committee on the Global Financial System (2007) notes:

*Local currency bond markets can help financial stability by reducing currency mismatches and lengthening the duration of debt. Such markets also help economic efficiency by generating market-determined interest rates that reflect the opportunity costs of funds at different maturities. The absence of such markets can lead borrowers to take risky financing decisions that create balance sheet vulnerabilities. Such balance sheet weaknesses*

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*played a key role in virtually every major financial crisis affecting the emerging market economies (EMEs) since the early 1980s.*

In the 2000s, emerging economies domestic bond markets have grown substantially. The outstanding stock of domestic bonds now exceeds \$6 trillion compared with only \$1 trillion in the mid-1990s (Peiris, 2010). Along with an increase in the size of the local debt markets, foreign participation has also increased substantially over the last decade. In contrast, the Indian policy framework on debt flows continues to be guided by the position adopted in the early 1990s. The regulatory framework is characterized by quantitative restrictions on foreign participation, resulting in limited investments by foreign investors. This study makes a case for opening up the local currency government and corporate debt market to foreign investors and provides a rationale for removing the restrictions on foreign participation based on sound economic policy objectives. The rest of the study is structured as follows: Section 2 provides an overview of the present regulatory framework governing debt markets in India. Section 3 outlines the legal foundations of the current framework. Section 4 describes the regulatory framework governing Government bond market and documents its evolution. Section 5 provides the rationale for easing the restrictions on foreign participation in local currency debt market. Section 6 discusses the recommendations of the study.

## **2. Present arrangements**

The present arrangement governing foreign borrowing comprises two parts:

**Dollar denominated debt** India borrows in foreign currency denominated debt through government borrowing (both bilateral and multilateral), external commercial borrowing (ECB) by firms including FCCB and FCEB, and fully repatriable NRI deposits.

**Rupee denominated debt** Foreign investment into rupee denominated debt takes the form of foreign investors buying bonds in the Indian debt market, all of which are denominated in rupees. This is curtailed by an array of quantitative restrictions (QRs). There are different limits for foreign investments in Government bonds and corporate bonds. The arrangement is further complicated by having sub-limits across assets and investor classes.

On April 1, 2013, a major attempt was made towards simplification of foreign investment limits in rupee-denominated bonds<sup>1</sup>.

1. The separate sub-limits of investment in Government Debt– Old of USD 10 billion and in Government Debt– Long Term of USD 15 billion were merged into a single limit of USD 25 billion in Government securities.
2. The separate sub-limits of USD 1 billion for QFIs, USD 25 billion for FIIs and USD 25 billion for FIIs in long term infra bonds were merged into a single limit of USD 51 billion for corporate bonds.

Table 1 provides the current position of capital controls on foreign investment in rupee denominated debt. On June 12, 2013, the foreign investment limit in Government debt was enhanced by USD 5 billion. However, the enhanced investment limit was available to a specified class of foreign investors.<sup>2</sup>

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<sup>1</sup> See SEBI circular CIR/IMD/FIIC/6/2013

<sup>2</sup> See SEBI Circular: CIR/IMD/FIIC/8/2013

**Table 1: Foreign investment in rupee denominated bonds**

| Instrument      | Cap (USD bn) | Eligible investors   | Sub-limits  |
|-----------------|--------------|--|---|
| Government debt | 25           | FII and QFI  | USD 3.5 billion in treasury bills within the limit of USD 25 billion    |
| Government debt | 5            | SWFs, Multilateral Agencies Pension Funds, Insurance Funds |   |
| Corporate debt  | 51           | FII and QFI  | USD 3.5 billion in Commercial papers within the limit of USD 51 billion |

**Table 2: Foreign ownership of Government bonds****(in percent)**

|     | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|-----|------|------|------|------|------|------|
| FII | 0.52 | 0.24 | 0.59 | 0.97 | 0.88 | 1.61 |

Table 2 shows the share of the Government bonds outstanding that are owned by foreign investors. While this share has risen through the years, it stands at 1.6 percent as at end March 2013. In absolute numbers, foreign investors own Rs 700 billion or approximately USD 11 billion of Indian government bonds. At present, the QR for foreign investment in government bonds stands at USD 30 billion. This small scale of ownership implies a substantial upside potential. Even if the ownership of foreign investors went up overnight by ten times (to \$110 billion), it would only amount to 16 percent of the existing stock of bonds.<sup>3</sup>

A comparison against other emerging economies (Table 3) shows that India greatly lags in conditions seen elsewhere in the world. This raises questions on the structure of capital controls in the rupee-denominated bond market that has resulted in scarce foreign ownership of Government bonds.

Table 4 shows the debt utilisation status of Government and corporate debt. The complex nature of quantitative restrictions discourages foreign investors to have deeper engagement in the Indian bond market. As an example, in corporate bond market, though the investment limit is Rs 244,323 crores, the actual investment is only Rs 81089 crores. This amounts to a meagre 33 percent of the investment limit.

**Table 3: Foreign holdings in local currency Government bonds****(Percent of total outstanding)**

| Country   | Sep 2012 | Dec 2012 | Mar 2013 |
|-----------|----------|----------|----------|
| Indonesia | 29.6     | 32.9     | 32.5     |
| Malaysia  | 28.5     | 29.7     | 31.2     |
| Thailand  | 15.0     | 16.3     | 17.6     |
| Korea     | 10.2     | 9.5      | 9.4      |

<sup>3</sup> The internal debt of the government stands at Rs.48.7 trillion. Government securities account for 90 percent of this.

**Table 4: Debt Utilisation Status (as on 26 August, 2013)**

| Category                          | Upper Cap<br>(USD billion) | Upper Cap<br>(INR crore) | Total Investment<br>(INR crore) | Percent to GDP<br>(2013; Percent) |
|-----------------------------------|----------------------------|--------------------------|---------------------------------|-----------------------------------|
| Government debt                   | 25                         | 124,432                  | 120,359                         | 1.2                               |
| Government debt <sup>1</sup>      | 5                          | 29,137                   | 1,671                           | 0.017                             |
| Government debt - treasury bills  | 5.5                        | 25,416                   | 15,803                          | 0.16                              |
| Corporate debt                    | 51                         | 244,323                  | 81,089                          | 0.81                              |
| Corporate debt - commercial paper | 3.5                        | 17,462                   | 12,185                          | 0.12                              |

Source: <https://nsdl.co.in/FII/FII.php>

1: Investments by FIIs registered with SEBI under the categories of Sovereign Wealth Funds, Multilateral Agencies, Endowment funds, Insurance funds, pension funds and Foreign Central banks as per SEBI circular ref. no. CIR/IMD/FIIC/8/2013 dated June 12, 2013.

The Working Group on Foreign Investment chaired by U. K. Sinha analysed these problems and proposed modifications. The Working Group pointed out that the existing regulations create incentives for Indian firms in favour of foreign currency borrowings, instead of issuance in rupees with investments by foreign investors.<sup>4</sup> Hence, the Working Group recommended that easing the restrictions on rupee-denominated debt is a safer way of managing globalisation. The Committee on Financial Sector Reforms chaired by Raghuram Rajan also recommended steady opening of rupee denominated government and corporate bond markets to foreign investors.

### 3. Legal foundations of the current framework

1. The power to regulate capital account transactions currently vests with the RBI. This power has been conferred on it by the Foreign Exchange Management Act, 1999 (“FEMA”). Specifically, Section 6(3)(b) of the FEMA confers this power.
2. Section 47 of the FEMA empowers the RBI to carry out the provisions of this Act. In exercise of its powers under Section 47 and Section 6(3) (b), the RBI came out with the Foreign Exchange

Management (Transfer or issue of security by a person resident outside India) Regulations, 2000 (“FEMA 20”).

3. Regulation 5(4) of FEMA 20 allows FIIs, QFIs and other non-resident investors to invest in rupee-denominated bonds subject to the specified terms and conditions. Regulation 5(4) was amended on October 19, 2012 to include QFI as an eligible investor class. With this amendment, three broad investor classes were identified—FIIs, QFIs and long-term investors. These investor classes were subjected to different investment restrictions.
4. Schedule 5 to Regulation 5(4) of FEMA 20 specifies the terms and conditions of foreign investment in rupee-denominated bonds. This Schedule was further amended on March 26, 2013. The intent was to create a unified framework of restrictions for the three investor classes— FIIs, QFIs and long-term investors.
5. The Proviso to Regulation 15(2) of Securities and Exchange Board of India (Foreign Institutional Investors) Regulations, 1995 empowers SEBI to impose limits on the maximum amount which can be invested in debt securities by the foreign institutional investor on its own account or through its sub accounts.
6. SEBI issues circulars governing various aspects of foreign investments in rupee denominated debt securities.

<sup>4</sup> See Master Circular on External Commercial Borrowings and Trade Credits RBI/2013-14/12 Master Circular No. 12/2013-14

## 4. Regulatory framework of foreign investment in Government bond market

In this section we describe the regulatory framework governing foreign investment in Government bond market and its evolution.

### 4.1 Changes in quantitative limits

The origin of policy on foreign investment in debt market can be traced back to November 1992, when Ministry of Finance approved the restriction in allocation of total investments by Foreign Institutional Investors (FIIs) between equities and debt instruments in the proportion of 70:30, that is, at the most, only 30 per cent of FII investment were allowed in debt securities. In November 1995, SEBI (FII) Regulations came into existence which notified that FII investments in equity and debt were allowed as part of the 70:30 limits. In 1996, a new category was introduced in the debt segment. Separate route was opened for 100 percent investment in debt securities. Thus, any FII willing to make 100 percent investments in debt securities was permitted to do so, subject to specific approval from SEBI as a separate category of FIIs or sub-accounts as 100 percent debt funds. In such cases, the restriction of 30 percent debt was not applicable subject to an overall debt cap by FIIs. In 1997, FIIs were permitted to invest in Government securities, first through the 100 percent debt route and later through the 70:30 route.

From 1996 to March 2004, the overall cap for FIIs to invest in Government debt was USD 1 billion with separate caps for 70:30 route and 100 percent debt route. The cap for the 70:30 route was USD 100 million and for the 100 percent debt route, the cap was USD 900 million. Since then the debt limits have been raised continuously over the years. Table 5 shows the foreign investment limit in Government debt (Old) across the years.

**Table 5: Foreign investment in Government debt (Old)**

| Date of change | Total limit (USD billion) |
|----------------|---------------------------|
| Nov-96         | 1                         |
| Nov-04         | 1.75                      |

|        |     |
|--------|-----|
| Apr-06 | 2   |
| Jan-07 | 2.6 |
| Jan-08 | 3.2 |
| Jun-08 | 5   |
| Nov-11 | 10  |

On November 26, 2010, in addition to the above framework of FII investment in Government securities, FIIs were also allowed to invest USD 5 billion in Government securities with a residual maturity of 5 years. In June 2012, this limit was enhanced to USD 10 billion and the residual maturity at the time of first purchase was reduced to 3 years. In January 2013, this limit was further enhanced to USD 15 billion. Since February 2013, the provision regarding 3 years residual maturity, in the Government debt long term category, at the time of first purchase is no longer applicable. However, within this category, FIIs are not allowed to invest in short term paper like treasury bills. Table 6 shows the foreign investment limit in Government debt (Long) over the years.

**Table 6: Foreign investment in Government debt (Long)**

| Date of Change | Total limit (USD billion) |
|----------------|---------------------------|
| Sept-2010      | 5                         |
| June-2012      | 10                        |
| Feb-2013       | 15                        |

Till April 2013, foreign investment was permitted in two categories of Government bonds:

1. Government debt-Old
2. Government debt-Long Term

In April 2013, the two categories were merged and the overall limit for FII investment in Government securities became USD 25 billion. This was done by merging the limits of USD 10 billion and USD 15 billion in G-Sec (Old) and G-Sec (Long Term) respectively. A separate sub-limit of USD 5.5 billion is kept for FII investment in treasury bills. In June 2013, a further enhancement has been done in the FII investment limit. The limit has been enhanced by USD 5 billion raising the cumulative cap to USD

30 billion. However, this enhanced limit of USD 5 billion is available for investments only to those FIIs that are registered with SEBI under the categories of Sovereign Wealth Funds (SWFs), Multilateral Agencies, Endowment Funds, Insurance Funds, Pension Funds and Foreign Central Banks.

## 4.2 Allocation methodology

Though the RBI, in consultation with the Government prescribes the cap on the maximum permissible investment by FIIs in debt category, the methodology of allocation of these limits is determined by the capital market regulator, Securities and Exchange Board of India, through its various circulars from time to time.

When the markets opened to FIIs in the early nineties, the limits were very small. At that time the allocation was through the quota system. According to this system, FIIs had to apply for a license to operate in the market. Once the routine checks were done by SEBI, license was issued and the FIIs were allowed to operate in the G-sec market. Revised additional limits were divided amongst the FIIs equally and the players who did not use their limits did not receive any share in the increased limit. This system was clearly anti-competitive.<sup>5</sup> It penalised smarter firms at the expense of the weaker firms. As markets progressed and more and more players started entering the market, quota system could no longer be in use because it was not transparent.

The allocation procedure was changed to first come first served (FCFS) basis since July 2008.<sup>6</sup> The allocation of unutilised/ unallocated limits for investments in Government Securities/ T-Bills came to be on first-come-first-serve basis. The allocation was valid for a period of 15 days from the date of the allocation on the expiry of which the unutilised limits lapsed. Later, in November 2008, the validity period was reduced to 11 days. FCFS had its own

share of technical issues with it. Since it was only time-priority method, a delay in seconds could change the allocation. The window opened on a specific date at midnight. On each of those dates, some 5000-10000 mails were received by SEBI once the window was opened. And since technically, the efficiency of the IT servers at the investors' end (including FIIs' foreign locations) and at the regulators' end could not be perfect, there were instances where e-mails were sent at a different time and received at different time and hence allocation could not be efficient. Realising the uncertainties in allocation of the limits, a number of investors started quoting more than required. Thus, utilisation got low as once the quoted allocation was allocated, they were not able to invest fully.

Considering the limitations of the FCFS methodology, auctions were introduced in the allocation of debt investment limits to FII. Auction mechanism was initially introduced for corporate debt through SEBI circular<sup>7</sup> and subsequently for Government securities through SEBI circular of May 2009.<sup>8</sup>

SEBI introduced auctions for a limited amount. For some time the allocation took place through both the FCFS and auction method. These circulars laid down the specifics of the auction i.e. the minimum amount that can be bid by a single entity, the maximum amount that can be allocated to a single entity. The time period for utilisation of the acquired limits was 45 days for the auction method and 11 days for the FCFS method. Gradually, FCFS was phased out, first from 'old' category and then from 'long term' category.

The limits that were not utilised were added back to the pool of free limits for auction. The time period for utilisation of limits was subsequently reduced from 45 days to 30 days.<sup>9</sup>

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5 For an analysis of the pitfalls of the quota system See "Quota Raj for debt inflows" available at <http://ajayshahblog.blogspot.in/2006/04/quota-raj-for-debt-inflows.html>.

6 Circular No. IMD/FII & C/ 27 /2008

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7 Circular No. IMD/FII & C/ 37/2009.

8 Circular No. IMD/FII & C/ 39/2009.

9 Sebi circular: CIR/IMD/FIIC/ 22/2012

### 4.3 Reinvestment

An important element of the regulatory framework of FII investment in Government securities is the facility of reinvestment. Due to the mismatch of the waiting period for next FCFS round and the investment opportunity, SEBI introduced a re-investment window of 5-15 days, whereby FIIs could continue to hold on to limits after sale or redemption.

According to SEBI, the reinvestment facility had the following unintended consequences:

1. Allowed FIIs to retain the debt investment limits till perpetuity by rolling over their investment during the re-investment period window. The ability to retain limits till perpetuity made the market anti-competitive.
2. As their average costs were comparatively lower, the existing large allottees continued to bid for debt limits at very high premia through the stock exchange bidding platforms. These costs could be amortised by them over a long period of time, in view of the perpetual nature of limits. This practice gave them an edge over other prospective bidders.
3. The cost of debt seemed uneconomical for the new fund based FIIs entities to participate in the bidding.
4. With the facility of reinvestment, there were no free limits, unless the Government announced fresh limits.

Considering these consequences, SEBI withdrew the facility of reinvestment through a circular<sup>10</sup> dated January 3, 2012. Henceforth, for all new allocations of debt limits to FIIs/sub-accounts, no re-investment period was allowed and the limits came back to the pool once the investment was sold or redeemed. Those FIIs who held limits at the time of this circular were allowed reinvestment facility under certain conditions.

<sup>10</sup> CIR/IMD/FIIC/1/2012

Prior to this circular, an FII which had acquired or obtained investment limits from SEBI, had the flexibility to reinvest into debt securities after the initial investment had been sold off or had matured, provided the subsequent investment was made within 15 business days of such sale or maturity of the earlier investment. Such changes in the regulatory framework adversely affected the interests of the foreign investors in the debt market. FIIs that were planning to use their existing debt limits over a relatively longer horizon by re-investing were not able to do so after the restriction on reinvestment was introduced. This reduced the attractiveness of debt securities and reduced the purchase of debt by foreign investors.

Since the prohibition on the reinvestment facility, SEBI received many proposals to consider changes in rules on reinvestment. Consequently on November 7, 2012, SEBI partially eased the restrictions on reinvestment.<sup>11</sup> With effect from January 1, 2014 it was decided that FIIs/ Sub-Accounts could reinvest during each calendar year to the extent of 50 percent of their debt holdings at the end of the previous calendar year.

In January, 2013, in response to the representations received, and to provide greater operational flexibility to FIIs/ sub-accounts, the following changes were made<sup>12</sup>:

- For those FIIs that did not hold any debt investment limits as on January 03, 2012 and purchased debt investment limits thereafter, it was decided that they would be allowed a cumulative re-investment facility to the extent of 50% of their maximum debt holding at any point of time during the calendar year 2013.
- From January 01, 2014, the re-investment facility as indicated in the SEBI circular dated November 07, 2012 became available during each calendar year to those FIIs which held debt investments as on December 31 of the previous calendar year.

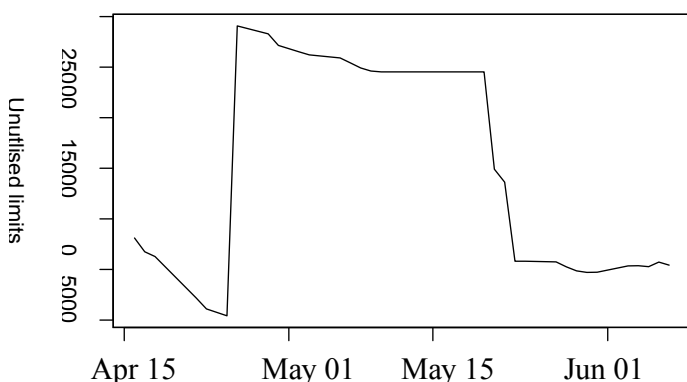
<sup>11</sup> CIR/IMD/FIIC/ 22/2012.

<sup>12</sup> CIR/IMD/FIIC/1/2013

#### 4.4 Unutilised limits

With the present system of auctions and partial prohibition on reinvestment, acquiring of limits and actual investments does not go hand in hand. Figure 1 shows the limits that are acquired but not invested by the foreign investors. Given the current system of monthly auctions and partial reinvestment, the investors bid for higher limits in anticipation of better investment opportunities and in the absence of such an opportunity, the limits remain unutilized.

**Figure 1 Unutilised limits**



As seen above, the regulatory framework is characterized by a number of frictions that adversely affect investors' interest in rupee denominated bond market.

#### 5. The objectives of economic policy reform

Five ideas guide our policy thinking about capital controls against foreign investment in rupee-denominated bonds:

1. Indebtedness through rupee-denominated bonds is qualitatively different from foreign currency borrowing, which can involve 'original sin'.
2. The effectiveness of monetary policy is enhanced when foreign investors have access to debt investment in India.
3. Foreign investment in financial markets in India fosters financial development in India, as opposed to investments by foreigners into Indian issuers at overseas locations such as London.

4. When foreign investors carry the currency risk of rupee fluctuations, they are likely to require hedging against exchange rate fluctuations. While this can be done overseas on the NDF market, giving foreign investors access to currency trading in India is in India's interest.
5. The major challenge that India faces is that of overcoming home bias on the part of foreign investors. In order to overcome home bias, policies must be conducive to the development of knowledge and organisational capital in foreign financial firms. This requires removing quantitative restrictions (QRs), and solving the tax impediments against foreign investors establishing operations in India.

#### 5.1 Avoiding original sin

Borrowing in foreign currency denominated bonds can induce the problem of "original sin" and "financial dollarization". The empirical literature has placed a high importance on these concerns (Yeyati, 2005; Eichengreen et al. 2007). A key finding of this literature is that the composition of external debt – the extent to which the debt is foreign currency denominated – is a key determinant of the stability of output, volatility of capital flows and management of exchange rates.

When a government or a company borrows in foreign currency it can suffer from currency mismatch – earning in local currency but repaying the debt in foreign currency. A sharp depreciation of the local currency can then sharply increase the costs of debt servicing and thus induce credit distress.

When currency mismatches are present, they create political economy pressures to manage the exchange rate, which leads to large-scale distortions of macroeconomic policy.

A safer option is to encourage local currency borrowings. In such a case, the foreign investor bears all the currency risk. There is no "original sin" when a foreign investor buys a local currency bond.

In India, at present, we do the reverse of what is considered as appropriate for sound macroeconomic policy. Foreign investment into rupee denominated bonds - which is not original sin - has been tightly restricted through quantitative restrictions. The policy framework incentivises firms to borrow abroad through the external commercial borrowings route,<sup>13</sup> which creates dollar liabilities on firms' balance-sheets.

Borrowing in foreign currency denominated debt is particularly likely to induce currency mismatch when the issuer is an infrastructure developer, who has cashflows almost entirely in rupees. In recent years, the difficulties of the Indian bond market have led to an emphasis on foreign borrowing for infrastructure financing. This is a particularly incorrect approach and needs to be replaced by a strategy where foreign investors come into India and buy rupee-denominated bonds issued by infrastructure developers.

## **5.2 Improving the effectiveness of monetary policy**

When the policy rate is raised, there are two impacts. Borrowing becomes costlier within India, which reduces demand and thus cools the economy. In addition, when the interest rate in India is higher, more capital comes into India, and the rupee appreciates, which cools the economy.

These two effects also work in reverse. When the policy rate is lowered, there is one channel working within India, where demand is increased. In addition, at a lower interest rate, less capital comes into India, and the rupee depreciates, which is expansionary.

The second channel has been largely ineffective till date, owing to the capital controls that affect debt flows into India. Changes in the policy rate have a feeble impact on the rupee, as the channels through which foreign investment comes into Indian debt are clogged. While foreign investment into equity is open, equity investment has a low sensitivity to the

policy rate. The main impact of monetary policy will come about through debt flows.

Liberalisation of capital inflows into the rupee-denominated debt market would increase the sensitivity of debt inflows to the policy rate. Through this, monetary policy in India would become more effective. When RBI raised rates, along with other effects, the rupee would tend to appreciate, which is contractionary. Conversely, when RBI cut rates, along with other effects, the rupee would tend to depreciate, which is expansionary.

## **5.3 Fostering domestic financial development**

Foreign participation in the Indian bond market will help accelerate modernisation of the debt market. For an analogy, the development of the equity market from 1992 to 2001 was, to a certain extent, influenced by the need to match the market arrangements that are found in other emerging markets. In similar fashion, if foreign investors are strongly present in the Indian Bond-Currency-Derivatives Nexus, there will be greater pressure to match the market arrangements that are found in other emerging markets.

Of particular importance is the choice of onshore versus offshore issuance. As an analogy, in the early 1990s, there was a surge of GDR and ADR issuance by Indian companies. Indian issuers and foreign investors preferred to meet each other in London or New York, instead of intermediation through the Indian equity market. However, after the equity market reforms took shape with the onset of equities trading at NSE in November 1994, overseas issuance by Indian firms dropped sharply.

With bonds, there are two possibilities: Indian firms borrowing overseas in dollars or borrowing overseas in rupees. Both cases involve reduced market activity and liquidity in India. The former involves original sin. Bond issuance in London, denominated in rupees, is relatively difficult when compared with issuance in rupees. For these reasons, there is strong

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<sup>13</sup> A permissible end-use of ECB is that the borrowed funds can be used for investing in outbound direct investment.

reason to favour a framework where foreign investors bring money to Indian issuers by purchasing rupee-denominated bonds in India.

#### **5.4 Currency hedging alongside rupee denominated bonds**

When a foreign investor buys a rupee-denominated bond, the currency risk is placed on him. All foreign investors will choose to hedge this risk some of the time. While many foreign investors may not be hedged at all times, all foreign investors who envisage buying rupee-denominated debt require to first have a clear mechanism for currency hedging as and when desired.

Given the substantial size of rupee derivatives that are trading overseas, foreign investors who buy rupee-denominated debt always have the ability to hedge these purchases overseas. Using the NDF market is free of taxation of transactions and there have been attempts by Indian tax authorities to impose source-based taxation.

At the same time, India is the natural venue for global trading in the rupee. It is advantageous to Indian authorities if the bulk of global trading in the rupee takes place in India. When this activity takes place in India, it fosters a deep and liquid market with the comprehensive development of the Bond- Currency-Derivatives Nexus. This will help improve the monetary policy transmission.

To the extent that foreign investors engage with Indian issuers on Indian soil, and to the extent that their currency trading activities take place in India, the revenue stream for financial services associated with these transactions will accrue to Indian financial firms. This will increase Indian GDP.

For these reasons, opening up access to currency trading in India – on terms and conditions which are as unencumbered as the NDF market – should be seen as an integral part of opening up the rupee denominated bond market.

#### **5.5 Credit risk management for rupee denominated bonds**

When an investor buys a rupee-denominated bond, the credit risk is also placed on him. All investors will

choose to hedge this risk some of the time. At present, due to the under-development in the credit derivatives market, the avenues for credit risk management for investors are very restricted. Liberalisation of this market will help give the investors the opportunity to hedge their credit risks. The key changes required here are: expansion of the list of market participants, and the list of debt instruments on which the credit defaults swaps can be written.

#### **5.6 Overcoming home bias**

In the field of international portfolio management, the major problem that is faced is that of ‘home bias’, where investors tend to keep too much of their money invested at home. As a consequence, the share of the global portfolio that is invested in India is below what it should be for global investors to achieve efficient diversification.

Home bias by foreign investors is closely related to a lack of knowledge about India. This is also associated with unstable responses to global and local events, such as capital flow reversals, sudden stops, etc. From a strategic perspective, India’s engagement with financial globalisation requires sound knowledge in the hands of foreign investors, so as to alleviate home bias.

At present, the market value of emerging market debt is roughly \$2 trillion. When India opens up, an additional \$1 trillion will be added into this and India will make up roughly one-third of EM debt. For a while, however, global investors are unlikely to place a third of their overall EM debt investments into India, owing to home bias.

Home bias is particularly strong against smaller securities and bonds issued by smaller companies. When India opens up, it is likely that global fixed income investors will relatively readily take to bonds issued by the top 10 firms. It will, however, be at least five years of sound policies before global investors buy over 10 percent of the bonds issued by the 1000th biggest firm of India. Alleviating home bias is required in order to avoid a non-level playing field where small firms in India lack access to foreign debt capital while large companies do.

In order to alleviate the home bias of foreign investors, the Indian strategy towards financial globalisation needs to be modified in several directions.

The key insight into home bias lies in the organisational capital of foreign financial firms. In the equity market, where India's engagement with financial globalisation is now 20 years old, a sophisticated 'ecosystem' of foreign investment into Indian equities has come about. All large global financial firms have a group that works on Indian equities. Databases and analysis of firms and portfolios are available. This has given a gradual process of alleviating home bias. At first, foreign investors purchased shares of the biggest companies with small weights. Over the years, as the internal teams of foreign financial firms have impounded knowledge about India within their organisations, they have become more confident and foreign investment has now percolated into the top 500 companies. However, even today, foreign equity investment has not percolated beyond the top 500 firms, which reflects the presence of home bias.

The problem of home bias is greatly amplified with debt investment. In the field of rupee-denominated bonds, quantitative restrictions have repeatedly disrupted the development of these organisations. For investments into bonds from Indian issuers to take place, global financial firms have to develop teams which specialise in this field. Over the years, these teams would gain confidence, and be willing to accept bonds issued by smaller companies. However, the formation of these teams has repeatedly hit a barrier in terms of quantitative restrictions and the auction system. When a foreign financial firm is blocked from accessing rupee-denominated debt, the team working on rupee denominated debt is disbanded, and this organisational capital is disrupted. A few months later, the Indian rules about quantitative restrictions and the auction system may be modified to make investment opportunities possible, but the organisational capital has to then be rebuilt from scratch.

If the quantitative restrictions on rupee-denominated debt are comprehensively and permanently removed in 2013, in the medium term, this will result in the

development of organisational capital within global financial firms, through which sustained investments into this new asset class will come about. At first, investment will be concentrated in liquid government bonds and in bonds issued by the top 50 companies. The magnitude of investment will be small. As the teams in foreign financial firms gain confidence and credibility, the weights will go up, and investment will percolate into the full range of government bonds and into bonds issued by smaller companies. This process will result in a reduction of home bias.

This process will be accelerated if foreign financial firms establish operations in India. As an example, the knowledge with foreign financial firms about the 500th largest firm in India will always be greater if the investment team is located in Bombay and not in Singapore. For this to come about, a critical impediment which needs to be solved is the tax treatment of offices of investment managers that are located in India.

When foreign money managers locate offices in India, this will diminish home bias against both equity and debt investment. In the case of the equity market, there is significant foreign ownership of the top 50 stocks, and small ownership of the next 450 firms. Reduction of home bias would involve larger foreign shareholding for these 500 firms, where foreign investment has already begun, and a percolation of foreign ownership beyond these 500 firms into the next 2000 firms. In the case of the bond market, foreign ownership of rupee-denominated bonds is primarily in the top 20 liquid government bond issues and in bonds issued by the top 20 companies. Reduction of home bias would involve percolation of foreign investment to all bonds issued by the government, and to bonds issued by the top 500 companies.

One element of the global fixed income investment landscape is fixed income index funds including ETFs. The most widely tracked debt market index is the 'J. P. Morgan GBI - EM Global Diversified' index. At present, it has a negligible country allocation for India, given the presence of quantitative restrictions that make it impossible to implement index funds.

If India removes quantitative restrictions on foreign investment into rupee denominated debt, it is expected that roughly 10 percent of the weightage in EM index funds will be allocated to India. As roughly \$100 billion is at present invested in EM debt index funds, this should generate a \$10 billion inflow into India within roughly a year.

Over and above this, there are substantial assets with actively managed EM debt funds, all of which would start building an India-related business once India opens up.

## 6. Recommendations

Drawing on this analysis, the next steps in policy reform consist of:

1. Removal of all existing quantitative restrictions: The existing framework of quantitative restrictions on foreign investment in Government bond market should be dismantled. This will encourage greater engagement of foreigners in the government debt market. Since this is rupee denominated debt, the concerns associated with “original sin” and liability dollarisation of financial firms do not arise.
2. Percentage limits on foreign investment: If at some stage, restrictions need to be imposed, the existing quantitative restrictions could be replaced by percentage limits on foreign ownership. This will enable greater foreign participation as the size of the Government bond market increases. Foreign ownership should be capped at a certain percentage of the outstanding government debt, such as at 10 or 15 percent of the total government debt. Under this framework, the Government debt market should be made operationally similar to the equity market. The regulator should allow free investments till the prescribed limit at any time. For this, the regulator should provide for daily dissemination of utilised levels to indicate to the market, the availability of spare investment. This would address the issue of bidding for higher limits and the presence of large unutilised limits in the market. Once the limit is reached, the investors can acquire Government bonds in the secondary market. This will help in easing the frictions associated with current auction system.
3. No distinction on asset class: Recently there has been an attempt towards merging the two categories of Government debt-old and long. The consolidated limit for foreign investment in government bond is USD 25 billion. However within this limit, the investment in treasury-bills is restricted to USD 5.5 billion. This limit should be eased in order to provide investors with flexible options to switch from long-term to short-term debt instruments. In general, there should not be any distinction between the asset classes within the prescribed umbrella limit.
4. No distinction on investor classes: The framework should not create artificial distinctions between investor classes i.e FII, QFI, Sovereign Wealth Funds etc. Recently, the increase in foreign investment limit in Government securities to USD 30 billion dollars is only applicable to certain specified classes of foreign investors.
5. KYC regime should be simplified: The current practice of submitting documents to multiple agencies should be done away with.
6. Sudden changes in market micro-structure should be avoided: This should involve the following steps: a) The regulator must state the long-run objective. b) Formal interactions should be done with market participants to identify problems in the market. c) A draft document should be released in the public domain incorporating the regulators response and what steps it proposes to take to mitigate the problems. d) The market participants should be allowed to give their feedback and comments within a specified time-frame. e) The regulator should then come up with a single amendment regulation incorporating the proposed changes.
7. Strengthen the liquidity and market efficiency of futures and options on currency underlyings in India: Give access to foreign investors (as

envisaged in the Budget Speech of February 2013) and increase the range of products available. This will allow them to hedge their exposure in the rupee-denominated bond markets.

8. Expand the scope of the currency derivatives market by including unlisted corporates and alternative investment funds as users of credit default swaps, and allow credit default swaps on unrated bonds and loans.
9. Clarify the tax treatment of foreign asset managers who build offices (“permanent establishments”) in India.

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# Earnings Management in India

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*Earnings management (EM) by companies is widespread throughout the world. The pressure to meet earnings targets of the market and thereby derive private benefits (in the form of managerial compensation) was found to be the driving force for EM world-wide. In the process the lack of quality of financial information disseminated by companies could affect investor decision-making and when detected by the market leads to severe losses for investors. The present study contributes to the literature by examining and quantifying the extent of EM in India by studying a cohort of 2229 listed Indian companies (non-financial) during 2008-2011. The study shows that the average earnings management in corporate sector(non-financial) in India is 2.9 per cent of the total assets of these firms which is comparable to the estimates in US, Europe and elsewhere in the world (around 1 to 5 per cent of total assets). The study reveals that small firms in India indulge relatively more in earnings management (10.6 per cent of the total asset) than the medium and large size firms. Industry-wise categorization shows that the companies in the line of business viz., construction and mining etc. are involved in relatively high levels of earnings management. Another finding of the study is that discretionary accruals are inversely related with leverage of companies. Further, the study did not find any statistically significant relationship between EM and performance of companies.*

*From the regulators point of view, these findings may be useful as it provides an additional tool for ensuring that financial reporting matches the real economic value of companies. Greater improvement in accounting quality and financial information can reduce asymmetry of information in capital market and protect investors who are ultimately lenders of capital for these companies. Efficiency and stability of capital market and financial system is a public good which every regulator seek to maximise. An increasing level of earnings management in a company or industry (above the average threshold of the industry) may provide much desired red signal for the regulator for enhanced monitoring and surveillance of the company/industry, so that integrity and stability of the financial system is not compromised.*

*Another policy implication of the study is the need for better and timely disclosure of financial information. Auditors can play an important role in monitor and disclosing financial reporting of companies so that management discretion (as accorded by the GAAP India) is minimized. The migration to IFRS planned in Indian corporate sector may reduce the management discretion over financial reporting. Given the international evidence that effective board of directors and audit committees can lead to reduced level of earnings management in companies, it is imperative that effectiveness of board of directors and audit committees may require greater attention of regulators.*

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## I. Introduction

Public companies face the pressure to meet or beat an important earnings benchmark, normally market earnings estimates. Companies that consistently meet or beat market earnings forecasts enjoy a high reputation as well as valuation premiums and lower cost of capital (Kasznik and McNichols, 2002; Brown and Caylor, 2005). When companies miss their earnings benchmarks, they suffer severe stock losses (Skinner and Sloan, 2002) and this adversely impacts executive compensation (Matsunaga and Park, 2001). As a result, managers of companies may use their discretion to manage earnings so that they can meet or beat current year market estimates. If the intention of reporting earnings figures is to provide private information to the market about the prospects of the company (earning informativeness) it could be seen as something 'positive'. This is referred to as 'efficient manipulation' (Ronen and Sadan, 1981; Chaney and Lewis, 1995; Tucker and Zarowin, 2006, Cahan et al., 2008). On the other hand, if managers resort to earnings management with the intention of pursuing their individual goals (such as managerial compensation), this is considered 'opportunistic manipulation' and the earnings figures reported by such companies are of poor quality and a measure of the information risk associated with them (Bhattacharya et al., 2003; Leuz et al., 2003).

Earnings management (EM) is possible by manipulating accruals (more by altering discretionary accruals) or by manipulating real activities (operational activities)<sup>1</sup>. In practice, real activities based EM occurs during the fiscal year and is realized by the fiscal-year end. After that, it is still possible for managers to adjust the level of accrual-based EM. Thus, in the real world, managers use multiple

EM techniques at the same time. The term 'accruals' corresponds to the earnings component that does not generate cash flows. Discretionary accruals are the portion of accruals over which management exercises discretion and this estimated portion of accruals is often used as a proxy of the earnings that are managed. EM, especially accrual-based earnings management is possible because accounting standards like Generally Accepted Accounting Principles (GAPP) allow alternative interpretation of accounting events (Teoh et al., 1988). The sources of earnings management include the choice of accounting methods, application of accounting methods and the timing of asset acquisitions and dispositions. The numerous scandals at the global level, especially the high-profile cases like Enron, WorldCom, Parmalat, Waste Management, Olympus, etc., and Satyam and HMT in India have eroded the credibility of financial reporting and marred the quality of earnings (Paltrow, S.J, 2002). Arthur Levitt (1998), the former Chairman of Securities and Exchange Commission (SEC) of the United States observes that EM is widespread, calls it a 'number game' and portrays it as a 'gray area between legitimacy and outright fraud'. Prior studies have also revealed that EM is pervasive and has reached a level that significantly compromises the integrity of financial reporting (Healy and Wahlen, 1999).

Managers get a number of financial incentives to meet performance expectations and derive private gains in the form of gaining earnings-based bonuses, increasing their promotion prospects, avoiding termination, avoiding a decline in the value of their stocks and stock appreciation rights/options, avoiding a downgrade of the company's debt, and so on. (Paltrow, S.J. 2002; Ball, 2009). The consequence

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<sup>1</sup> Most of the current research on earnings management focuses on detecting abnormal accruals. Managers also have the incentives to manipulate real activities to meet earning targets (such as providing discounts to temporarily increase sales, overproducing to report lower cost of goods sold, and reducing discretionary expenses like R&D, advertising expenditures, sales of profitable assets, etc). See Graham et al. (2005), Roychowdhury (2006) and Zhang (2012) for a discussion on real earnings management.

of earnings management is that the stock price of the company may get 'distorted' and pervasive manipulation of financial information could adversely affect investor confidence, drive stock markets down and raise the cost of capital significantly. Regulators across the world are concerned about the quality of financial reporting, maintaining an efficient capital market, ensuring investor protection, and the promotion of financial stability.

Research on earnings management in emerging markets like India is important as there is a high demand for capital by companies from global markets and foreign institutional investors play an important role in channeling this capital. Sustained flow of foreign capital (portfolio capital) into the Indian stock market can be fulfilled only if investors are protected from accounting frauds, financial misconduct and deceptive earnings management practices. Moreover, there is a substantial segment of retail investors in India who are unsophisticated and depend on financial reports of companies for making investment decisions and regulators have a fiduciary duty to protect these unsophisticated and gullible investors.

Firms make sales by either collecting cash or extending credit to their customers. Their accounting earnings are equal to their cash earnings plus accruals<sup>2</sup>. Insiders (managers) can opportunistically manipulate earnings figures as managerial discretion allows them flexibility, for example, in deciding how quickly to depreciate fixed assets and how large doubtful accounts should be. Earnings Management<sup>3</sup> thus can be defined

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<sup>2</sup> Total accruals are defined as the change in non-cash working capital accounts minus depreciation and amortization.

<sup>3</sup> It is useful to distinguish earnings management (EM) from earnings manipulation, earnings fraud, and creative accounting (Ning, 2005, 2006). Earnings manipulation means that management takes deliberate steps to bring reported earnings to a desired level. EM refers to the earnings manipulation through exercising the discretion accorded by accounting standards and corporate laws, and/or structuring activities in such a way that expected firm value is not affected negatively. Earnings fraud refers to the earnings manipulation by violating accounting standards and corporate laws, and/or structuring activities in such a way that reduces expected firm value; while "creative accounting" refers to the earnings manipulation practices that do not violate accounting standards or corporate laws because of the lack of relevant standards or laws.

as the discretionary use of judgment by insiders (managers) in financial reporting and in structuring transactions to misinform stakeholders about the underlying economic position and performance of the entity. Given this definition, earnings management is a financial reporting phenomenon (Beneish, 2001).

Earnings management has become a topic of increased interest for financial regulators. An understanding of earnings management practices helps regulator(s) to improve the functioning of capital markets, reduce asymmetry of information, reduce cost of capital and protect small and minority shareholders' interests. Important regulatory interventions to mitigate earning management practices in the US include the Regulation of Fair Disclosure passed in 2000 (to prohibit selective disclosure of material information) and the Sarbanes-Oxley Act of 2002<sup>4</sup>. These interventions allow auditors to have a more consistent and precise framework for evaluating the financial statements of firms. In turn, both financial analysts and public or private shareholders benefit from not only more accurate financial information, but also more consistent financial reporting by firms as well as across industries, thereby allowing the best possible conclusions to be drawn. Financial reporting plays two important roles in the capital market. Firstly, it enables capital providers (shareholders and creditors) to evaluate the return of potential investment opportunities. Secondly, it allows capital providers to monitor the use of capital once committed (Beyer et al., 2010). Both these functions are undermined when

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<sup>4</sup> Sections 302 and 404 of SOX have received the most attention. Section 302 deals with corporate responsibility for financial reports. In practice, this means that both the CEO and CFO of a public firm must take responsibility for the content of the financial report. Section 404 deals with the assessment of internal controls by management. Management is obliged to take responsibility for the establishment and maintenance of internal controls and it must assess the effectiveness of the internal control structure and the procedures for financial reporting. Section 404 also obliges the auditor to assess whether the assertions made by management are fair or not

managers opportunistically manage financial reports to derive private benefits. EM is one of the reasons for poor accounting quality. Less earnings management is considered one criterion of better accounting quality (Barth et al., 2008).

Detecting earnings management is a challenging task. The literature has followed several approaches, with varying characteristics. First, there is a large amount of literature that attempts to identify discretionary accruals based on the relation between total accruals and hypothesized explanatory factors. This literature began with Healy (1985) and DeAngelo (1986), who used total accruals and change in total accruals, respectively, as measures of management's discretion over earnings. Jones (1991) introduced a regression approach to control for non-discretionary factors in influencing accruals, specifying a linear relation between total accruals and change in sales and property, plant and equipment. These analytical and methodological advances have enabled researchers and practitioners to detect and quantify the extent of EM using discretionary accruals as a proxy for earnings management. There is substantial evidence in the US, Europe and other emerging markets that managers engage in earnings management<sup>5</sup>. Empirical work has also recorded that regulatory interventions like RFD and SOX in the US has resulted in a lower earnings management (Ronen & Yaari, 2007, Wilson, 2009).

India is the one of the fastest growing economies of the world. The number of listed companies in the Bombay Stock Exchange has risen from 4,344 in 1985 to 5,133 at end of March 2012. The market capitalization of these companies was around 74 per cent of India's GDP at end of March 2012 (SEBI, 2012). It would be interesting to examine the magnitude of EM existing among firms in the private corporate sector in India as well as in the companies/industries where it is preponderant. This would provide valuable insights to regulators like the Securities and Exchange Board

of India (SEBI) about the adequacy or changes in regulation required so that investors (especially unsophisticated investors) can make the best possible conclusions from financial statements.

### Objectives of the Study

The objectives of the study are as follows:

1. To examine whether earnings management exists in India among firms which are publicly listed;
2. If it exists, what is its magnitude compared with evidence from other countries;
3. What are the determinants of discretionary accruals – are they related to the firm's specific attributes (such performance, leverage, size);
4. What are the regulatory implications of EM?

The study is organized as follows: Section II reviews the literature on the subject and develops a hypothesis for testing. Section III discusses the database and methodology for the study. Section IV presents the empirical results and Section V summarizes the conclusions from the study.

## II. Review of Literature and Hypothesis Development

The use of earnings management is widely debated and actively researched. Schipper (1989) defines EM as "...purposeful intervention in the external financial reporting process, with the intent of obtaining some private gain...". Healy and Wahlen (1999) also define EM as a "...managers' judgment 'in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers..."(p.368). Mulford and Comiskey (2002) define EM as "...active manipulation of earnings towards a pre-determined target...". All these definitions focus on the legal accounting and economic choices that may be used to influence reported earnings.

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<sup>5</sup> See Healey (1985), Guidry et al. (1999), Defond and Jiambalvo (1994), Barth et al. (1995, 2010), Kasznik (2002), Healey and Whalen (1999).

Identifying earnings management is one of main challenges for both researchers and practitioners (Dechow et al., 2012); it is neither visible nor transparent. Academicians have devised indirect methods to estimate earnings management. One widely used method is to gauge the non-discretionary part of accruals. Isolating discretionary and non-discretionary accruals is the most important factor in developing a good earnings management detection model. The difficulty in isolating the non-discretionary and discretionary portions from total accruals by investigators (auditors, analysts, investors, and researchers) makes it convenient for firms looking to engage in earnings management. The analysis of earnings management is often discretionary accruals focused (Dechow et al., 1995, 2012).

The literatures on earnings management especially discretionary accruals as a proxy for earnings management are far ranging and selectively reviewed in the following sections.

#### *EM and Accrual Anomaly*

One of the controversial issues in EM is whether accruals are priced efficiently by the market (future stock returns). Starting with Sloan (1996<sup>6</sup>), a large amount of literature has emerged on the idea that the stock market struggles to understand the accruals components of reported earnings. Sloan (1996) provides empirical evidence (based on US data) that the current earnings performance of US companies is more persistent for companies with low levels of accruals. Hence, investors tend to overweigh accruals and are subsequently surprised if accruals turn out to be less persistent than expected. This overestimation of the persistence of earnings leads to abnormal positive returns for low accrual companies and abnormal negative returns for companies which have low levels of accruals.

#### *EM and Initial Public Offerings (IPO)*

There is research on the reporting of earnings around

IPOs of common stock (Teoh, Welch and Wong, 1988b). The study of Teoh et al. (1988b) shows that companies manage earnings in anticipation of going public with an equity issue (with an IPO).

#### *EM and Seasoned Equity Issues*

Studies by Shivakumar (1996), Teoh et al., (1988a) and Rangan (1998) also provide evidence of earnings management around seasoned equity offerings. They indicate that management faces the incentive to manage earnings upwards around a seasoned equity offering to maximize the offer price for its shares of the stock.

#### *EM and Executive Compensation.*

In the literature, the executive compensation contract has been found to create strong incentives for earnings management. Theoretically, management compensation contracts are viewed as devices to reduce the conflict of interest between managers and shareholders and thereby maximize a firm's value. However, these compensation contracts may induce earnings management simply because managers' compensation is either tied to accounting earnings (for example, bonus) or stock prices. Studies by Cheng et al. (2005), Bergstresser and Philippon, (2006) and Jiang, Petroni and Wang (2010) have shown that executive compensation is more closely related to the value of the stock and that such 'incentivized' executives indulge in higher levels of earnings management.

#### *EM and Audit Quality*

Several studies have examined the relationship between audit quality and earnings management. Studies by Becker et al. (1998) and Francis et al. (1999) find evidence that discretionary accruals in firms audited by Big 6 auditors are less than in the firms audited by non-Big 6 auditors. This evidence shows that audit quality has an important bearing on the magnitude of EM.

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<sup>6</sup> For an up-to-date survey of the literature in this field, see Richardson et al. (2010).

### *EM and Investor Protection*

One of the central conflicts in a company is the conflict between managers and investors. The moot question is whether strong and well-enforced investor protection, especially minority shareholders, can reduce EM. The study by Leuz et al. (2003) based on cross-country analysis (31 countries) shows that the level of earnings management decreases with investor protection.

### *EM and Analyst Coverage*

Analysts play an important role in monitoring the companies. Research by Yu (2008) has shown that EM is relatively low in companies where analyst coverage is high.

### *EM and Sarbanes-Oxley Act of 2002 (SOX).*

Cohen et al. (2008) report that accrual-based earnings management increased steadily from 1987 until the passage of SOX in 2002. After 2002, accrual-based EM recorded a significant decline. Conversely, the level of real earnings management declined prior to SOX and significantly after the passage of SOX. These findings suggest that companies switched from accrual-based to real earning management methods after the passage of SOX.

### *EM in Pre and Post-IFRS period*

One of the interesting areas of study is the effect of the introduction of International Financial Reporting Standards (IFRS on earnings management. The study of Barth et al., (2008) of 21 countries found that firms adopting IFRS were found to be indulging in 'less' earnings management and more timely recognition of losses compared with firms which did not adopt IFRS<sup>7</sup>.

The study by Mara et al. (2011) of Italian companies after the introduction of IFRS (in 2005) found that board independence and audit committees play a significant role in moderating earnings management.

## **Hypothesis Development**

There is also considerable literature (apart from the issues discussed above) on the various facets of earnings management. Earnings management can be behaviorally attributed to firm-specific or non firm-specific characteristics. Bartov et al. (2001) compiled evidence stating that firms may meet or beat their earning expectation through earnings management. Myers et al. (2007) argue that the firms that had preceding positive earnings are more likely to manipulate earnings, to keep a consecutive earnings growth trend; therefore, the performance of the firm in the prior year influences the manager's tendency to manipulate earnings to meet or exceed the analyst's earnings forecast. Based on the above literature, it is hypothesized that:

H1: Earnings management and firm performance are positively related.

Earnings management is also related to the firm's characteristics such as size, leverage, etc. It also makes practical sense that highly leveraged firms would have a greater impetus to meet or exceed their industry peers as well as analyst predictions when it comes to earnings reporting. Any substantial drop in their share price would have serious negative effects on their leverage ratio, as it would increase in the event of a lowering of their stock price. Consequentially, an increase in the leverage ratio could erode investor confidence in the firm's ability to manage payments on the higher leverage ratio. As per contracting theory, a high levered firm is more likely to follow an income increasing approach (Watts and Zimmerman, 1986). The management of highly levered firms is more likely to report positive discretionary accruals. Consistent with these viewpoints, it is hypothesized that:

H2: *Earnings management and firm leverage are positively correlated.*

One of the firm attributes that has an important

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<sup>7</sup> For an early result on the economic consequences of IFRS, see Daske et al. (2006).

bearing on earnings management is size. Firm size is often used as a proxy for information availability in the market. Information for large firms is generally more available than small firms. Richardson (2000) finds evidence that large firms have less incentive to manage earnings than small firms. Lee and Choi (2002) also find that smaller firms are more likely to manage earnings to avoid reporting losses than large firms. Therefore, it is hypothesized that:

H3: Earnings management and firm size are negatively correlated.

### III. Data Base and Methodology

#### *Database*

The focus of the present study is non-financial publicly-listed Indian companies. In order to capture the overall picture of Indian corporate sector, the investigation started with 3457 publicly listed companies available on S&P Capital IQ(CIQ)<sup>8</sup>. Financial data were initially collected initially for the period 1996-2012. Since the quality of financial data has varied substantially over a period of time, our endeavor was to obtain comparable panel data for which empirical investigations could be conducted. Since we could obtain comparable financial data for 2229 firms in India (which is the largest in the empirical investigation so far<sup>9</sup>) for the period 2008-2011, we focused our empirical investigation on this period. We excluded the year 2012 due to extraordinary discretionary accruals and considered 2012 as the outlier year. The market capitalization of 2229 firms in 2011 account for almost the market capitalization of firms listed in the BSE. Financial institutions were excluded because of their different dynamics in earnings management as opposed to non-financial firms.

#### *Methodology*

The amount of managed earnings is the difference

between reported earnings and true earnings. There are three methods of estimating earnings management. One approach is to focus on specific accruals such as provision of bad debts (widely used in the banking industry). The second approach is to investigate discontinuities in distribution earnings (for e.g., variability in earnings). But the most common way of detecting earnings management is through the 'accruals' portion of company financial statements. Accounting adjustments known as accruals is the difference between reporting earnings and operating cash flows. Accruals consist of a discretionary portion which is often manipulated by managers and a non-discretionary portion which is dictated by business conditions. Researchers use empirical models to decompose total accruals into non-discretionary and discretionary accruals. Discretionary accruals are then used as proxy for earnings management.

#### *Discretionary Accrual Models*

In the following section, we will discuss the five of the most widely used models in measuring non-discretionary and discretionary accruals<sup>10</sup>. Managers use accrual-based earnings management techniques to provide flexibility within accounting rules to manage firm earnings. One of the simplest methods to manage firm earnings is through early recognition of revenue. This method affects several financial statement accounts including revenue, accounts receivable and total assets. The models discussed below, try to detect earning management by measuring percentage changes between financial statement accounts.

#### *(a) The Healy Model (1985)*

One of the earliest discretionary accrual models was developed by Healy in 1985. The model uses mean of total accruals scaled by lagged total assets from the estimation period as the measure of non-discretionary accruals. The Healy (1985) model assumes that non-discretionary accruals follow a mean reverting

<sup>8</sup> <https://www.capitaliq.com/home.aspx>

<sup>9</sup> One recent study (Rudra et al., 2012) was based on 67 firms listed in BSE.

<sup>10</sup> For a discussion of these discretionary models, see Dechow et al. (1995).

process. This implies the following model for non-discretionary accruals:

$$NDA_t = \frac{\sum TA_t}{T} \quad (1)$$

Where:

NDA = estimated non-discretionary accrual;

TA = total accruals scaled by lagged total assets;

t = 1, 2...T is a year subscript for year included in the estimation period; and

Unlike other accrual models, the Healy model predicts that systematic earnings management occurs in every period. Thus, in order to estimate mean total accruals, Healy divided the sample into three groups, with earnings predicted to be managed upward into one group and downward into the other two groups. This approach is equivalent to treating the group that is predicted to be managed upwards as the estimation period and the other two groups as the event period. The mean total accruals from the estimation period then represent the measure of non-discretionary accruals.

(b) *The DeAngelo Model (1986)*

The underlying assumption of the DeAngelo(1986) model is that non-discretionary accruals follow a random walk process. The DeAngelo (1986) model uses the previous year's total accruals (TAt-1) scaled by lagged total assets (At-2) as a measure of non-discretionary accruals. The DeAngelo model can be viewed as a special case of the Healy model in which the estimation period for non-discretionary accruals is restricted to previous year observations. Dechow (1995) suggests that the DeAngelo model is more appropriate to be used when discretionary accruals follow a random walk, while the Healy model is appropriate to be used when discretionary accruals follow a white noise process around a constant mean. The empirical results suggest that the total accruals follow an approximate white noise process (Dechow, 1995).

$$NDA_t = TA_{t-1} \quad (2)$$

Where:

NDA<sub>t</sub> = non-discretionary accrual at time t;

TA<sub>t-1</sub> = Total accrual at time t-1;

A<sub>t-2</sub> = Total Asset at time t-2.

(c.) *The Jones Model (1991)*

Jennifer Jones (1991) proposes a model that attempts to control for the effects of changes in a firm's economic circumstances on non-discretionary accruals. She indicates that changes in total assets, gross revenue, and gross property plant and equipment (PPE) are the determinants of non-discretionary accruals. The idea of the Jones (1991) model is that sales revenue proxies for the economic events that generate current non-discretionary accruals, while gross PPE controls for non-discretionary accruals related to depreciation expense. Thus the Jones (1991) model is based on two key assumptions. Firstly, sales revenue is assumed to be unmanaged. Secondly, changes in current assets and liabilities are assumed to be driven by changes in sales revenue. The Jones (1991) model for non-discretionary accruals in the event year is:

$$NDA_t = \alpha_1 \frac{1}{A_{t-1}} + \alpha_2 \frac{\Delta REV_t}{A_{t-1}} + \alpha_3 \frac{PPE_t}{A_{t-1}} \quad (3)$$

Where

$\Delta REV_{it}$  = revenue of firm i in year t less revenue in year t - 1 scaled by total asset at t - 1;

$PPE_{it}$  = gross property plant and equipment of firm i in year t scaled by total asset at t - 1;

$A_{t-1}$  = total assets at t-1; and

$\alpha_1, \alpha_2, \alpha_3$  = firm-specific parameters.

Estimates of the firm-specific parameters ( $\alpha_1, \alpha_2, \alpha_3$ ) are generated using the following model in the estimation period:

$$TA_t = \alpha_1 \frac{1}{A_{t-1}} + \alpha_2 \Delta REV_t + \alpha_3 PPE_t + \varepsilon_t \quad (4)$$

(d) *The Modified Jones Model (1995)*

A major weakness of the Jones (1991) model is its inability to capture the impact of sales-based manipulation, since changes in sales are assumed to result in a non-discretionary model (Dechow et al. 1995). In an attempt to overcome this limitation, Dechow et al. (1995) proposed a modification to the standard-Jones model. The modified Jones model is identical to the standard Jones model (1991) with the exception that the change in debtors ( $\Delta REC$ ) is subtracted from  $\Delta REV$  at the second stage (equation 6). The original Jones model (1991) uses a three-stage approach to bifurcate total accruals into their discretionary (managed) and non-discretionary components. In the first stage, total accruals (TA) are estimated using the following definitional equation:

$$TA_t = \frac{\Delta CA_t - \Delta CL_t - \Delta Cash_t + \Delta STD_t - Dep_t}{A_{t-1}} \quad (5)$$

Where ,

$TA$  = Total accruals,

$\Delta CA$  = change in current assets

$\Delta CL$  = change in current liabilities

$\Delta Cash$  = change in cash and cash equivalents

$\Delta STD$  = change in debt included in current liabilities

$Dep$  = depreciation and amortization expense

$A$  = Total Assets

In the second stage, the Modified Jones Model (1995) is used to compute non-discretionary accruals (NDA). The model is:

$$NDA_t = \alpha_1 \frac{1}{A_{t-1}} + \alpha_2 (\Delta REV_t - \Delta REC_t) + \alpha_3 PPE_t + \varepsilon_t \quad (6)$$

Here,  $\alpha_1$ ,  $\alpha_2$ , and  $\alpha_3$  are firm-specific parameters for year  $t$ ,

$\Delta REV$  = change in revenues scaled by total assets;

$\Delta REC$  = change in receivables scaled by total assets;

$PPE$  = gross property, plant and equipment scaled by total assets; and

Estimates of the firm specific parameters,  $\alpha_1$ ,  $\alpha_2$ , and  $\alpha_3$  are generated using the equation (7) in the estimation period. Total accruals are regressed on the change in sales ( $\Delta REV$ ) and the gross level of property, plant and equipment (PPE) for the panel. Thus, the model is:

$$TA_{it} = \alpha_1 \frac{1}{A_{it-1}} + \alpha_2 \Delta REV_{it} + \alpha_3 PPE_{it} + \varepsilon_{it} \quad (7)$$

The descriptions of variables are the same as mentioned in previously discussed equations.  $\alpha_1$ ,  $\alpha_2$  and  $\alpha_3$  denote the OLS estimates of  $\alpha_1$ ,  $\alpha_2$  and  $\alpha_3$ . The estimates of  $\alpha_1$ ,  $\alpha_2$  and  $\alpha_3$  are those obtained from the original Jones Model. The only adjustment relative to the original model Jones Model is that the change in revenues is adjusted for the change in receivables in the event period to determine non-discretionary accruals.

In the third stage, after computing total accruals (TA) and nondiscretionary accruals (NDA), discretionary accruals (DA) were computed using equation (4):

$$DA_{it} = TA_{it} - NDA_{it} \quad (8)$$

Positive DAs suggest income-increasing manipulations, while negative DAs indicate income-decreasing manipulations. Managers have incentives to manage earnings not only upward, but also downward. In good years, they could want to hide some earnings for future reporting use, while in bad years they could take a bath (overstate bad assets or take a large restructuring charge) to make future earnings targets easier to meet.

(e) *Industry Model*

The industry model was used by Dechow and Sloan (1991). Similar to the Jones model (1991), the industry model relaxes the assumption that non-discretionary accruals are constant over time. The industry model for non-discretionary accruals is

$$NDA_t = \gamma_1 + \gamma_2 \text{median}(TA_t) \quad (9)$$

Among the models described, modified Jones model is widely used in empirical investigations. Dechow et al. (1995) finds that that a modified Jones

model provides the most powerful test of earnings management compared to the Healy, DeAngelo and standard Jones and industry model. Dechow et al. (1995) evaluated the performance of various accrual models discussed above in terms of specification (i.e., the probability of a Type I error) and power (i.e., the probability of a Type II error) and found the Modified Jones Model to be superior. Similarly, Guay, Kothari and Watts (1996) and Peasnell, Pople and Young (2000) also corroborate the conclusions of Dechow et al. (1995). Hence, we adopt the Modified Jones Model for empirical investigation with respect to India.

#### IV. Empirical Results

This section briefly reviews prior literature on EM in the Indian context and presents the results of the present study on earnings management in the Indian corporate sector (non-financial) in India during 2008 to 2011 and its determinants (as enunciated by hypothesis in the section III).

Although there is considerable empirical literature of earnings management especially in the context of the US, in the Indian context, there are only limited studies have been done (Shen and Chih 2005; Chikpalkatti and Rishi 2007; Sarkar et al. 2008; and Rudra and Bhattacharjee (2012). The Shen and Chih (2005) study found earnings management to be prevalent among Indian banks. Chipalkatti and Rishi (2007) found banks with low profitability indulged in earnings management. Sarkar et al. (2008) found a negative relationship between board independence and earnings management. Rudra and Bhattacharjee (2012) found some evidence of adoption of IFRS leading to low earnings management. The studies in the Indian context are based on a relatively small sample and lack robustness<sup>11</sup>. In the following paragraphs, we present the results of our empirical study with respect to India.

<sup>11</sup> The study by Rudra and Bhattacharjee (2012) found discretionary accruals among Indian firms to be as high as 48.3 percent (of total assets) for 2010.

Table 1 reports the descriptive statistics of estimates of discretionary accruals (DA) in the Indian corporate sector during 2008-2011. The average discretionary accruals is estimated at 2.9 percent of the average total assets of Indian companies (of around \$ 399 million) during 2008-2011, which is slightly above of the recent estimates of 1% percent of the total assets in the US context (Sra et al., 2013). In the pre-SOX period, discretionary accruals were relatively higher - 1 to 5 per cent of the total assets of US corporations (Dechow, 1995). The magnitude of discretionary accruals (DA) in the Indian context during 2008-2011 varied substantially as evident from the minimum and maximum values. The average return on assets (ROA) was around 7.5 percent and here also, the variation was substantial as evidenced by the minimum and maximum values. On an average, most of the firms in the cohort had positive returns (ROA). The average leverage ratio of the Indian non-financial corporate sector at 0.54 is relatively lower; and median value is also similar (0.56).

**Table 1: Descriptive Statistics**

|              | Discretionary Accruals (DA) | SIZE(in million \$s) | LOG SIZE | ROA    | LEV     |
|--------------|-----------------------------|----------------------|----------|--------|---------|
| Mean         | 0.029                       | 399.087              | 1.635    | 0.075  | 0.536   |
| Median       | -0.020                      | 40.700               | 1.610    | 0.072  | 0.563   |
| Maximum      | 17.645                      | 68989.100            | 4.839    | 2.923  | 13.636  |
| Minimum      | -19.651                     | 0.011                | -1.959   | -1.455 | 0.000   |
| Skewness     | 0.534                       | 14.764               | 0.293    | 2.563  | 11.217  |
| Kurtosis     | 293.754                     | 296.745              | 3.146    | 87.397 | 356.869 |
| Std. Dev.    | 0.633                       | 2203.515             | 0.850    | 0.102  | 0.328   |
| Observations | 8916                        | 8916                 | 8916     | 8916   | 8916    |

*(This table presents the variables for the analysis of measuring earnings management through discretionary accruals (calculated by the Modified Jones Model) of 2229 publicly listed Indian*

companies from 2008-2011. The variable *SIZE* is total assets. *ROA* is return on assets. *LEV* is leverage (*Total Liabilities/ Total Assets*.)

Table 2 reports the industry-wise picture of discretionary accruals in the Indian corporate sector (non-financial). As is evident from Table 2, the highest magnitude of discretionary accruals and hence earnings management was recorded in

the construction and mining sectors (9.4 percent and 3.4 percent of total assets respectively). The manufacturing sector had, on an average, discretionary accruals of the magnitude of 2.6 percent of the total assets. The service sector also had a relatively high earnings management (discretionary accruals were around 3.3 percent of total assets), while the trade sector (wholesale and retail) observed negative discretionary accruals.

**Table 2: Industry-wise Average Discretionary Accruals**

| Four-digit SIC Codes                                 | Industry Classification (Sector-wise)                          | Number of observations | Average Discretionary Accruals (DA) |
|--|--|------------------------|-------------------------------------|
| 01XX – 09XX  | Agriculture, Forestry, and Fishing                             | 36                     | 1.7%                                |
| 10XX;<br>12XX – 14XX                                 | Mining   | 160                    | 3.4%                                |
| 15XX – 17XX  | Construction   | 340                    | 9.4%                                |
| 20XX – 39XX  | Manufacturing  | 6388                   | 2.6%                                |
| 40XX – 49XX  | Transport, Communication, Electric, Gas, and Sanitary Services | 376                    | 2.1%                                |
| 50XX – 51XX  | Wholesale Trade  | 252                    | -1.1%                               |
| 52XX – 59XX  | Retail Trade   | 76                     | -4.2%                               |
| 70XX;<br>72XX – 73XX;<br>75XX – 84XX;<br>86XX – 89XX | Services   | 1228                   | 3.3%                                |
| 91XX – 99XX  | Others   | 60                     | 23.3%                               |

*(This table presents the industrial sector-wise average discretionary accruals (calculated by the Modified Jones Model) of 2229 publicly listed Indian companies from 2008-2011. Average discretionary accruals are multiplied by 100 to get the average in percentage.)*

Table 3 reports discretionary accruals according to size of the companies. As is evident, small firms have higher discretionary accruals (10.6% of total assets) compared to medium sized companies (0.4%

of total assets) and large sized companies (0.3% of total assets). Thus, it is evident that EM (proxied by discretionary accruals) and size of the company are inversely related (H3). This result is as per risk-reward theory – smaller firms are more risky and demand higher returns from investors and hence managers of small firms indulge in higher EM. This is also evident from the negative correlation between discretionary accruals (DA) and size reported in Table 4.

**Table 3: Firm Size and Average Discretionary Accruals**

| Firm Size                    | Average Discretionary accruals(DA) |
|------------------------------|------------------------------------|
| Small (< Q1) (n = 2227)      | 10.6%                              |
| Medium (Q1 to Q3) (n = 4460) | 0.4%                               |
| Large (> Q3) (n = 2229)      | 0.3%                               |
| All (n = 8916)               | 2.9%                               |

(This table presents the average of discretionary accruals (calculated by the Modified Jones Model of 2229 publicly listed different-sized Indian firms. Here Q1 = 10.60 million and Q3 = 149.93 million. If TA (total assets) < Q1, firm size is considered as small and if TA > Q3, firm size is assumed to be large. Firms with assets sizes from Q1 to Q3 are taken as medium-sized firms. Average discretionary accruals are multiplied by 100 to get average in percentage.)

Table 4 also reports the correlation between discretionary accruals (DA) and leverage (LEV) and performance (ROA). Evidence revealed in Table 4 shows that there is a negative and statistically significant relationship (at 1% level of significance) between discretionary accruals and leverage [negating hypothesis 2 (H2)]. This result is not surprising as leverage is relatively low in the Indian non-financial corporate sector. Lastly, we also found a negative and statistically insignificant relationship between discretionary accruals and performance of companies thereby negating hypothesis 1(H1).

**Table 4: Correlations among variables -DA, SIZE, LEV, and ROA**

|      | DA                   | SIZE                | LEV                  |
|------|----------------------|---------------------|----------------------|
| SIZE | -0.011<br>(0.294)    |                     |                      |
| LEV  | -0.053<br>(0.000)*** | 0.031<br>(0.003)*** |                      |
| ROA  | -0.004<br>(0.711)    | 0.025<br>(0.017)**  | -0.069<br>(0.000)*** |

Note: Figures in () are p-values.

\*\*\*, \*\*, and \* indicate 1%, 5%, 10% significant levels.

(This table presents the correlations among variables for the analysis of measuring earnings management through discretionary accruals (calculated by the Modified Jones Model) of 2229 publicly listed Indian companies from 2008-2011. The variable SIZE is total assets. ROA is return on assets. LEV is leverage (Total Liabilities/ Total Assets).)

## V. Concluding Observations

The empirical study of discretionary accruals of 2229 listed Indian companies (non-financial) during 2008-11 shows that the estimated average discretionary accruals of the corporate sector in India is 2.9 per cent of the total asset of these firms. The study reveals that small-sized companies in India indulge in relatively more earnings management (10.6 percent of the total assets) than medium- and large-sized firms. Industry-wise categorization shows that the companies in businesses such as construction and mining, etc. indulge in relatively high levels of earnings management. Another finding of the study is that discretionary accruals (proxy for EM) are inversely related to the leverage of companies. Further, the study did not find any statistically significant relationship between EM and the performance of companies.

These findings provide a yardstick about the quality of financial accounts in the corporate sector in India and its relevance for investor decision-making. The magnitude of EM is confidential information and known only to the managers of the company. In capital markets, sophisticated investors (like institutional investors) are capable of understanding the existence and magnitude of EM and the EM risk. It is the unsophisticated investors who are gullible to EM practices. Those who prepare financial accounts have a fiduciary duty to reflect real economic outcomes in the financial accounts. When managers do not voluntarily disclose this private information, there is a need for enhanced disclosure regulations. Accounting standards, disclosure requirements, auditors, analysts and regulators enforcement actions can certainly reduce information asymmetry in the

capital market and ensure that the accounting system and financial reporting provides information about firm value.

The study recommends enhanced surveillance, monitoring and regulatory action by the securities market regulator, for a company or industry, which is indulged in high level of earnings management (above the average threshold of the industry). Independent (external) audit is the primary institutional mechanism for verification of financial reports. However, there is a cost of committing to a particular level of independent audit in terms of quantity and quality of audit resources required. The chosen level of independent audit will determine the accuracy of financial reports and independence from managerial manipulation.

The quality of financial reports, financial restatements and instances of fraud are some mechanisms through which financial reporting can be evaluated. EM studies provide corroborating mechanisms to the prevalence and magnitude of EM. External monitoring agencies like external auditors, analysts and institutional investors can play an important role in preventing aggressive (deceptive) financial reporting by companies. EM studies can provide additional tools to regulator(s) to verify the quality of financial reports so that capital providers (shareholders and creditors) can evaluate the return potential of investments. Greater improvement in accounting quality and financial information can certainly reduce asymmetry of information in capital market and protect investors. Efficiency and stability of capital market and financial system is a public good which needs to be maximized.

Another policy implication of the study is the need for better and timely disclosure of accounting information. Auditors/regulators have an important role to play in this task. They are required to monitor and disclose items in which management discretion is exercised widely. The migration to IFRS planned in the Indian context could reduce the avenues of managerial discretion in financial reporting. Given the international evidence that an effective board of

directors and audit committees can lead to reduced level of earnings management in companies, it is imperative that regulators pay greater attention to the effectiveness of these boards and committees. Besides, the enforcement of strong investor protection laws, especially to protect the interests of minority shareholders can certainly reduce the level of earnings management as proved by international evidence.

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# Impact of Increased Derivatives-Trading in India on the Price-Discovery Process

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*Based on a study of the futures and options on NSE Nifty and ten other randomly-selected NSE stocks, we found that spot-market has been dominating the futures and option markets and that the dominance of futures market over options has diminished after the increase in STT (Security Transaction Tax). We propose that the STT on protective-put and hedged-call positions should be reduced, as clearly explained later in the paper, to give a boost to the option market. To our knowledge, this is the first paper to analyze price-discovery (PD) in India's single-stock-options market using the information conveyed by the option-prices and compare it to PD in the corresponding futures and spot markets. This is also the first paper in the Indian context to analyze the PD simultaneously in the three markets for the individual stocks (ten of which were selected by this study): option, futures, and spot. This is also the first paper to analyze PD in the market for futures and options on these ten stocks and on Nifty during three different regimes pertaining to STT (Security Transaction Tax). Though there are numerous studies on PD in the market for futures on Nifty and on single-stocks, there is only one study that has analyzed PD in Nifty-option market resulting from prices or returns and there are a couple of studies that have tried to ferret out the price-influencing information provided by Nifty-option open-interest and traded-value.*

## 1. Introduction

This paper analyzes whether introduction of financial derivatives led to better price-discovery (PD) in India. First, we study whether, from the days of the introduction of futures and options on Nifty and ten selected individual stocks, the volatility of the price or return of the underlying asset increased or decreased. Then, we analyze whether price-formation in the derivative market leads, lags, is contemporaneous with, or is independent of price-formation in the spot market. We also look at the liquidity in the derivative market (as measured by the trade-value) and try to

correlate it to the PD process. The paper is organized as follows. Section-2 provides a conceptual foundation of PD, Section-3 gives some relevant institutional information and data in the Indian context, Section-4 reviews the existing literature, and Section-5 concludes, with some suggestions for extension, after giving the details of the data, methodology, and results of this study.

## 2. Conceptual and Theoretical Foundation

### 2a. Market Microstructure (MM)

MM (market microstructure) studies “how specific

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trading mechanisms affect the price formation process” (O’Hara 1995). Price is determined by demand and supply. But how the buyer (or the demand) and seller (or supply) meet – or what the ‘exchange’ or the ‘market’ looks like - can vary drastically: from one-to-one face-to-face meeting on one extreme to program-trading on the other. But, the traditional equilibrium analysis has ignored the actual process by which prices are formed. Therefore, the “symmetric information-based asset pricing models do not work because they assume that the underlying problems of liquidity and price discovery have been completely solved” (O’Hara 2003). It is Demsetz (1968) that brought in the relevance of the time dimension of demand and supply in price-setting, which, in some sense, led the foundation of market microstructure. He highlighted that even though demand and supply may match during a period (say an hour or a day), they may not match ‘at every point’. So a buyer and seller may be willing to offer a premium for ‘immediacy’ which simple demand-supply analysis has ignored. Thus, the excess of ask price over bid price (the ‘bid-ask spread’) can be thought of as a mark-up paid for the “predictable immediacy of exchange” in organized markets (ibid).

## **2b. Market-Efficiency and Price-Discovery (PD)**

Informationally efficient markets are those where price of each asset reflects, as soon as possible if not immediately, all ‘available’ new information about it; here, depending on the degree of efficiency, ‘available’ could mean historical, public, or all (including private), as we move up the ladder of efficiency. Thus, when new material information about an asset arrives in the market, it gets incorporated in the asset’s price very ‘fast’, how fast depending on the degree of the market’s efficiency. When multiple markets are there for the same asset, there can be differences in the degree of efficiency in reflecting the new information. So, one of the markets may be the most efficient in incorporating the new information; this market is where the ‘price formation’ – or the *initial* ‘price formation’ - takes place. Another market may be the least efficient. But, there is more. If the markets are

all independent, ‘price formation’ processes in them are all independent. If they are integrated, however, then information flows from one market to another. In one extreme, price may form in one market and other markets just follow suit (‘borrow the prices’); here, the former is the ‘dominant’ market and the latter ‘satellites’ (Garbade and Silber 1979). But, it is also possible that price in each market reflects the new information only partially, and each market looks at the other market to gather more information. Then, price formation would be taking place in the different markets simultaneously, followed by each market taking information from the other markets and then revising its prices. The process of formation of prices is what we call ‘price discovery’ (PD). In initial studies on this issue, the futures market and the cash or spot market were taken as the two markets where PD could take place; researchers analyzed whether new information was reflected - through a change in the price - first in the futures market or first in the cash market (Garbade and Silber 1983). It is, of course, quite possible that price-changes in one market do not *always* lead price-changes in the other market, but does so only *more often* than the other way round (ibid). Anyway, the role of futures market in PD has been recognized for quite long (Working 1962); in fact, it is argued that the “function of primary price formation lies with the futures market” (ibid). Consistent with this, Garbade and Silber (1983) find, using US data for food and non-food commodities, that 75% of new information gets incorporated first in the futures prices and only then flows to cash prices.

## **2c. Basic Characteristics of Derivatives and Relationship of Their Value to Spot-Price**

We just talked about ‘futures’. What is it? It is a kind of contract. It binds two parties, buyer and seller, to transact a given quantity of a specified asset (of a particular quality in some cases) at a future date at an agreed-upon price called the futures price. Of course, due to a feature called marking-to-market (whereby the account books of both parties are adjusted everyday to reflect the change in the closing or ‘settlement’ futures price vis-à-vis the previous

day), the agreed-upon price is paid over the life of the contract not in one-shot on the maturity-date, as is the case with a forward contract or, for that matter, other contracts like ‘option’. An option differs from futures in the sense that, whereas futures binds both sides, an option gives one side – it can be the potential buyer or seller – the right and the other side the obligation. The option buyer has the right to buy (call) or sell (put) at a pre-specified price - called the strike-price or the exercise-price - whereas the corresponding option-seller has the obligation to sell (deliver) or buy (accept delivery) at that price; for this obligation, the seller charges a price, called premium, to the option buyer at the time of entering into a contract. Like futures, option also has a maturity-date, generally called the expiry-date and, depending on the option-type, it can be exercised on or before the expiry-date (American) or only on the expiry-date (European). But, as we can see, unlike in the case of futures, the transaction may not take place in the case of an option, if the option-buyer chooses not to (exercise his right). It may be worth pointing out that options on individual stocks in NSE of India used to be only of the American type earlier, but became only of the European type since November 2010. Both futures price and option price are functions of the prevailing spot (or cash market) price. Futures price is typically given by a simple function as follows:  $f = S (1 + r - q + i)^T$ , where  $f$  is the futures-price of the contract maturing at the end of  $T$  years,  $S$  is the current spot price,  $r$  is the risk-free interest rate (typically the compounded rate of return per year),  $q$  is the compounded annual return on the underlying asset,  $i$  is the compounded annual inventory cost like that for storage and insurance, and  $T$  is the years-to-maturity, the number of days between now and  $t$  expressed in years (and, thus, equal to days-to-maturity divided by 360 or 365). For stock options and stock-index options,  $q$  is typically the dividend-yield. If we use the APR (annual percentage rate) analogue instead of the compounded annual rate, the above equation would change to the following:  $f = S (1 + APR - q + i) T$ . The continuous-time version of the above equations is given as follows:  $f = S e^{(r - q + i)T}$ ,

where  $r$ ,  $q$ , and  $i$  represent the continuously compounded rates of the variables as described above. So, in the simplest model, we can derive the futures-implied-spot-price as follows:

$$S = f / (1 + r) \quad \dots (1)$$

where  $r$  is the interest rate between the trade-date and the futures’s maturity-date.

As all the above equations show,  $f$  would always move up and down with the spot price. It is not that straightforward with option price or option premium: the call option price goes up when spot price rises, but the put option premium falls. There are many models that capture that, the most famous among them being the Black-Scholes model, which gives the call price and the put price, respectively, as follows.  $C = S e^{-qT} N(d_1) - X e^{-rT} N(d_2)$ ;  $P = X e^{-rT} N(-d_2) - S e^{-qT} N(-d_1)$ ,

$$\text{where } d_1 = \frac{\ln\left(\frac{S}{X}\right) + \left(r - q + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}; d_2 = d_1 - \sigma\sqrt{T}.$$

Here,  $C$  is the call price,  $P$  the put price,  $X$  the strike-price or exercise-price of the option, and  $N(.)$  the cumulative probability distribution function for the standardized normal distribution. In this framework, it can be shown that the following parity relationship exists at any point between the prices of the call and put on the same asset with the same strike price and same expiration date:  $C - P + PV(X) = S$ , where  $PV(X)$  represents the PV of  $X$ , the strike-price and is given by  $X / \{(1 + r)^T\}$  [which can also be represented as  $X / \{(1 + APR * T)\}$ ], or its continuous-time version,  $X e^{-rT}$ . This changes as follows when we bring in dividend-yield,  $q$ , into picture:  $[C - P + PV(X)] e^{qT} = S$ . But, these are only applicable to the European options on non-dividend-paying securities. For American options on non-dividend-paying stock, only the following inequality is shown to be satisfied:  $C - P + PV(X) < S < C - P + X$ . So, in the simplest model,

We can derive the PCP (put-call-parity)-Implied spot-price as follows.

$$S = C - P + X / (1 + r) \quad \dots (2)$$

where  $r$  is the interest rate between the trade-date and the option's maturity-date.

### 3. Indian Institutional Framework

#### 3a. Brief Description of NSE and BSE and Their Price Determination Processes

Bombay Stock Exchange Limited (BSE) was established as "The Native Share & Stock Brokers' Association" in 1875. It was the first stock exchange in India which got permanent recognition on 31 August 1957 under the Securities Contract Regulation Act, 1956. In the olden days, the meetings of the stock-brokers took place under banyan trees in front of the Town Hall in Mumbai. Ten years down the line, they shifted to the shadow under another set of banyan trees, the one at the junction of Meadows Street. Hence, SEBI's silver-jubilee publication by Malik et al (2013), which chronicles the evolution of the Indian stock-market through the ages, is aptly titled *Banyan Tree to e-trading*. As the number of brokers multiplied, so did the required square-feet for their meeting-place. Finally, in 1874, they found their 'own' permanent place, appropriately christened the Dalal Street (Brokers' Street). The Exchange launched the very first equity-index of the country, the S&P BSE SENSEX based on 30 shares, on 2 January 1986. Its base year was taken as 1978-79 and the corresponding index level on 1 April 1979 to be 100.

Upon request from the central government, some leading financial institutions of the country got together to form the National Stock Exchange Limited (NSE). Interestingly, it was incorporated in November 1992 as a tax-paying company, the path not followed by any other stock-exchange of the country. In April 1993, it got recognition as a stock-exchange as per the Securities Contracts (Regulation) Act, 1956. It commenced operations in the Wholesale

Debt Market (WDM) segment in June 1994 and in the Capital Market (Equities) segment in November of that year, while operations in the Derivatives Segment commenced much later, only in June 2000.

In India, the Futures and Options (F&O) trading system provides a fully automated trading mechanism. It provides a screen-based trading – doing away with floor-based system - on a nationwide basis. It has a surveillance mechanism backed by online monitoring, which also facilitates transparency of trading operations in this order-driven market. As and when orders are received, they are time-stamped and immediately process it for the best potential match. Any unmatched order is carried in different 'books' as per price-time priority.

The best buy order matches with the best sell order. It is possible that an order would match partially with another order, requiring more than one trade for the order to be fully satisfied. The matching mechanism looks at the buy orders from the seller's perspective and the sell orders from the buyer's perspective. So, the best buy order is the one with highest price, while the best sell order is the one with lowest price.

Members may feed in buy and sell orders to the online system. An order is displayed on the screen till it is fully matched by a 'counter-order' and results into one or more trades. Or, a member may watch the existing orders in the system and place an order reactively that matches partially or fully with them. Orders that are not matched are called 'passive' orders, while those that are placed in to match the existing orders are called 'active' orders. To ensure that orders that come earlier get higher priority than those that come later, matching always takes place, naturally, at the price of the passive order.

#### 3b. F&O (Futures and Option) Segments in India

Equity-Derivatives trading took off in India in June 2000 following approval by the *Securities and Exchange Board of India* (SEBI) on the basis of recommendation of the LC Gupta Committee. The derivative segments of NSE and BSE were permitted to start trading and settlement in approved derivatives

contracts with the involvement of their clearing house/corporations. Initially, SEBI approved trading in futures contracts based on different equity-indices, such as prominent ones like NSE's S&P CNX Nifty and BSE's Sensex. Later on, option- trading was permitted in indices as well as individual securities.

BSE started the first exchange-traded index-derivative in India on 9 June 2000. The inauguration of trading was done by Professor J. R. Varma, Member of SEBI and Chairman of the committee that formulated the risk-containment measures for the derivative-market. Then followed a series of innovative-product launching: Sensex-Option 1 June 2001, Equity Options (on 31 stocks) on 9 July 2001, and Equity (or Single-Stock) Futures on 9 November 2002.

NSE was not behind. It started futures on its popular flagship index, S&P CNX Nifty, on 12 June 2000. Trading in Nifty Options followed on 4 June 2001. It then went ahead with Equity Options (on individual securities), edging past its closest competitor, BSE, by only a week to become the first exchange in India to launch equity-option. Single-stock futures were introduced on 9 November 2001.

### **3c. Some Descriptive Data about Indian F&O Segments**

As delineated above, equity derivatives started trading in India in June 2000. At present, there are three exchanges which offer equity derivatives trading in India, namely NSE, BSE and the new entrant, MCX-SX, which commenced operation only in 2013. Equity-derivatives market, containing derivatives on both indices and individual stocks, has witnessed a phenomenal growth in India. As Table-1 shows, the average daily turnover has increased from 420 crore rupees (equivalent to 4,200 million or 4.2 billion rupees) in 2001-02 to 1,55,408 crore rupees in 2012-13, implying a compounded annual growth rate (CAGR) of more than 70%.

## **4. Review of Relevant Research**

### **4a. Review of Literature on MM and PD**

There have been numerous studies around the world about MM of derivative-markets in general

and their roles in PD in particular. The reason is simple. Since many potential buyers and sellers hedge their positions in the futures or option market, it is believed that these markets convey information to the spot market that it would not otherwise have. Moreover, trading costs are typically lower and liquidity higher in the futures market. So, it is natural for researchers to explore whether this indeed is the case with different derivatives – futures and options in particular - in different countries at different points of time. There are various possibilities when multiple markets – say, as in here, spot and derivative markets - exist. The prices in the two markets can be completely independent (typically when there is no communication) or fully integrated (when there is perfect two-way communication); in most cases, it would be a mixture of the two, the usual scenario being that there is a dominant market where the price is discovered and price-specific information is then relayed to the satellite market. It is also likely that there is bi-directional causality where information flows from each market to the other, though with the possibility that one market is still dominant in this.

The survey by Madhavan (2000) on MM, though a bit dated now, provides an excellent insight into the initial theoretical and empirical research in PD. He categorises MM research into four broad categories. The first one is on price-formation and PD, which study determinants of trading costs as also the process by which price gets to reflect information over time. The second branch, on market-structure and design, focuses on how trading-protocols affect liquidity and market quality and thus price-formation. Information and disclosure, the third category, addresses transparency issues and analyzes the ability of the market players to observe information about trading process. Issues arising from the interplay between MM and other finance areas like corporate-finance, say that about the under-pricing of initial-public-offerings, come under the ambit of the fourth category.

In one of the earlier theoretical models with practical implications, Smidt (1971) argued that, in addition

to what Demsez (1968) had modelled, the market-maker, in her quest to constantly bring her inventory up or down to a desired level, would influence price, thus making it depart, during the course of a day or sometimes even over a longer period, from the true value. But, it is Garman (1976) who formally modelled the relation between dealer's quote (or bid-ask spread) and the inventory level. One of the model's implications is that a dealer having a sizeable long position in inventory would not go for addition unless there is a drastic price reduction. Models by Stoll (1978) and Amihud and Mendelson (1980) reflect the intuition of the Garman model.

Mayhew (2000) made a more focused, though quite detailed, review of theoretical and empirical work on the effect of introduction of derivative on the underlying cash market, including PD. He points out that a simple way to analyze PD is to look at the lead-lag relationship between spot and derivative market of an asset. Kawaller, Koch, and Koch (1987) took one-minute-interval spot and futures data for S&P-500 index for 1984-85 and found that the futures leads the spot market by 20-45 minutes, with longer lead in the more active nearer term contracts, but the spot market leads only by a maximum of two minutes. Realizing that asynchronous trading could be showing the spot-market as lagging, many authors try to overcome the problem. Harris (1989) examined the S&P-500 spot and futures data in five-minute-intervals ten days around the US stock-market crash of 1987 and concluded that, though the extreme movements in the cash-futures basis was caused due to infrequent-trading, even after correcting for that, the futures market still led the cash (or spot) market. Also using five-minute-interval data from April 1982 to March 1987, Stoll and Whaley (1990) overcame the infrequent-trading problem by making the spot return pass through an ARMA filter; they also found that the futures market leads by 5-10 minutes and sometimes cash market also leads, but the incidence of the latter effect is diminishing over time. Chan (1992) looked at the 20-share MMI index, which is less subject to infrequent trading, and both MMI and S&P-500 futures contracts. He also found strong support for

futures leading spot and weak support for the reverse. In fact, he also observed that the index-futures led even the most-active component-stocks that are a part of the index. He also highlighted that the lead-lag relationship is not affected whether good or bad news is received or whether market activity is high or low. In an insightful paper, Wahab and Lashgari (1993) pointed out that earlier empirical works were misspecified, because they failed to recognize that the spot and derivative prices were cointegrated.

While Kamara, Miller, and Siegel (1992) have found no increase in spot-market-volatility due to introduction of S&P-500 futures, Antoniou and Holmes (1995) have argued that the introduction of stock-index futures increased spot-market volatility in the short run, but not in the long run. Frino, Walter, and West (2000) used high-frequency data for Share-Price-Index futures contract on Sydney Futures Exchange from August 1995 to December 1996 and analyzed the effect of release of macroeconomic and stock-specific information on the PD process in the spot and futures market. They found that the lead of the futures market strengthens significantly around the time of release of macroeconomic information, which is consistent with a scenario where investors with superior information on the broad market are more likely to trade in the index futures. There was also some evidence that the lead of the future market weakens and that of the equity-market strengthens around the release of information specific to individual stocks, consistent with a scenario where investors with stock-specific knowledge prefer to trade in underlying shares.

In one of the more recent studies, Tse, Bandyopadhyay, and Shen (2006) consider three different derivatives on the DJIA (Dow Jones Industrial Average) index of US and observe that they contribute to different extent to the PD process; they verify their findings by taking derivatives on S&P 500 index and conclude that multi-market leads to better efficiency in PD. Chen and Chung (2012) find that introduction of options on SPDR (Standard & Poor's Depository Receipts Trust Series I) has contributed an improvement in

the quality of the underlying SPDRs by augmenting liquidity and facilitating PD. In an interesting study, Xing, Zhang, and Zhao (2010) report that, in US, stocks underlying options with the steepest volatility-smile underperform those underlying options with the flattest smile by 10.90% per year, after adjusting for risk. The former also suffer the worst earnings shock in the subsequent quarter. This is perhaps because traders with unfavourable news trade out-of-the-money puts, and equity-market is slow in impounding information contained in volatility-smiles.

As mentioned, such studies have been carried out all over the world. Kenourgios (2004) analyzes the relative movements in Greece's FTSE/ASE-20 index and the three-month futures on it and finds two-way causality. A survey by Lien and Zhang (2008) argues that, while there is clear evidence for the PD role of futures market in emerging markets, its price-stabilizing role cannot be established unequivocally. Schlusche (2009) analyzes the German blue-chip index, DAX, and, using Schwarz and Szakmary (1994) procedure, concludes that futures market is the most significant contributor to the PD process; he also highlights that, instead of liquidity, it is volatility that is the key for the PD leadership.

#### **4b. Study of Derivative Exchanges**

Tsetsekos and Varangis (2000) conducted a survey among almost all the derivative exchanges that were in operation in 1996: 75 in all. They made some important observations. As against the traditional approach of starting with derivatives on agricultural commodities, emerging markets have begun their innings with index-based and interest-rate-based derivatives. They also find that emerging markets introduce index derivatives more quickly than do their industrial counterparts. Most exchanges reported using the open-outcry system, though there is a discernible shift towards electronic-trading, which is the choice for the more recent entrants. Two-thirds of the exchanges had their own in-house clearing facility, but a recent tendency has been

towards a common clearing for a group of exchanges; besides, most were self-regulating bodies owned by their members. Using "changes in consumer prices, prime interest rates, government bond yields, industrial production, growth in real gross national product (GNP), the level of GNP, and the share of investments in GNP" as economic proxies and "stock -market turnover and capitalization, the variance in stock -market capitalization, the value of stocks traded, the volatility in value traded, and the number of listed companies in the stock exchange" as capital-market-condition proxies, they did not find any statistically significant variable among these to make a country or market 'derivative-exchange-ready'.

Treviño (2005) analyzed 1999-2005 data for 83 derivative exchanges in 58 emerging-markets and, based on volume of contracts, inferred from the Hirschman-Herfindahl Index that the smaller exchanges have increased their market-share from 9% to 37% during this period. They also observed that most of the new-born derivative exchanges have focused on financial derivatives with or without commodity derivatives while the older one started with the latter type; this is partly because financials attract higher liquidity than commodities. They also point out that, in order to separate trading-rights from membership-rights, so as to allow outside ownership of bourses, derivative exchanges have undergone demutualization. They also discovered that interest-rate derivatives commanded the highest dollar-volume in both exchanges and over the counter (OTC) market, followed by equity-linked ones in the exchanges and foreign-exchange-based ones in the OTC.

#### **4c. Brief Review of Literature on F&O on Commodities in India**

Using 2005-2010 crude-oil spot and futures data in a US, a UK, and an Indian exchange, Goyal and Tripathi (2012) find Granger causality between spot and futures markets and conclude that PD mostly occurs not in the emerging exchanges but in the mature exchanges, where spot leads future. Using daily spot

and futures prices of some agricultural, metal, and energy products during 2003-2011, Sehgal, Rajput, and Deisting (2013) find that the futures market plays the dominant role in the PD process. But, volatility-spillover is not present for most commodities, suggesting the absence of an efficient risk-transfer-system.

#### **4d. Review of Literature on F&O on Nifty and Individual Stocks in India**

In one of the first studies in India on its financial-derivatives market, Gupta (2002), using 1998-2002 data on Sensex and Nifty and corresponding futures data from 2000 to 2002, found that the volatility in futures market is not necessarily higher than that in the spot market and the introduction of futures in fact led to a reduction in spot-market-volatility. They, however, caution to take the latter observation in the right perspective, as other microstructure changes like closing-down of the 'badla' system and curtailment in the trading-cycle took place following the introduction of the above-cited derivatives. Analyzing the daily data on BSE Sensex and NSE Nifty, as well as the broad-based BSE-200 and Nifty Junior, from January 1997 to March 2003, Bandivadekar and Ghosh (2003) also concluded that volatility reduced in both the Indian exchanges in the wake of the introduction of index-futures in 2000. They also observed that, while the reduction in Sensex's volatility captures only the market effect, that in Nifty's both market and the derivative effect – the effect of introduction of futures. Raju and Patil (2002) found that time-varying volatility is exhibited by some Indian equity indices. To examine the effect of expiration-day of options and futures on price, volume, and volatility of the underlying spot, Vipul (2005) took 2001-2004 data, within one day on the either side of the expiration, on 14 NSE stocks that had derivatives trading on them. Using nonparametric test, he found that the share-price tends to go down the day before expiration of its derivative contract and strengthen the day after, with this increase much higher for those shares whose derivatives trade in higher volume compared to their spot. Pandian and Jeyanthi (2009) took 1998-2008 data for BSE Sensex and NSE Nifty

and found that bull phases had lower volatility than bear phases. Saravanan and Deo (2010) analyzed the spot and futures prices of Nifty during 1996-2007 and found that introduction of derivative reduced, though only marginally, volatility in the spot market. They feel that presence of uninformed traders in the derivative market may be inducing volatility in that market, which may lead to lesser reduction in volatility in the spot market than would have been observed if only informed traders played in the derivative market. They, however, observed that, following introduction of derivatives, spot-market volatility reacted less to old information and took this as a sign of increased efficiency. They argued that, the positive relationship between volume and price volatility implies that a future contract would be successful only if there is considerable uncertainty associated with the underlying asset. Sakthivel and Kamaiah (2010) took 2000-2008 daily closing prices of Nifty and the three Nifty futures: near month, next month, and far month. They found that there is a long-term relationship between the spot and futures markets and that there is bidirectional volatility spillover between these two markets. Pati and Rajib (2010) took 2004-2008 data for Nifty futures and, using ARMA-GARCH and ARMA-EGARCH models with GED distribution, and discovered time-varying volatility as had other earlier research. Agarwalla and Pandey (2013) took high-frequency data during 2001-2009 for 307 NSE stocks which are either index stocks (part of an NSE index which had derivatives trading on them), or futures stocks (which had futures trading on them), or were both, and, in addition, 300 other most liquid stocks. They found that both futures-stocks and index-stocks experience higher volatility during the last thirty minutes of the expiry of their relevant derivative contracts, with the higher magnitude for the futures group. They also report different intraday volatility pattern for futures stocks, which they think may be due to parallel PD in their futures markets. Interestingly, they conclude that the cash-settled nature of the stock-futures induce high volatility in the spot market during the futures's trading period.

Raju and Karande (2003) is one of the earliest studies on PD of financial derivatives in India. Using Nifty futures data from June 2000 to October 2002, they have also found that its introduction has brought down the volatility in the spot market. Further, they find that, while there was no causality till August 2001, there was bidirectional causality from September 2001 onwards (with PD occurring in both the spot and the futures markets). Bose (2007) took daily closing prices during 2002-2006 for Nifty spot and futures to study the PD process. She concludes that, in the short-run, the futures market - which adjusts faster to new information and absorbs most of the consequent volatility - leads the spot market; but, in the long-run, the information-flow is bidirectional, though futures does have a slight edge. Karmakar (2009) used daily data from June 2000 to March 2007 for Nifty spot and the near month contract for Nifty futures and analyzed their relationship using a Vector ECM (Error Correction Model). They found that, though the causality is bidirectional, futures price affects spot price more than the other way round. In fact, while the futures market information continues to flow to and affect the spot market right from day 1 till day3, the spot market's effect on futures market is felt only on the third day. They had found log prices of both spot and futures to be non-stationary, but corresponding returns to be stationary. Pradhan and Bhatt (2009) took daily closing spot and futures (near month contract) prices of Nifty from 2000 to 2007 and studied the PD process. They found that PD takes place mainly in the spot market, which functions as the dominant market and leads the futures market. But, Srinivasan (2009), who analyzed Nifty daily spot and futures data from 2000 to 2008, found that there is a bi-directional causality between the spot and futures market. Mukhtar (2011) used daily closing values of Nifty and its futures from June 2000 to November 2008 and found that PD occurs in both spot and futures market, though the latter has greater speed of adjustment towards equilibrium; bidirectional causality is also discovered. Sadat and Kamaiah (2011) used data on 42 NSE stocks of high market-capitalization and found abnormal volume

and price-change on days just prior to expiration-day of the related futures contract. Choudhury and Bajaj (2013) used 2000/2001-2010 data on daily spot and futures prices of individual stocks and found that futures price leads the spot in case of Nifty and 21 stocks and is led by spot in case of 20 stocks.

With the availability of high-frequency intraday data, it has become quite insightful to use these, though analyzing them over a long horizon can pose considerable computational challenge. Reddy and Sebastin (2008) took high-frequency data on Nifty and its near-month futures from October 2005 to September 2006 and analyzed the information-transmission process of PD using the information-theoretic concept of entropy. They found that information flow from futures to spot is more pronounced than that from spot to futures. Debasish (2009) used high-frequency data for 2001-2008 for Nifty as well as futures and options written on it. He found that the futures market leads the spot market, though its dominance is diminishing over time. He also found the option market to be overall leading the spot market, though sometimes it reverses, implying feedback. Interestingly, he also argued that the Nifty call leads the futures more than the converse, whereas futures leads put more than the opposite. He clarified that, since his study covered a reasonably bullish period, which might have attracted more activity in the Nifty call market, this could have been observed; this belief is backed by the stronger lead of call over put during that period, though it is a puzzle why the two instruments with the same trading-costs should at all have a lead-lag relationship. Gupta and Singh (2009) took intraday (five minutes' interval) spot and futures data on Nifty and the 50 most liquid stocks in NSE from April 2003 to March 2007 to study the PD process. They found that, though PD takes place in both spot and futures markets, it is the futures market that strongly Granger causes the spot market. Interestingly, they find that, though the difference between the spot-price-implied-futures-price and the actual futures-price does not vary much for Nifty as the maturity-date is approached, the difference increases for individuals stocks, contrary to what

most other studies find. Mallikarjunappa and Afsal (2010), using minute-by-minute data during July-December 2006 for twelve most liquid stocks, find that a contemporaneous and bi-directional lead-lag relationship between the spot and futures market, thus without any dominance by either of the markets.

Aggarwal and Thomas (2011) took minute-by-minute data from March to August 2009 on 97 stocks and their near-month futures trading in NSE. They also took price-impact (from the limit order books) as the measure for liquidity. They conclude that liquidity in futures market plays a pivotal role for its dominance in PD and only when a stock's futures market is illiquid does its spot market play a leading role here. They also find that the futures market plays a more important role when there are large price-movements. Agarwalla, Jacob, and Pandey (2012) took high-frequency volume, volatility, and price data from July 2010 to June 2011 for the fifty stocks in NSE Nifty as on 18 October 2010, the day NSE reintroduced pre-open call-auction for these fifty large-capitalization stocks, perhaps with a hope to facilitate PD relating to them. Using the correlation between overnight-return and subsequent returns as a measure of the call-auction's ability towards improving PD, they concluded that there was no such 'good news'; they conjecture that the short duration of the call-auction may be the reason behind this. The press also points out that the absence of continuous trading leads to the traders' failure to get an adequate idea about the price structure and thus makes PD difficult (Shah and Mascarenhas 2013). They, however, found that price synchronicity – the ability of the pricing model used to explain the actual variations in stock returns - improves after the introduction of the call auction, which typically is not expected to have any impact on the PD during the day, especially for the highly liquid stocks. Choudhury and Bajaj (2012) took high-frequency NSE spot and futures data from April 2010 to March 2011 on 31 stocks and found that there was bidirectional information flow between spot and futures market among 30 of them, with Wipro being the sole exception, having the flow only from spot to futures. They also concluded that futures leads spot

in case of 12 of them and the reverse happens in case of the rest.

Some researchers have tried to look at the information-conveyance power of option-prices from a different perspective. Srivastava (2003) used data from November 2002 to February 2003 on 15 most liquid stocks of NSE and options on them and analyzed, using the methodology developed by Bhuyan and Chaudhury (2001), the power of open-interest and volume to predict the underlying spot price. He found both the variables to have significant explanatory power, with open-interest being more significant. He also found that option-market helps in the PD process in the underlying cash-market. Mukherjee and Mishra (2004) used daily spot prices for only Nifty and option-prices as well as open-interest (OI) and trading-volume (TV) for all the available strike-prices of the nearest month Nifty option for two sets of periods: June-December 2001 and January-June 2004. They found that, though TV had no power in the beginning – just after Nifty option was introduced - to predict the movement of later spot prices, it became quite significant at it, towards later periods, even more than OI, which itself also moved from being significant to more significant towards the later part. They further discovered that, the combined efficiency of OI and TV is higher than the sole efficiency of each of them. Overall, the index option market improves its power of PD in cash market. Sehgal and Vijaykumar (2008) took daily data during 2004 and 2005 for number of contracts and traded-value of the most frequently-traded 38 stocks out of 51 in that had calls and puts available on them in NSE. They found that both these option-liquidity proxies are positively correlated with stock price, stock return volatility, and stock liquidity and negatively related to the firm size, which the authors took as a proxy for the uncertainty in the information environment. Taking traded-value (TV) and net-open-interest (NOI) data for options on Nifty and 15 NSE stocks from November 2001 to November 2004, Srivastava, Yadav, and Jain (2008) analyze the power of these two variables to predict the underlying spot price. Using the above-cited methodology followed

by Srivastava (2003), they found that, for Nifty, call and put NOI-based predictors are significantly positive and negative, respectively, while call and put TV-based predictors are both significantly positive but not as prominent as the NOI-based ones. For stocks, NOI-based predictors exhibited the same characteristic in ten cases, with TV-based predictors not showing any consistent signs. But, a study by Pathak and Rastogi (2010) shows that both NOI and TV are relevant for the purpose.

The role of STT in the derivative market has attracted attention from some researchers. Slivka, Aggarwal, Shastri, Sisodia (2012) took eight of the stocks which had liquid futures contracts in NSE, with half each from bank and IT sector. One trading day in each of the months from June 2011 to December 2011 was chosen, with the near month (same month in this case) contract expiring in 20-24 days. Matching the timing of the spot and futures trade to the same second, potential arbitrage profits were calculated, using different STT. The study concluded that a reduction of 75% in STT was required to achieve any meaningful arbitrage opportunities.

## 5. The Current Study

### 5a. Data Sources

Nifty futures started in June 2000 and Nifty options in June 2001. (Single) Stock Options began trading in July 2001 and futures in November 2001. But, we dropped every derivative's first month, as it exhibits very high volatility. To be able to compare spot, futures, and options over the same period, we wanted synchronous data for all these three contracts on Nifty and the ten selected stocks. Therefore, given that the last among the above-cited derivatives was introduced in early November 2001, our study period starts on 1 December 2001. The exception was, of course, BPCL, whose equity-options started in January 2002. So, for this, the starting date was 1 February 2002, though ending still 31 December 2012, as it is for all.

We collected the closing-price data for the above period for spot, futures, and options (on Nifty and ten

stocks). The ten stocks were randomly chosen. All data on these eleven securities (that is, Nifty plus ten stocks) were obtained from NSE. We also collected the 2001-2012 risk-free-rate (the 91-day TB auction cut-off-yield) data from the website of RBI (Reserve Bank of India).

The study period from December 2001 to December 2012, which is a month more than eleven years, was broken down into the following seven sub-periods.

SP-1 → Subperiod-1) NS (No STT): 1 December 2001 to 30 September 2004

SP-2 → Subperiod-2) PS (Post STT): 1 October 2004 to 31 May 2008

SP-3 → Subperiod-3) IS (Increased STT): 1 June 2008 to 31 December 2012

The choice of these cut-offs was dictated by the dates for introduction and subsequent change in India's Security Transaction Tax. Security Transaction Tax (STT), payable *inter alia* on the value of purchase or sale of selected securities including futures and options, came into effect on 1 October 2004 and became payable by the futures-seller at a rate of 0.01% of the futures-price and by the options-buyer, only if she exercises, at the same rate on the strike-price. On 1 June 2008, it became applicable also to premium received on option sales at a rate equal to that on futures sales, which had changed on 1 June 2006, along with the rate payable at exercise of options, to 0.017%; moreover, on that date, the rate payable at the exercise of options shot up to 0.125%.

### 5b. Methodology

Kenourgios (2004) outlines the basic procedure that we need to follow before we embark on the more complex part of the PD analysis. We first need to test for stationarity in the level, as well as in the first difference, of the spot price and the other prices (whether futures price or option-prices-implied-spot-price) the Augmented Dickey Fuller (Dickey and Fuller 1981) test - ADF test in short -. For the first-difference, the equation for the spot-price would look something like the following, if we believe that the order of lag would be at most two, as is found in

many economic time-series data.

$$\Delta S_t = \alpha + \beta t + \rho S_{t-1} + \gamma_1 \Delta S_{t-1} + \gamma_2 \Delta S_{t-2} + u_t$$

If  $\rho = 0$ , then we cannot reject the null hypothesis of a unit root which implies a random-walk process for the variable. It is quite possible that the variable is non-stationary at level but stationary at first-difference. Anyway, the problem with ADF test is that it does not allow any serial correlation or heteroskedasticity. To overcome this problem, we would also employ the Phillips and Perron (1988) test – PP test in short - which is relatively robust even when there is serial correlation and heteroskedasticity. The above equation should be tested separately for both the spot and the other prices mentioned above, each of which is represented above generically as  $S_t$ .

It is quite possible that there is some systematic characteristics in the lead-lag relationship of derivative and spot markets for different underlying assets or indices. If that is indeed the case, it may be wiser to test simultaneously for the direction of flow of information between spot and derivative market.

To test for co-integration, we would resort to, as Kenourgios (2004) does, Johansen-Juselius procedure. We did not use any Vector Error Correction Mechanism, because of discontinuity in some data. Our set of equations is as follows.

$$\Delta S_t = \alpha_1 + \sum_{i=1}^n \alpha_{11}(i) \Delta S_{t-i} + \sum_{i=1}^n \alpha_{12}(i) \Delta F_{t-i} + \sum_{i=1}^n \alpha_{13}(i) \Delta O_{t-i} + \varepsilon_{S_t}$$

$$\Delta F_t = \alpha_2 + \sum_{i=1}^n \alpha_{21}(i) \Delta S_{t-i} + \sum_{i=1}^n \alpha_{22}(i) \Delta F_{t-i} + \sum_{i=1}^n \alpha_{23}(i) \Delta O_{t-i} + \varepsilon_{F_t}$$

$$\Delta O_t = \alpha_3 + \sum_{i=1}^n \alpha_{31}(i) \Delta S_{t-i} + \sum_{i=1}^n \alpha_{32}(i) \Delta F_{t-i} + \sum_{i=1}^n \alpha_{33}(i) \Delta O_{t-i} + \varepsilon_{O_t}$$

The above first-difference VAR (vector autoregressive) models can be estimated with OLS method. In any case, if two markets (or instruments) cointegrated, then causality must exist in at least one direction and can, of course, be bi-directional too (Granger 1986). For example, if some  $\alpha_{12}$  above are non-zero and all  $\alpha_{21}$  are zero, then the futures market is the dominant

If a long-run relationship exists between the spot (represented as S) and derivatives (whether futures price or option- implied-spot-price and represented as F) markets by price-changes in one market causing price changes in the other, we could, following Kenourgios (2004), present the relationship as follows.

$$F_t - \delta_0 - \delta_1 S_t = \varepsilon_t$$

If either spot or derivative price-processes are non-stationary, Ordinary Least Square (OLS) regression cannot be applied. If both are non-stationary in such a way that the error term is stationary, then, as pointed out by Engle and Granger (1987), derivative and spot price processes are cointegrated, and they have an equilibrium relationship. Their co-integration implies that derivative and spot prices are integrated of the same order, which can be inferred from the unit-root-test described earlier. If the spot and derivative prices are non-stationary, but their first-differences are stationary, then the prices are effectively cointegrated at level (1,1), denoted as CI(1,1), with d1 being the cointegrating coefficient.

market and the spot market satellite. Similarly, for the spot market to lead the option market, we have to have some  $\alpha_{31}$  non-zero and all  $\alpha_{13}$  zero. On the other hand, if all the above sets of variables are jointly and severally non-zero, there is a bi-directional relationship, while, if they are zero, there is independence.

But, as Goyal and Tripathi (2012) point out, the above error-correction-mechanism does not capture contemporaneous correlation, for which they supplement their tests with a test advocated by Phillips, Wu, and Yu (2011) for short-term collapsing asset-price bubbles that are not picked up by unit-root and co-integration tests. We do not reckon that test to have been extended to financial derivatives too; but it may throw some useful regulatory insights. We have, however, not employed that here.

### 5c. Results

For all the futures series, we chose the most active future contract on each date; but in case the most active contract was maturing on that date, we took the second most active contract, as the volatility on expiration-day of derivative-contracts has been reported to be quite high by many studies. Then, we take three spot prices: the actual spot price, the futures-price, and the put-call-parity-implied spot-price ('option-implied-spot' hereafter) derived from the option prices using equation-2 above. We ran some analysis using the spot-price as implied by the futures-price and *prima facie* seemed to find the results to be not too dissimilar; but more analysis there is warranted.

Then, using both ADF and PP tests, we analyzed the stationarity of their natural-log values and found that all series are non-stationary. So, we took the first-difference of the log-values and, again using ADF and PP, found them to be stationary. Table-2, which presents some descriptive statistics and the Jarque-Bera p-values, also presents the ADF and PP p-values to highlight this. The table presents the information for the full period, as well as the three sub-periods. It is interesting to note, which is not unusual and not at all unexpected here, that the standard-deviations of the level are quite close for the three contracts: spot, futures, and option-implied-spot. Of course, we are effectively dealing here with three surrogates of the spot-price, though it is a bit less so when we are taking the futures-price instead of the futures-implied-spot price.

Table-3 presents the average annual volatility for each year and as also for the sub-periods (non-standardized). It does not fully corroborate what previous research says: that spot-market volatility has fallen following the introduction of derivatives. Though the changes have been inconsistent across years and stocks, some general observations can be made. In the first year after introduction of derivatives, that is, in 2001, spot volatility fell for almost all, though not all, of our stocks. But, as expected, the volatility of Nifty and the individual stocks was quite high in the post-meltdown era of 2008 and 2009, which also reflected in high volatility in SP-2 (subperiod-2). What is more interesting, however, is that volatility fell appreciably thereafter. By 2012, for the spot contracts, it had fallen to quite a low level, almost compared to the 2001-level for the majority and thus, for most, was lower than the level of the year preceding the introduction of the derivatives. But, comparison of the 2012-level with the initial years after the introduction of derivatives shows volatility to have increased for many futures and option contracts.

Having realized that our first-difference series (of log values, of course) are stationary, we checked, using Johansen-Juselius procedure with a linear-trend, whether spot, futures, and option-implied-spot are cointegrated. The Table-4 overwhelmingly shows that they are. Thus, despite their non-stationary nature, derivatives and spot markets exhibit a long-term relation. This exists also between futures and options on individual stocks, a relationship none had hitherto studied in the Indian context. But, the table also highlights that, at a five percent level of significance, there are typically at most one cointegrating equation. One simple – rather simplistic – way of stating it is that the long-term relation between our spot, futures, and option contracts is somewhat unique. This led us to study the causality between these three contracts: spot, futures, and options. As Table-5 shows, there are causalities in various directions for the different stocks and even for the same stock over different sub-periods. To get a more cohesive picture of it, we

came up with a simple and novel way of summarizing the information, which is presented in Table-6. Panel-A presents information for basic causality, whether one affects the other, independent of whether reverse causality exists or not. Clearly, the effect of F (futures) and S (spot) on O (Option) is the main significant observation, if we ignore the frequencies of independence. Panel-B captures whether the causalities are unidirectional or bi-directional. Here also, we see that the influence of F on O is quite high in the beginning, but falls drastically by SP-3 (subperiod-3). But, the influence of S on both F and O becomes more pronounced by the last sub-period or remains at the earlier high level. Panel-C, again taking the information in the way Panel-A took, shows the information in what we may call the NR (net run rate) format: how one of the three influences the two others. Here again, barring the high frequency of “no causality”, we find that the strong influence of S on the two others (F and O) has gotten stronger over time, while that of F on the others has gotten weaker over time. Panel-D puts the perspective in the same light as Panel-B had done. It shows that there is more independence than bidirectional causality. But, when it comes to one-way causality, it tells – quite consistent with its preceding panel - is that, S’s influence on the two others has appreciably gone up over time, while that of F on the others has somewhat fallen. Though our approach here is, we think, quite innovative and insightful, these findings are not very inconsistent with other findings that futures and options lose their dominance on spot-market over time, but here, the derivative-markets have mostly been satellites and become more so over time.

The next table, Table-7, presents the causality analysis for the full-period from two different perspectives: the full period as a whole and the overall findings for the three-subperiods. Panel-B highlights the influence of S on F and O and that of F on only O. Panel-C corroborates that, but brings in two newer insights not thrown in by our earlier tables. It shows that, in the twelve-year period as a whole, O also had influence on the two other contracts and that each of the derivative contracts has bidirectional causality

with the other derivative and the spot. This finding should alert us to the fact that analysis based on long intervals may have conclusions quite different from what the short periods would more effectively bring out. Similarly, Panel-E tells us that, based on the combination of the three sub-periods, we would tend to infer that S’s dominance over the derivatives has increased over time, while the full-period analysis – which, of course, cannot suggest anything regarding the trend in dominance – would find S’s dominance over O to be the only significant conclusion. Panel-F regarding the trend in dominance – and, therefore, naturally, only for the subperiods – wraps it up succinctly: only the dominance of spot has increased significantly over time. This should make us analyze why the derivatives markets have failed to dominate, though they are often desired to.

Though a reasonably clear picture regarding the increasing dominance of S and lacking or falling dominance of F and O has been emerging from the above analysis, we deemed it appropriate to complete the analysis by doing a VAR (variable auto-regression) analysis, which investigates whether past levels – whether price or return - of O, F, and S affect the current values of the two others (and, less interestingly for us here, its own current values). Table-8 presents the analysis along with the significance-indicator of the coefficients (an asterisk, ‘\*’, implies significance at the five percent level). To make more sense of these numerous figures, we summarize them in Table-9. The full-period analysis highlights what we should have expected: past levels of S affect current the level of each of F and O and past levels of F affect the current level of each of S and O. Again, as somewhat expected, F’s influence has diminished a little bit by the last sub-period, while that of S has increased slightly. Just to see whether the above findings anyway translate into trade-value of the three contracts, we computed the annual trade-value across the years. Table-10 shows that the trade-values (TV) of the single-stock futures and options have been steadily increasing over time. When we take futures TV as a percent of the spot TV, we find that, in recent years (and, in particular

between 2011 and 2012), it has fallen in more than half the case, including that of the Nifty. During the same time, the TV of options as a percent of the TV of spot has increased for all the stocks in our sample, though it has marginally fallen for Nifty. Anyway, the TV of options as a percent of that of the futures has increased during that period for all our stocks as well as Nifty. This increasing popularity of stock-options despite their reducing efficiency in PD is bound to puzzle some.

Findings by Mishra and Mishra (2013), who have reported analysis of single-stock-options from a different perspective, may provide some answer. They computed the TV-weighted and OI (open interest) weighted average-strike-price - for calls and puts separately - for each trade-date and analyzed whether any of these four (Call-TV-weighted, Put-TV-weighted, Call-OI-weighted, or Put-OI-weighted average-strike-price) had any capacity for PD. They found that, during each of the sub-periods and the whole period, for each stock-option as well as Nifty, almost all of these were influenced by the spot and the futures. Moreover, for the single-stock options, none of these played any role in PD. But, for Nifty, interestingly, during subperiod-1 and subperiod-3, they found that almost all of these also influenced futures and options, thus causing bidirectional causality. During the whole period also, consistent with what some other researchers have found, the Call-TV-weighted strike-price, and only that, influenced futures and option, thus showing the capability for PD. Overall, these results are consistent with our earlier finding about the waning importance of single-stock options in the PD process. But, they somewhat countered the finding about Nifty option, which we had earlier reported to have bidirectional causality with futures and spot during the first two sub-periods, though it was fully dominated by them in the third sub-period as well as the whole period.

To look at the popularity of options more minutely, we focused on ATM (at the money) and NM (near money) calls and puts. ATM denotes the call or put with the strike-price exactly equal to the spot-price,

but they were often not available. So, we took the call and the put with the strike-price closest to, which was not always necessarily equal to, the spot-price; these are NM options. We have put both ATM and NM under ATM. As Table-10 shows, the combined TV of the ATM call and put as a percent of the total TV of all options has shown a downward tendency in the recent years. Though it might be due to some reaction in the aftermath of the global meltdown, it might also be due to some institutional changes, like the Exchange switching from American stock-options to European ones or some relative change in the STT. So, in this light, an 'experimental' recommendation we may like to make – particularly to further encourage purchase of calls and puts, though only ones which are at or near the money - is as follows. That STT be reduced – if not waived – when an investor buys an ATM (at the money) or NM (near-money) put – where the strike price is equal to or close to the prevailing spot price – and exercises the put at expiration-date by selling his shares. Similarly, if an investor buys an ATM or NM call and exercises it at maturity, the same benefit should be extended to her if she buys shares on or just before the option-expiration-date. Whether and how to tax any profit from these ATM calls or puts are easier issues to debate.

#### **5d. Conclusion**

In this study, we took synchronous daily spot, futures, and option prices on Nifty and ten randomly selected stocks and found that, while the spot-market is increasing its dominance over futures and options, the futures market's dominance over option-market has drastically fallen following the increase in STT. The traded-value of the corresponding options, however, has increased over time. We propose a reduction or elimination of STT on purchase, for hedging purposes, at-the-money and near-money calls and puts that are accompanied by purchase and sell of corresponding shares at or just before the expiration date.

To our knowledge, this is the first study in the Indian context to a) analyze price-discovery (PD) in India's single-stock-options market using the information conveyed by the option-prices and compare it to PD

in the corresponding futures and spot markets, b) simultaneously analyze the PD in spot, futures, and option for the individual stocks (ten of which were selected by this study), and c) analyze PD in the market for futures and options on these ten stocks and on Nifty during three different regimes pertaining to STT (Security Transaction Tax).

### 5e. Suggested Extensions

This study can be extended in many ways. First, instead of using put-call pairs only for inferring implied spot-prices, one should use all calls and puts, though it would be more complex and require stronger assumptions. Second, instead of studying options and futures on each individual stock separately, a panel analysis should be carried out. Sometimes, panel-analysis throws insights that are not available when studying them separately. Panel unit-root test is also sometimes considered superior to the standard unit-root test. Moreover, there have been very few, if at all any, panel-cointegration analysis to analyze equity and index derivatives in India. Third, more varieties of price should be brought in to picture. Using opening prices of different securities along with the closing prices used can throw more light on the lead-lag relationship relating to price-discovery between the three contracts under focus: spot, futures, and option. Then, of course, high-frequency data should be ushered into the picture. The only constraint with this kind of data is that, analyzing it over a long period – as we have done here for a comparative analysis over multiple subperiods – is a challenging task. Fourth, though this study broke-down the sample period to only three subperiods; given that it spans the global-meltdown of the late 2000 and also microstructure changes in NSE (like replacement of American-style single-stock-options with European analogues from January 2011), a finer division of the full-period is called for based on those. Fifth, one should also use information conveyed by the traded-value and open-interest of the index and single-stock options to see if there is some price-specific information there that can facilitate price-discovery. In that light, it is worth coming up with measures of ‘efficiency’ of the derivative-markets other than in price-discovery or in leading spot markets.

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# Penetration of Mutual Funds in India: Opportunities and Challenges

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*We carry out a preliminary enquiry into the nature of geographical penetration and distribution of mutual funds in India as well as their likely determinants. Using a questionnaire survey we collect qualitative and quantitative evidence from fund managers on the nature and determinants of their geographical presence throughout the country. Distribution channels seem to play a major role in fund penetration and facilitating these rather than trying to boost demand through financial literacy may be a more effective way of achieving better fund penetration.*

*The Indian mutual fund industry is one of the fastest growing and most competitive segments of the financial sector. As of August 2013, the total AUM stood at Rs. 7.66 trillion. However, growth rates of AMCs have come down from the peak levels seen in the early 2000s. One of the biggest reasons behind this is the lack of healthy participation from a large part of the country. This lack of penetration can be due to two reasons: a) Low demand of mutual funds from the public outside the major (T-15) cities. This low demand in turn could be caused by low levels of financial literacy, cultural attitudes towards savings and investments etc., and b) Low supply of mutual funds from AMCs outside the major cities. The low supply could be due to perceived lack of demand from the general retail investor or due to lack of available manpower in these areas.*

*The study first documents how Assets under Management (AUM) are unevenly distributed across the country and then proceed to scrutinize the reasons behind this uneven penetration. It focuses on the AMCs distribution networks using proxies such as the distribution of independent financial agents (IFAs) across the country, sales made by IFAs, distributional efficiency of AMCs etc., A survey of fund houses was carried out to gain a better understanding of the causes holding them back from expanding beyond top 15 cities.*

*The study found that low number of agents (per capita) in sub-urban and rural areas and the slow growth rates in mutual fund sales in the corresponding areas are closely associated with each other.*

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## 1. Introduction

Although a large number of studies have been carried out on the growth and financial performance of mutual funds in India (Boston Analytics, 2010), (PWC, 2013), not much light has been shed on the causes for the low penetration of mutual funds outside the top fifteen cities. There is research looking at the causes for the variation of mutual funds industry across developed countries. However, such work typically does not differentiate between the various regions of the nations included (Khorana et al., 2005). While such studies may help policymakers in determining the ideal inter-regional macroeconomic conditions to develop a healthy mutual fund industry, they rarely explain the differences in mutual fund penetration within a country.

It is well known that mutual funds offer their investors benefits difficult to obtain through other investment vehicles. Benefits such as diversification, access to equity and debt markets at low transaction costs and liquidity are some such advantages. Given these benefits, one would imagine that Indian households, characterized with gross domestic savings of close to 28% of the total Gross Domestic Product (World Bank, 2012), one of the highest in the world, would flock to invest their savings in mutual funds. However, a recent report (PWC, 2013) points out that the distribution of assets under management (AUM) across cities is highly skewed in favor of the top fifteen (T-15) cities of India. The top 15 cities identified by AMFI as major investment hubs. The cities include Mumbai (including Thane & Navi Mumbai), Delhi (including NCR), Bangalore, Kolkata, Chennai, Pune, Ahmedabad, Hyderabad, Baroda, Panjim, Jaipur, Lucknow, Surat, Kanpur and Chandigarh. The T-15 cities contribute to 87% of the entire AUM in the country. Even within the T-15 cities, the top five cities (Mumbai, Delhi, Chennai, Kolkata and Bangalore) contribute 85% of the entire AUM at the T-15 level i.e. 74% of the entire AUM in the country (PWC, 2013).

It is important to inquire into the causes of this skewed investor participation rate. There are several factors

which could possibly explain this variation. Cross-country studies have pointed out that laws, regulations and governance, supply side factors, demand side factors and technological issues could all affect the size of mutual industry in a given country (Khorana et al. 2005). Some of these factors such as laws and regulations are not applicable to our study since they are uniform across India and do not vary from one state to another. The factors that we focus in our study are therefore mainly supply and demand side factors.

Our study divides the supply side i.e. delivery mechanisms into three alternative channels: independent financial advisors (IFAs), banks and in-house distributors. We focus on these delivery channels used by Indian mutual fund houses. To begin with, we document relationships between demographic and economic variables on one hand and mutual fund penetration on the other to discern the underlying factors which could help explain the success of a mutual fund in a given part of the country. We do this using data collected from all the mutual funds aggregated at district levels and by observing time-series data.

We next survey Indian mutual fund houses to identify the regulatory and distributional challenges that according to them hold them back from increasing their business in areas which presently have a low number of mutual funds. We also inquire into human resource problems that could be holding back their penetration even if the fund houses did want to increase their presence in the less developed districts of India.

Our study brings out several interesting results which would be of considerable use to the fund houses, regulators, financial practitioners and scholars in general. We confirm that bulk of the mutual fund sales outside the T-15 cities are caused by IFAs. We also find that demographic and social indicators such as adult literacy and bank penetration are only weakly correlated with mutual fund penetration in a given area. Areas with the highest mutual fund presence tend to be those where the proportion of households with more than Rs. 300,000 income and

IFA presence happen to coincide. We also find that IFAs do not usually focus on those areas which have the highest propensity to invest in mutual funds (as reflected by the districts with the highest proportion of the families earning more than Rs. 300,000 per annum). This suggests that the present AUM levels can be increased by several percentage points if IFAs were made to apply their efforts in the right areas.

The rest of this study is organized in four sections. The next section presents the opportunities and challenges in investing in mutual funds. The third section describes the methodology and the source of our data gathered for the study together with the statistical analysis of the data. The fourth section presents the responses of the fund houses on what is holding the industry back from increasing its penetration outside the T-15 cities. The final section of the report presents the conclusions and suggests directions for future studies.

## 2. Literature Survey

While discussing about various channels of distributions (PWC, CII, June 2013) points out that Independent Financial Advisors (IFAs) play a crucial role in fund distribution. They interact with the investors on a regular basis and provide advice on scheme selection to asset allocation and asset diversification. Thus, they have the potential to influence the investors' decision and sell the MF products. This approach has its risks as well. If the IFAs are not empowered with professional training and education, they run the risk of mis-selling schemes. Without proper training, it would be difficult for IFAs to explain or convince small town investors about the advantages of mutual funds over traditional investments like savings accounts, FDs etc. The AMCs and the regulator need to enhance the financial literacy across the country through regular programs and campaigns beyond top 15 cities.

Laws, regulation and governance characteristics play an important role in the development of financial sector. La Porta et al. (1998) examine the role of laws governing investor protection, transparency of

reporting, Insider trading, Taxation, the quality of enforcement of the laws, potential conflicts of interest between the fund and the fund investors (Thompson & Choi, 2001) and the ownership concentration across several countries and their financial development.

Supply side issues, by which we mean the characteristics of the financial services sector, will affect the size of the mutual fund Industry. Issues like bank concentration (Nicola & Michele, 2001), breadth of the distribution channels, restrictions from entering securities business (Barth et. al, 2001), ease of entry into the fund industry like cost of setting up a new fund, time required to set up a new fund and presence of government supported competitive financial products are noted in the literature for their contribution to the growth of the industry.

Several demand side factors can be used to explain the size and diversification of mutual fund industry in a country. Some of these factors include education, literacy, presence of information sources, industry age etc. At the same time, there are some trading characteristics like transparency and transaction costs (Chiyachantana et. al, 2004) which also can be used to determine some of the characteristics of the mutual fund industry.

Barber et al., 2005 argue that the purchase decisions of mutual fund investors are influenced by salient, attention-grabbing information. Investors are more sensitive to salient in-your-face fees, like front-end loads and commissions, than operating expenses; they are likely to buy funds that attract their attention through exceptional performance, marketing, or advertising. They found consistently negative relations between fund flows and front-end load fees. A negative relation between fund flows and commissions charged by brokerage firms was also documented. In contrast, no relation (or a perverse positive relation) was found between operating expenses and fund flows. Additional analyses indicate that mutual fund marketing and advertising, the costs of which are often embedded in a fund's operating expenses, account for this surprising result.

Müller & Weber, 2010 investigate the consequences of financial literacy in the context of mutual fund investments. They found that the level of financial literacy is not related to the performance of the actively managed funds. In contrast, overconfidence might prevent subjects from investing passively. A positive relation was found between the belief of being better than average in identifying superior investments and the likelihood of buying an active fund, thus confirming this notion. Also, better-than-average thinking is positively correlated with financial expertise.

Massa et al., 1999 identify a set of systematic factors that explain a significant amount of the variation in flows. They examined common component to mutual fund investor behaviour and tried to find out which asset classes may be regarded as economic substitutes by the participants in the market for mutual fund shares. They found that flows into equity funds, both domestic and international, are negatively correlated to flows to money market funds and precious metals funds. This suggests that investor rebalancing between cash and equity explains a significant amount of trade in mutual fund shares. The negative correlation of equities to metals suggests that this timing is not simply due to liquidity concerns, but rather to sentiment about the equity premium. This paper also finds that the factors derived from flows alone explain as much as 45 per cent of the cross-sectional variation in mutual fund returns.

There has been a debate in the mutual fund industry that the abolition of entry load has reduced the incentives for the distributors to go after new clients. The restriction of entry load on existing and new mutual funds in 2009 affected the functioning of the mutual fund industry and leading fund houses and distributors had to restructure their business and operating models in order to arrive at a profitable solution. However, researchers (Anagol & Kim, 2012) who have examined the claim that abolition of

entry loads had hampered the penetration of mutual funds have found no evidence behind such claims.

A study by Anagol et al. (2013), evaluated a major Indian investor protection reform that reduced commissions tied to mutual fund sales by banning the distribution fees that mutual funds had previously earmarked for commissions. They identified the policy impact by comparing funds charging high versus low distribution fees pre-reform. The researchers argued that contrary to industry claims that limiting commissions would dramatically reduce mutual fund investment; there was no evidence that the reform reduced asset growth in mutual funds.

Apart from the macro economic factors the anecdotal evidence says that Indian Mutual fund Industry is incapacitated by the lack of proper distribution channels<sup>1</sup>, entry loads, investor awareness, governance and risk management, technology and low retail participations<sup>2</sup>.

Zechner et al., 2011 study the interface between intermediaries and portfolio managers (including mutual funds) and investors. There are often multiple financial advisors between portfolio managers and investors. Portfolio managers pay significant “kickbacks” to compensate advisors for price discrimination or marketing. Kickback payments increase portfolio manager fees and reduce returns. Portfolio manager competition reduces kickbacks, but increases independent advisory services. The study focuses on financial intermediaries as distinct agents and the economic roles they play. Their analysis of financial intermediation also provides six major findings:

1. Financial advisers facilitate small investor use of actively managed funds by minimizing information search costs. With rational investors and competitive advisors, fund management fees are reduced. Advisers that do not receive kickbacks increase investor welfare.

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<sup>1</sup> *Distribution Spectrum and the changing Business Environment: Indian Mutual Fund Industry (PWC, 2011).*

<sup>2</sup> *Indian Mutual Fund Industry-Towards 2015*

2. Mutual funds make widespread use of kickbacks to compensate financial advisors. With sophisticated investors, fund kickbacks subsidize advice costs for smaller investors. With unsophisticated investors, kickbacks support aggressive advisor marketing. When advisors receive fund kickbacks, investors use additional advisory services.
3. Mutual fund payments of kickbacks are associated with higher management fees and lower fund performance. When investors are sophisticated, kickbacks affect only high net worth investors. When investors are unsophisticated, all investors are negatively impacted.
4. Mutual fund distribution channels impact fund performance. Indirect channels distribute underperforming funds. Direct and indirect channels distribute actively managed funds with equal or higher performance than passive funds.
5. Kickbacks are reduced by competition among actively managed funds. Increasing fund competition generates additional advisory services.
6. Lastly, fund investors would benefit from better disclosure of kickbacks. Kickbacks should be paid with transparent cash payments, rather than for specific sales related activities.

Khorana et al. find that consistent with related findings from the law and economics literature, the mutual fund industry is larger in countries with stronger rules, laws, and regulations, specifically where mutual fund investors' rights are better protected. The industry is smaller in countries where barriers to entry are higher, measured by the effort required to set up a new fund. The fund industry is larger in countries with a wealthier and more educated population, and where the industry itself is older. Finally, the fund industry is larger in countries in which defined contribution pension plans are more prevalent. These results indicate that laws and regulation, supply-side, and demand-side factors simultaneously affect the size of the mutual fund industry.

Investor reaction to mutual fund performance conditions the behavior of mutual fund managers and fund complexes. It has wide-reaching ramifications for the trading of assets across the globe. (Keswani

& Stolin, 2012) have few observations using UK data on monthly fund sales and purchases made via seven distinct distribution channels. Their paper seeks to examine differences in the way different types of investors respond to fund performance information, and in particular, the extent of non-linearity in their response functions.

Where mutual fund investments are deployed and how they are managed are perennial issues that are largely determined by investor reaction to fund performance. Yet the population of investors is heterogeneous and liable to be influenced by the intermediation process (if any) of their fund purchases and redemptions. Their investigation shows that the way investors respond to prior fund performance has a great deal to do with who the investors are and how the fund is being sold. Although both individuals and institutions buy into funds in a "convex" manner, that is, they are more influenced by investment performance when a fund has done well than when it has done poorly, this effect is much more pronounced for retail investors. Yet among retail investors, too, sharp differences exist: the flow performance relation is linear and rather flat, for buys made through fund company affiliated sales force, while it is both steep and strongly convex for fund purchases that are either un-intermediated, or intermediated by independent advisors.

Consistent with the notion that investors take more care with making their investments initially than with monitoring subsequently, the sensitivity of aggregate outflows to performance is quite a bit lower than that of inflows. Investor outflows increase at a faster rate when performance declines in the region of below-average fund performance than they decrease when fund performance improves in the region of above-average performance. Retail and institutional investors behave comparably in this regard.

Performance of a mutual fund matters a great deal more while investors decide whether to invest rather than whether to redeem. Nevertheless, several investor types behave in an inconsistent manner with respect to the aspects of performance they consider important. Specifically, independently advised investors react to

the non-alpha portion of performance when buying funds but not when selling them, while insurance companies do the opposite.

The paper suggests that from the perspective of regulators the best active fund investors are those who induce the most intense competition for superior performance among fund managers, i.e. those whose reaction to fund performance is especially strong. At the same time, strong reaction to past performance tends to be convex, thus inducing excess risk-taking. It also tends to spill over into sensitivity to non-alpha performance, rewarding active fund managers for actions unrelated to stock-picking, which is the activity that justifies active fees in the first place.

### 3. The Mutual Fund Industry in India: Opportunities and Challenges

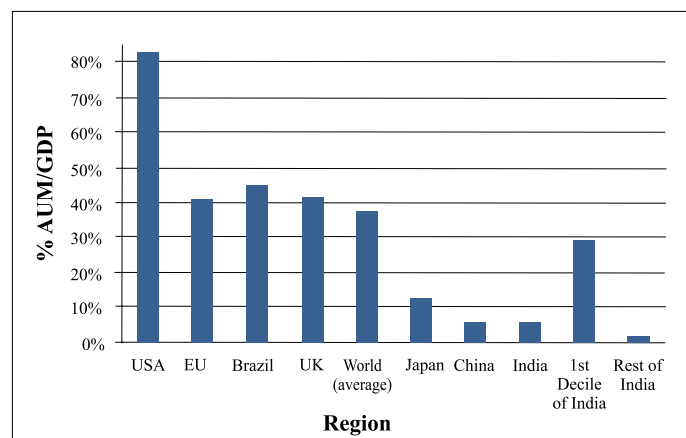
The Indian mutual fund industry finds itself in an economic landscape which has undergone rapid changes over the past three years. The industry achieved a high water mark when it doubled its AUM from Rs. 3.6 trillion in FY2007 to Rs. 6.13 trillion in FY2010 – clocking an impressive growth rate of 16.2% per year. Since then the Indian economy (coupled with the emerging economies) has faced a slowdown – the most severe of which are happening as this report is being written. From an average Gross Domestic Product (GDP) growth rate of 8-9% during the 2008-2011 years, the Indian economy is now growing at a lackluster 4.8% growth rate in Q2 2013. Coupled with a steep decline in the value of the Indian rupee, the mutual fund industry now finds itself in a capricious global economic environment. However, there is strong reason to believe that the Indian mutual fund industry has not yet seen its global peak and if proper measures are taken, the industry could get back on its former growth path.

One of the biggest challenges that the mutual fund industry faces is the lack of healthy participation from a large part of the country. To illustrate this lack of participation, we first aggregated the AUMs originating out of each district of India. We then rank ordered all the districts of India in descending order

of their domestic product (GDP) and then partitioned this list into ten parts. The top 60 districts formed the first decile followed by the second decile and so on. We then aggregated the AUMs and GDPs for each of these deciles and took the ratio of these two figures. The AUM/GDP ratio is one of the best indicators of how much of the yearly income in a given district is being invested into mutual funds.

While the figure of rupees 7.5 trillion of AUM may sound impressive on paper, this figure is marred by a sharp divide in terms of investment in the first decile of districts and the rest of the country. Chart 1 on the next page presents this stark contrast. For the country as a whole, the AUM/GDP stands at approx. 6.99%. When this ratio is calculated for the first decile of districts, the ratio is 29.52% - slightly lower than the world average. However, the rest of India paints a dismal picture with the AUM/GDP ratio standing at 1.82%. This skewed origination of AUM in India is its single biggest challenge and its biggest opportunity at the same time.

**Chart 1: AUM/GDP Ratio**

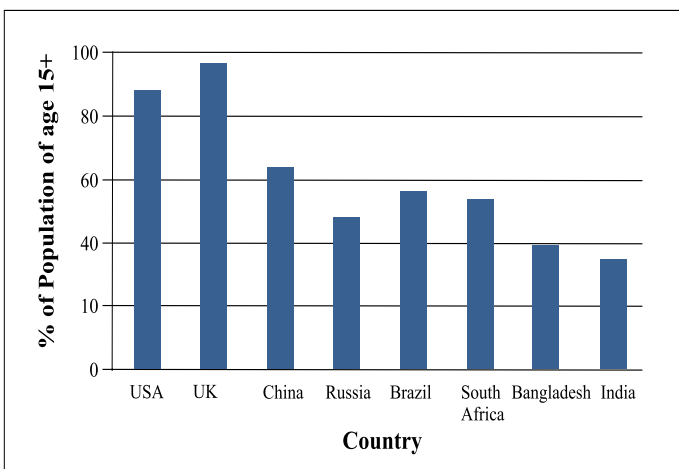


Source: ICI Fact book 2013, Authors' Survey Data

This under penetration of financial inclusion is not unique to mutual funds, but a deeper structural problem characteristic of the Indian financial sector. More than half of India's population does not have any access to formal banking services. According to 2012 World Bank Global Findex, only 35.23% of respondents in India have an account (either self or together with someone else) at a bank or some other formal financial institution. Even in savings

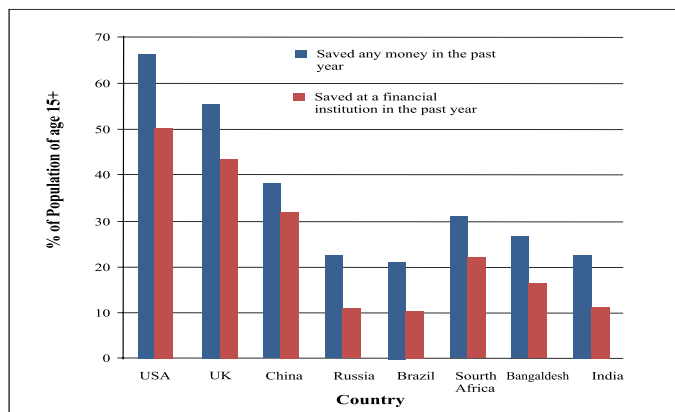
indicators at formal or informal institutions, India continues to be a laggard. Even Bangladesh with a 47% lower per-capita Gross Domestic Product (GDP) based on purchasing power parity performs better in financial inclusion parameters. We reproduce some of these financial indicators from World Bank's Global Findex survey as Charts 2 and 3 to highlight some of the key areas where India lags.

**Chart 2: Percentage of people above 15 years of age operating a Saving/Checking account at a formal institution**



Source: Demircuc-Kunt & Klapper, 2012

**Chart 3: Saving propensity indicators**



Source: Demircuc-Kunt & Klapper, 2012

Financial inclusion has for long been a priority for the policy makers in India. The Reserve Bank of India (RBI) has permitted the banks to use the services of Business Facilitators and Business Correspondents. A roll out of Ultra Small Branches (USBs) in remote locations is one of the steps being taken in this direction.

Direct Cash Transfers and linkages with Aadhaar would be a step forward towards the goal of financial inclusion and may prove beneficial to mutual fund houses in the long run. With below poverty households finally coming to own bank accounts, fund houses could use pre-existing bank channels to offer investment opportunities when these people finally start earning saving.

The advantages of having an active participation by retail investors in mutual fund are not just limited to financial inclusion. It has been shown in past studies that institutional investors (in the form of mutual funds) 'herd' towards small-cap and mid-cap stock which offer growth prospects thereby increasing the depth and breadth of capital markets (Wermers, 1999). Institutional buying and selling of stocks also increases the price-adjustment process in capital markets and under right conditions institutional investors tend to decrease stock price volatility. All these effects are desirables as far as financial markets are concerned.

*Financial literacy and investment practices*

One of the major reasons behind the under-penetration of mutual funds is the lack of understanding about mutual funds, how they differ from ordinary investments and how they manage to offer superior returns over traditional investments. According to a report on mutual funds investments published by Boston Analytics in 2010, approximately a third of all of respondents from Tier II Indian cities did not know how and where to invest in mutual funds (Boston Analytics, 2010). Most people remain unaware of basic financial concepts such reward (return) to variability (risk) ratio, asset allocation, benefits of diversification, passive-active investment strategies etc.

Most Indian households tend to be extremely risk averse and wary where they invest their hard earned savings. As a result, they are conservative with their savings and tend to invest in 'safe' assets. Investors perceive mutual funds as risky investments (despite the fact that several funds invest in government bonds, thereby being safer than bank deposits) and tend to

invest their savings in tangible assets such as gold, jewelry, real estate or fixed deposits in banks. These choices are a result of a mindset which has generally seen investing in stock markets and other market traded securities as akin to gambling. This is reflected by the proportion of savings of Indian households in the financial markets. The gross domestic savings and investment at current market price by households was 22.3% of GDP 2011-12 (RBI Annual Report, 2012). The household investment in physical and financial assets was 14.3% and 8.0% respectively. The investment in shares and debentures as a percentage of gross financial savings by households was 3.6% during 2011-12. The gross financial savings by household in mutual funds is estimated at 2.5% out of total 3.1% in shares/debentures.

According to a Max New York Life-NCAER India financial protection survey carried out in 2008, Indians prefer keeping 65 percent of their savings in liquid assets like banks, post office deposits or as cash at home, while investing 23 percent in physical investments like real estate and gold. Only 12 percent of the total savings were invested in financial instruments like mutual funds or stocks (NCAER Max New York Life, 2008).

The Mutual fund industry offers something for everyone. A large number of schemes are offered by AMC's and offering are made to suit the investor's risk appetite, desired returns or period of investment. As of March 2013, a total of 1294 different mutual fund schemes were on offer across AMC's (SEBI Annual Report 2012-13). Investors can choose the schemes according to the structure: Open-ended Funds or Close-ended Funds or by the objective of their investment: Growth Funds, Income Funds, Balanced Funds or Money Market Funds.

However, one of the ironies of having a large and established mutual fund industry is that this variation serves to intimidate rather than inform a small investor. To begin with, there exist mutual funds which focus exclusively on one type of asset class and then there are funds which hold securities from different assets. At the same time, several mutual fund schemes have

two to three variations on each fund such as growth, monthly dividend, annual dividend etc. Besides offering different schemes for investment, AMC's also offer several investment plans to their customers. Systematic Investment Plans (SIPs), Systematic Withdrawal Plans (SWPs), Systematic Transfer Plans, Triggers, Insurance Options and many other plans are designed to give a degree of control and flexibility to the investor.

While all this is highly beneficial for a well informed investor, all this is highly intimidating to an investor who is barely financially literate and has little time (or energy) to do his/her research before buying a fund. Boggled by all this complexity, the investor routes his savings to lesser complicated fixed deposits and/or physical assets (Halan, 2013). Lack of standardization in the processes and customer service standards creates unnecessary hassles in investing (Adajania, 2013).

This combination of ignorance, risk-aversion and mutual fund complexity are huge hurdles that AMC's in India will have to overcome if there is to be any increase in retail participation in mutual funds. Investors need to be made to look beyond the traditional avenues of investment through sensitization and education. In addition to this, campaigns should be tailored to increase the visibility of debt funds which generally tend to be safer than equity funds.

#### *Distributional efficiency and number of agents*

Another challenge that AMC's in India face is increasing the efficiency of their distributional channels. As we later show in our analysis, distributional efficiency (defined as the AUM earned for one rupee spent on distribution costs) plummets beyond the 4<sup>th</sup> decile of districts. In other words, attracting new investors in small cities does not come cheaply for the Asset Management Companies beyond the top 200 districts by GDP. More money has to be spent on distribution and marketing for getting investments in poorer districts.

However, AMC's tend to play safe and seem unwilling to focus on their distribution channels outside the

T-15 cities. This can be inferred by observing the geographical spread of their distribution costs. It is seen that 89.75% of all the distribution costs by AMC's are incurred in the T-15 cities and their corresponding districts.

In a recent interview, an AMC reported that in the present distribution model, it takes a typical AMC three years to break even (Kirkire, 2013). This presents a significant challenge to the expansion of AMC's since they are judged on an annual basis. Thus, even if an AMC did want to expand into several towns at once, the paybacks would be so far away in the future that only the least risk-averse managers would go ahead with such expansions.

As of March, 2013, the total number of ARN (AMFI Registration Number) holders registered with AMFI stood at approximately 52,000. Of these, 48,000 are individual ARN holders and 4000 are corporate ARN holders. While these numbers may sound substantial, it should be noted that the number of active distributors are just 18% of the total reported figures. Besides these, approximately 38,000 corporate employees registered with AMFI under corporate ARN holders (Association of Mutual Funds in India, 2013).

Furthermore, considering insurance sector's 2.5 million agents, the number of active mutual fund agents is a big hurdle for penetration and expansion of AMC's outside of T-15 cities. If the reach has to be increased to Tier II and Tier III cities, the distribution network needs to be overhauled and innovative incentive structures need to be adopted.

Over here, it is worth comparing the incentive structures in place for mutual fund agents and those of other commission based products such as insurance. Insurance agents can earn up to 35% commission on the premium for the signing up of a new customer<sup>3</sup>. Insurance companies with less than ten years of business operations offer up to 40% of the premium

as commission. The corresponding commissions offered to agents bringing in new mutual fund sales ranges from 0.2-0.8% for debt fund to 1-4.5% for ELSS funds. This disparity continues into years subsequent to the sale of the two financial products. For insurance products, the commissions decline to 7.5% for second and third years and 5% to the rest of the life of insurance product. Mutual fund companies on the other hand offer a "trail commission" ranging from 0.5-1.0% on the AUM. This commission is typically taken out from the investors' AUM. This would have two impacts on the sale of mutual funds. Firstly, if the mutual fund purchased by an investor performs poorly (as compared to the index), the investor would not just have a poorly performing investment but also have an additional expenditure to be paid to the mutual fund agent. Secondly, an agent who works in an area characterized with low AUMs will not be able to sustain an income by the trail commission alone. These two factors combined could further depress the sale of mutual fund sales.

However, the biggest question remains unresolved. What causes the AMC's to invest less outside the T-15 cities? Is it because of an inefficient distribution network? Or is it because of lack of demand from areas outside T-15 cities? In the following section, we try to answer this conundrum by looking at the data we have collected through multiple angles. We report on where most growth in AUM is taking place, the distributional efficiencies of AMC's outside T-15 cities and what are the factors which influence growth of AMC's in a particular area.

#### **4. Data Collection, Methodology and Descriptive Statistics**

##### *Data Collection Procedure and Survey Details*

In conjunction with Securities and Exchange Board of India (SEBI), we asked all the fund houses currently operating in India to provide details about

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<sup>3</sup> <http://www.basunivesh.com/2013/06/14/life-insurance-vs-mutual-fund-agents-who-earns-more/>

their operations throughout India through a survey. The survey was designed in a manner to gain a better understanding of the operational details of AMC's at both macro and micro levels.

At a macro level, the survey asked the AMC's to provide the total number of folios and assets under management at a country level on the last date of the fiscal year since 2010. The AMC's were also requested to provide a breakup of their folios at a retail and non-retail level. The AMC's were also asked to provide the distribution, commission and advertisement costs and total number of schemes in operation at the end of each fiscal year since 2011.

To gain a better understanding of the geographical reach of the AMC's, we asked the AMC's to provide all the cities/towns in which they had at least one office and the number of years since the AMC's were present in that city/town. However, since a large number of mutual fund sales happen outside dedicated mutual fund offices (through independent financial agents), we asked AMC's to also report on the number of folios and assets under management at a city/town/village level as of the end of fiscal year since 2011.

We classified the distribution and delivery channels of mutual funds in three categories: distributors, banks and independent financial agents. We asked AMC's to provide details of the number of agents they employed at each level and the amount of money spent on marketing and distributions costs at a city/town level as of 31<sup>st</sup> March 2013.

We then asked AMC's to provide their opinions and views on a range of issues such as financial literacy, availability of fresh talent for recruitment, regulatory framework, distributional efficiencies etc. The AMC's were asked to score each of these questions based on five-point Likert scale in which scores ranged from a "strongly agree" to "strongly disagree". Lastly, we asked AMC's to rank order factors which effect penetration from the "least important" to the "most important" factor.

To the best of our knowledge, this is the first study which takes distribution costs and sales into account at the city/town level. Taken as a whole, the availability

of the data at this level revealed some interesting insights about AMC's operations – especially their operations outside the major cities.

### *Methodology*

Unlike previous studies which have largely used cities as their primary units of analysis, it was decided the best results could be obtained only if the data was aggregated at the district level. The reasons behind this were two-fold.

The main reason was that, the survey data revealed the operations of AMC's extended well beyond Tier I and II cities. While it is true that the scale of AMC's operations in the large cities of India dwarfs their operations in the smaller cities, it is worth noting that taken as a whole AMC's are present all across India. The smallest town to have at least one independent financial agent was the town of Singtam in East Sikkim with a population of just 5431. In our data, we found that through their independent financial agents and bank agents, AMC's have extant operations in well over 1,500 towns and cities.

In this regard, the distribution networks of AMC's are far wider and comprehensive than is often perceived. However, performing an analysis on such a large number of towns becomes unwieldy and is often accompanied with a lot of noise. Many towns which are close to large cities (e.g. towns located in between Indore and Ujjain (which are located just 50 kilometers from each other) benefit from having two large cities thereby having much larger fund representation than they otherwise would have had they not been in between the cities) become outliers which make the results difficult to interpret. By aggregating all the towns and cities into their respective districts, the information becomes far easier to understand.

The second reason was purely statistical. Municipal and city level data in India are hard to come across. While the census results reveal a lot of demographic information at the district level, the same is not true for city level results. Factors such as literacy levels, SEC level classification, GDP levels etc. are not easily available or reliable at a micro level. Often, when the data is available, it is ill-suited to be used

for statistical uses. For these reasons, we decided to take districts as our unit of analysis.

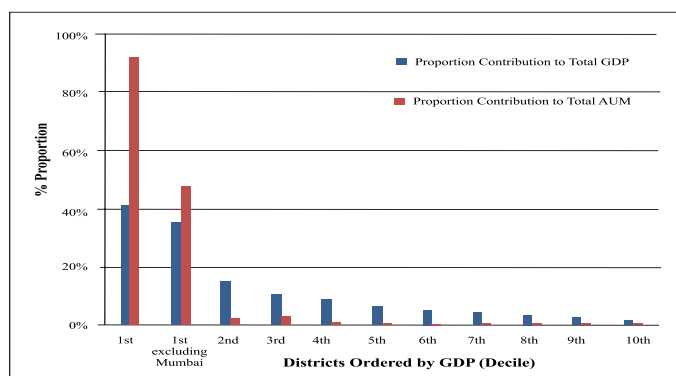
*District Domestic Product and AUM/GDP distribution*

One of the most common metric to capture the penetration of mutual funds in a given country or area is to find the AUM/GDP ratio. This ratio captures the amount of wealth invested in mutual funds to the earnings of a given region.

It is well known that the geographical distribution of AUMs in India is heavily lopsided in favor of the large cities. The recent report by CII-PWC highlights this by pointing out that 74% of the AUMs originate in the top five cities with another 14% originating from the next ten cities. In other words, the top fifteen cities contribute an astonishing 88% of the entire mutual fund market (PWC, CII, June 2013).

Before calculating the AUM/GDP distribution, all the districts of India were ranked in the descending order of their respective domestic products. This list was then split into ten equal groups (i.e. we took deciles) and then each decile’s contribution to the nation’s gross domestic product was calculated. The resulting distribution is depicted by the vertical blue bars in Chart 4 below.

**Chart 4: Contribution to GDP by Decile**



Source: Authors’ Survey Data

As shown, the top 60 districts of the nation contribute a net of 41% to the country’s GDP. The last four deciles (i.e. 240 districts) contribute to just 12% to the nation’s economy. We then repeated this process for the same list, only this time – AUMs were taken. The same sixty districts (contributing 41% to the GDP)

contribute over 90% to the total AUMs of the nation. The contribution of the next sixty districts (i.e. the 2<sup>nd</sup> decile) is just 4% and proceeds to fall off rapidly for the remaining districts.

The AUM/GDP ratio of the districts using the same distribution was then calculated using the same method. While the first decile has an AUM/GDP ratio of 29.53% - this ratio is comparable to developed economics like the UK (40%) and EU member nations (41%). The corresponding AUM/GDP ratio for the second decile is 2.82%. Starting from the fifth decile, AUM comprises less than 1% of the district GDP. The exact measures are given in Table I.

**Table 1: AUM/GDP ratio across Indian districts**

| Region                                  | AUM/GDP         |
|---|-----------------|
| Mumbai                                  | 126.10%         |
| 1st Decile                              | 29.53%          |
| 1st Decile <i>Excluding</i> Mumbai city | 12.67%          |
| 2nd Decile                              | 2.82%           |
| 3rd Decile                              | 3.72%           |
| 4th Decile                              | 1.89%           |
| 5th to 10th Decile                      | less than 1.00% |

However, one thing to note in the above analysis is that Mumbai is the elephant in the room. Mumbai alone contributes a staggering 58.25% to the entire nation’s AUM. To put it an alternate way: For every 5 rupees invested in a mutual fund, 3 rupees of that investment originates in Mumbai. Mumbai’s AUM/GDP ratio is 126.09% which indicates that money from outside Mumbai is coming to be invested there. So, it should be kept in mind that any category/decile/state etc. which includes Mumbai as one of its components will get a boost in its measure. It should also be kept in mind that approximately 80% of the AUMs invested in Mumbai are institutional or non-retail in nature. Such large non-retail participation is justified considering that almost all large companies’ headquarters and financial operations are conducted out of Mumbai.

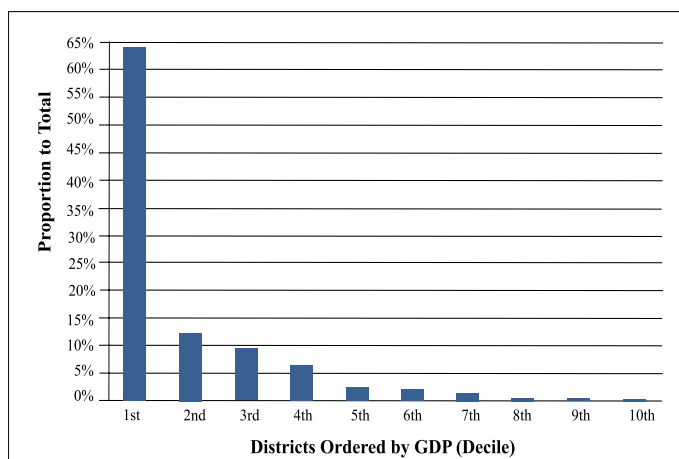
The inclusion of such high aberrational figures would lead to misleading results and interpretations if one

does not exclude them from the analysis. Therefore, going forward we report the first decile of districts two times – once including Mumbai and another time excluding it. If one excludes Mumbai from the first decile of districts, the AUM/GDP ratio drops to 12.67% - a figure comparable to Japan's AUM/GDP ratio (12.4%).

*Independent Financial Agent distribution by District GDP*

The above results raised the question to why there would be such a skewed distribution of AUM distribution across the country. To shed more light on this, we recalled from the PWC-CII study that Independent Financial Advisors (IFAs) play a crucial role in fund distribution and sales. We therefore wished to find out how agents are geographically distributed across the country. We first sorted the districts into deciles in the same manner described above. The number of agents working in each district was then calculated and aggregated into each decile. The results are presented in Chart 5.

**Chart 5: IFA by District GDP**



Source: Authors' Survey Data

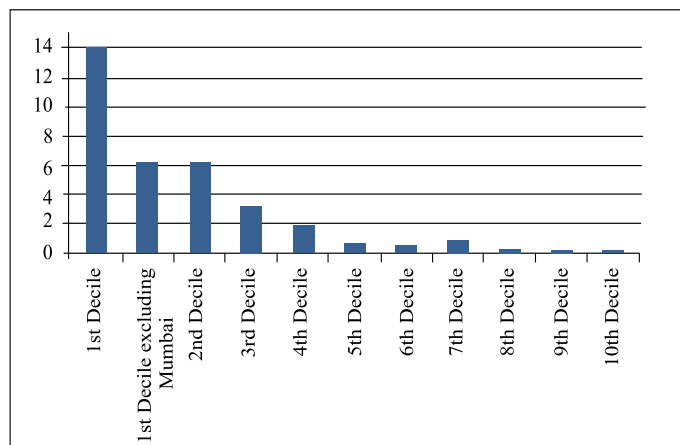
Approximately, 75% of all the agents (independent and bank) are located in 20% of country's districts. While the geographical distribution of IFAs is clearly skewed in favor of the first decile, the level of skew is not to the extent it was in AUM origination where the top 5 cities were contributing to 74% of the total AUMs in the country.

At the same time, it is worth noting that the ratio of the agents is not commensurate with the GDP distribution – the bottom 50% of districts contribute 17% to the nation's GDP but have only 4% of all the agents in the country. Even if people in these districts would like invest their savings into mutual funds, they would be hard pressed to find agents or distributors who would be willing to sell them these investment products.

*AUM per Agent*

We then decided to see how agents are performing across these districts. To do this, we decided to examine the AUM generated by each agent across all districts. We again ranked and partitioned the districts as mentioned above and computed the average AUM generated by each agent.

**Chart 6: AUM/Agent (in Million Rupees)**



Source: Authors' Survey Data

As can be seen, the top 50 districts of the nation clearly dominate the rest of India as far AUM generation is concerned. Even if we were to exclude Mumbai from the first decile, the AUM generation potential still dominated the remaining districts of India. However, there is another implication that can be drawn from the above graph. If the average AUM generated is significantly higher in a particular area (as it is here), it is expected that agents would tend to congregate in those areas where they can achieve maximum sales. Thus, the geographical reach of mutual fund agents is more likely to be explained by the potential revenue or AUM generation of each district. So, even if mutual fund houses (or the regulator) push agents

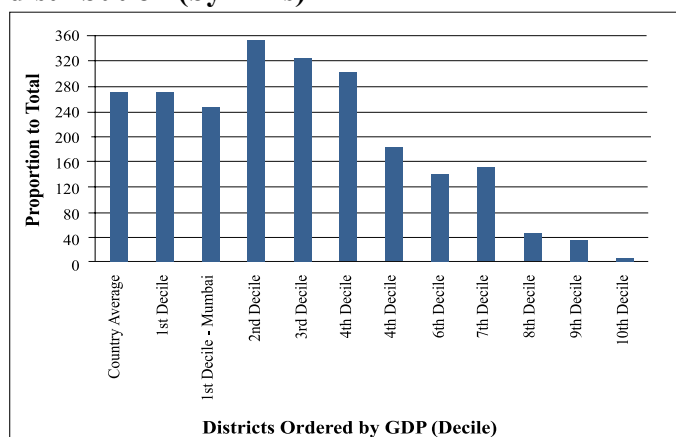
into districts other than the first decile, they are most likely to meet stiff resistance from the agents due to low potential sales in that region.

Looking at the above results, it is clear that the top 50 districts of the country receive a disproportionate amount of attention by AMC's and agents.

#### Distributional efficiency of Fund Houses

However, such overcrowding could have some other consequences. By having such a large presence in just one location could lead to inefficiencies. We decided to test this out by examining the distribution efficiencies of the fund houses. Specifically, we asked how much does one rupee spent on distribution earn in AUM.

**Chart 7: AUM generated per rupee spent on distribution (by IFAs)**



Source: Authors' Survey Data

The above graph throws an interesting insight for fund houses: while it may be true that the potential earnings for 90% of the districts are a fraction of the top decile, the 2<sup>nd</sup> to 4<sup>th</sup> decile district offer more “bang for the buck” as far as distribution costs are concerned. Spending one rupee in a top decile district would earn a fund house an average of Rs. 270 in AUM. Spending the same amount in the 2<sup>nd</sup> decile will earn an average of Rs. 355 in AUM. In other words, due to the untapped potential of these districts, distribution networks in this decile are 31.5% more efficient than the top decile. The corresponding figures for the 3<sup>th</sup> and 4<sup>th</sup> deciles are 21.3% and 12.3% respectively.

#### Growth in AUM since FY2011

We then wanted to examine the growth of assets under management for individual districts and how they have grown over the last two years. Two areas where we had expected growth to occur was Bihar and Gujarat given the high economic growth that these two states have experienced over the past 5-10 years. We calculated the growth of AUMs in these two states along with other states which typically lag the national averages – Rajasthan, Uttar Pradesh, Jharkhand, Madhya Pradesh and Odisha. We computed the CAGR for these states two times – once for the overall state and once after taking out the state capital (this is because capital district would tend to crowd out the AUM growth in the other districts in the state). The results for the states are given below:

**Table 2: Growth Rates of AUM of select states**

| State   | Growth Rate |
|---|-------------|
| Bihar   | 5.54%       |
| Bihar <i>excluding</i> Patna district                     | 24.64%      |
| Jharkhand   | 6.47%       |
| Jharkhand <i>excluding</i> Ranchi district                | 4.14%       |
| Madhya Pradesh  | 2.79%       |
| Madhya Pradesh <i>excluding</i> Bhopal & Indore districts | 8.11%       |
| Odihsa  | 11.92%      |
| Odihsa <i>excluding</i> Bhubaneswar (Khurdha) district    | 3.97%       |
| Rajasthan   | 6.77%       |
| Rajasthan <i>excluding</i> Jaipur district                | 4.22%       |
| Uttar Pradesh   | 7.01%       |
| Uttar Pradesh <i>excluding</i> Lucknow district           | 7.53%       |
| Gujarat   | 8.61%       |
| Gujarat <i>excluding</i> Ahmedabad district               | 1.87%       |

With the exception of Odihsa, all the states – including Gujarat – lag behind the country average of 9.88%. However, the growth rate for some states – notably Madhya Pradesh and Bihar – improves once the

capital districts are taken out. We remove the capital districts because their AUM levels which are often 10-20 times the AUM levels in smaller districts. If the capital districts are taken out, smaller districts tend to outperform their larger counterparts is because the AUM levels in these districts is so low that even a small addition in AUM leads to a large percentage change in growth. Gujarat and Odisha are standout states where the bulk of the AUM growth is coming from their capital districts. Whether this is due to economic factors or logistical is covered in a separate section of the report.

We then proceeded to map the growth rate of all the districts of India as given in Map 1A. Our findings suggest that the maximum growth is happening in areas with the least AMC presence. Most of the places with the maximum growth (75% and above) is happening in parts of Central India, Haryana, Himachal Pradesh and Bihar. A comprehensive list of the fastest and slowest growing states is given in Table 3.

**Table 3: Fastest and Slowest Growing States**

| Slowest Growth    |             | Fastest Growth   |             |
|-------------------|-------------|------------------|-------------|
| State Name        | Growth Rate | State Name       | Growth Rate |
| Arunachal Pradesh | -18.13%     | Sikkim           | 139.95%     |
| Puducherry        | -7.83%      | Manipur          | 94.48%      |
| Madhya Pradesh    | 2.79%       | Himachal Pradesh | 36.02%      |
| Andhra Pradesh    | 3.27%       | Haryana          | 32.82%      |
| Tamil Nadu        | 3.75%       | Nagaland         | 23.77%      |
| Bihar             | 5.54%       | Tripura          | 20.31%      |
| Jharkhand         | 6.47%       | Uttarakhand      | 18.54%      |

Source: Authors' Survey Data

To further understand the characteristics of the spread of mutual funds, we check the geographical

distribution of folio growth in the country. The number of new folios can be taken to approximate the size of new entrants in the mutual fund market. We map out the growth in the number of folios from 2011 to 2013 in Map 1B. It seems to indicate that growth is strongest in the states of Maharashtra, MP, parts of Karnataka and Andhra Pradesh.

Map 1C presents the number of retail folios for every 1000 households. Here, a clear north-south divide seems to be visible. Large parts of North India have very low presence of mutual funds in the retail space. Exceptions to this are the north Indian states of Punjab and Haryana where the proportion of retail folios is relatively higher.

Map 1D shows the number of retail folios after controlling for bank account penetration. This depicts the ratio of folios to the number of thousand households with bank accounts in 2008 as per the Indicus Analytics database. For example, a ratio of 60 implies that for 6% of bank holders in a given district have invested in mutual funds. The map shows that districts with the lowest measure were in Madhya Pradesh, Uttar Pradesh, Bihar and Jharkhand, as well as some pockets of Rajasthan and Andhra Pradesh.

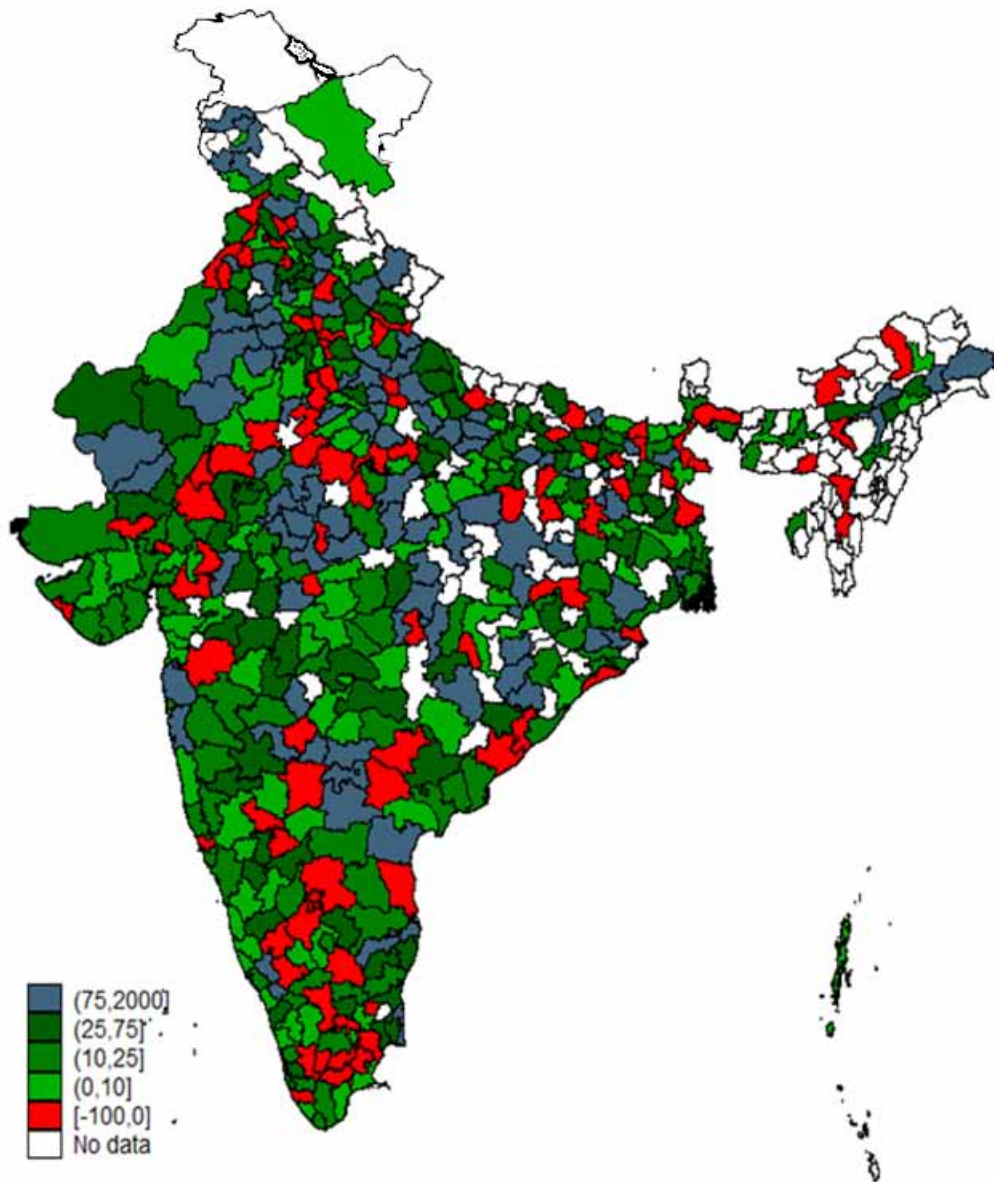
Map 1E which plots the AUM/GDP ratio as of 2013 summarizes the current penetration scenario and corroborates the T-15 bias already mentioned. As can be seen in the map, the penetration of mutual funds in most districts of the country is less than 1%.

In the coming section, we attempt an analysis of the causes of this scenario of geographical distribution of mutual funds

## 5. Statistical Analysis

After observing the variation in AUM penetration and AUM growth rates across the various districts, it would be worth finding out the factors which cause some areas to receive preferential access to mutual funds, independent financial agents etc. while other states lose out.

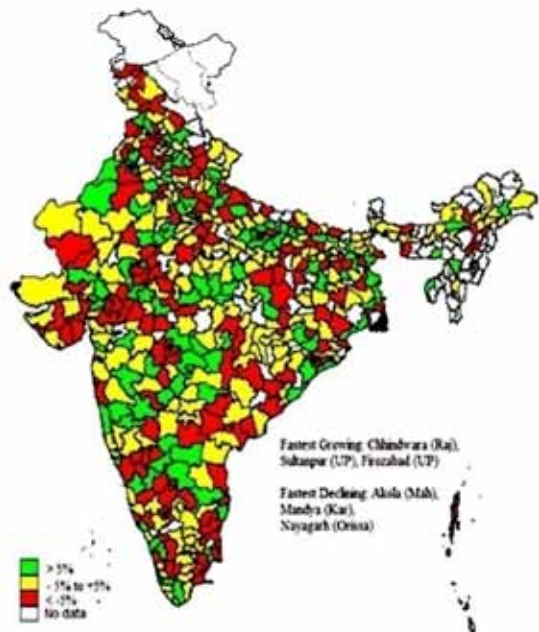
**Map 1A: AUM Growth Rates of Districts (%)**  
**AUM CAGR 2011-13**



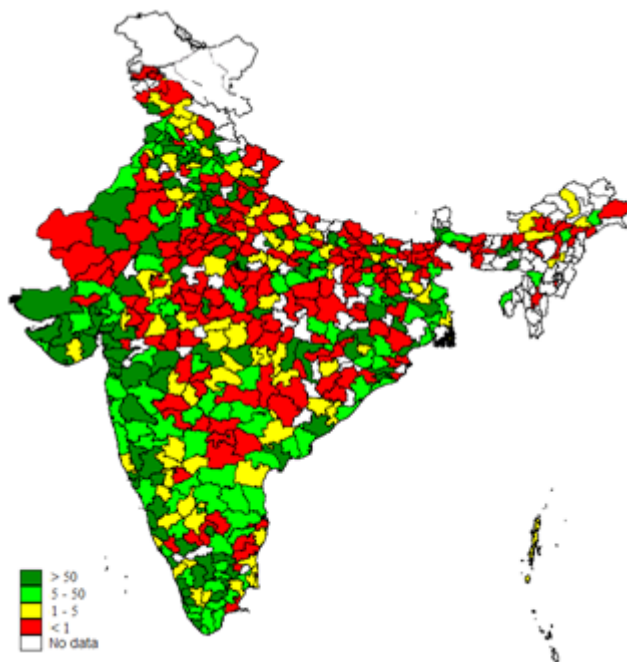
Source: Authors' Survey Data

**Other AUM characteristics**

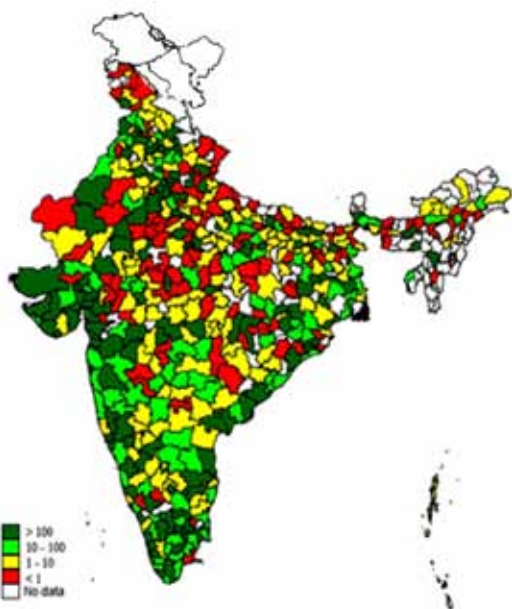
Map 1B: Folio Growth (2011-13, %)



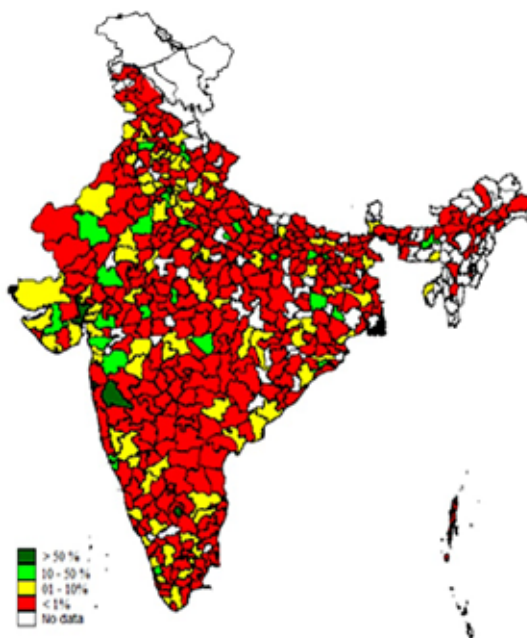
Map 1C: Retail Folio per 1000 households (March 2013)



Map 1D: Retail Folios for 1000 households with Bank Accounts (2013)



Map 1E: AUM/GDP (2013, %)

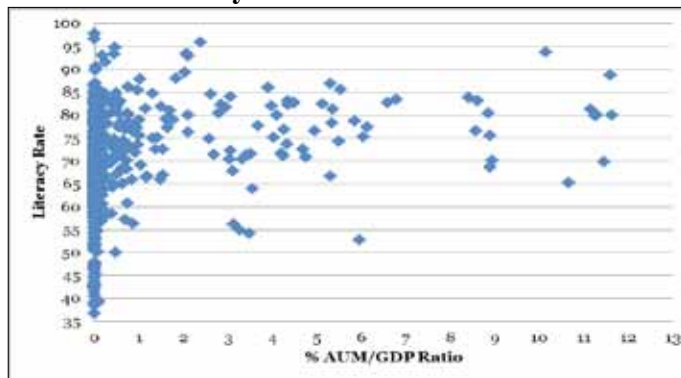


Source: Authors' Survey Data

The most obvious reason that is often quoted in the literature is that financial literacy for the average Indian household – especially in rural areas – is so low that they have difficulty in understanding complex investment vehicles like mutual funds. To test this hypothesis, two variables were chosen to see if there was any such relationship could be established.

The first variable chosen was literacy. It would be reasonable to presume that literate people would have a much better understanding of financial matters and investments. A scatter plot depicting literacy rates on the vertical axis with AUM penetration on the horizontal was plotted. We took out the values for TIER I cities which had high AUM/GDP values since they would tend to distort the graph. The result was as follows:

**Chart 8: Literacy vs. AUM Penetration**



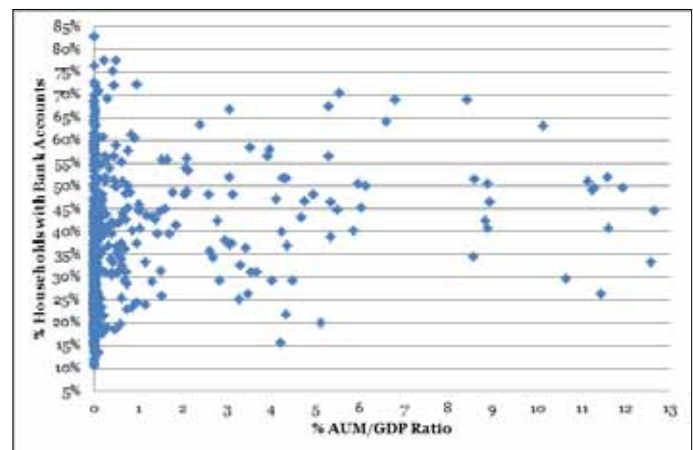
Source: Authors' Survey Data

From the above graph, there doesn't seem to be much correlation in between literacy rate and AUM penetration. In fact, the districts with less than 1% AUM/GDP ratio form a solid vertical line on the graph. While there are several districts with low literacy rates with no mutual fund presence, there are other districts with high literacy rates (e.g. Kasargod in Kerala) have AUM/GDP levels of 0.01% to 0.02% of their GDP.

The correlation coefficient between literacy and AUM/GDP levels is 0.21. Another way to think about this is to square this number and derive the coefficient of determination to determine the strength of the relationship between these two variables. The coefficient of determination measures how much of

the variance in dependent variable (AUM penetration) is captured by the independent variable (literacy). The coefficient of determination in this case is just 0.0441 or 4.41%. This means that literacy rates explain only 4.41% of the total variation in AUM/GDP ratio across the country. All this leads to the conclusion that literacy levels are not a good proxy for mutual fund penetration in that area.

**Chart 9: Bank Penetration vs. Mutual Fund Penetration**



Source: Authors' Survey Data

One flaw with choosing literacy as a proxy for explaining mutual fund penetration is that it may not necessarily be true that literate people have enough to invest in mutual funds. It is very much a possibility that a farmer practicing subsistence agriculture has completed his primary education and therefore is counted as a literate person. To compensate for this flaw, it was decided to choose a variable which would capture a person's exposure to investment opportunities. The variable chosen to overcome this was the proportion of households in the district having a savings account with a bank. The scatter plot of these two variables is shown in Chart 9 (refer previous page).

A pattern similar to the previous graph emerges. While this time the districts are more scattered about, there is no clear relationship between the two variables. Most damagingly, there are several districts in which over two-thirds of the households have savings accounts but still have little (or no) access to mutual funds. The correlation coefficient is 0.36 which implies a weak

correlation and an inconclusive relationship between the two variables. The coefficient of determination in this case is 0.1296 implying that bank penetration explains only 12.96% of the entire variation in AUM/GDP ratio.

However, this weak relationship can also be interpreted in the following manner: Banks and savings account holders are not being tapped as much as one would imagine for sale of mutual funds. It would be reasonable to suggest that the number of people with surplus money is likely to be higher in those districts where bank penetration is higher (say 65% and above). However, given that there are a large number of districts with high penetration with little to no mutual fund penetration suggest that banks are not being utilized as distribution centers for mutual funds. If one can assume that saving account holders visit their bank branches even once in two months, this would present a good opportunity to inform people about mutual funds and possibly convert them into investors.

*Multivariate Analysis*

To overcome this, it was decided to run a regression analysis to better eke out the causes for mutual fund penetration across India.

There are two reasons why penetration of mutual funds in some districts is higher than another. The first reason could be that people in the district are extremely rich and are looking for investment opportunities. In other words, the savings propensity for a richer district would be higher than that of a poorer district. The second reason for a high mutual fund penetration could be the presence of agents and distributors. If the number of agents in a particular

district is high, the people in the district are more likely to be aware of mutual fund as an investment asset. This would particularly be true for the districts in the first decile (refer back to Chart 5).

We analyze the effect using two independent variables. The variable chosen to capture the saving propensity in a district was the percentage of households with more than Rs. 300,000 of annual income. Households with these income levels above this can be expected to save at least some percentage of their annual income in some form. This variable is represented by 3Lakhs Per Annum (LPA) and is calculated by taking the number of households earning more than Rs. 300,000 and dividing it by the total number of households. The second variable is the number of financial agents in the district. This variable is represented by Mutual Fund Agents (MFA).

We thus have the following model in mind:

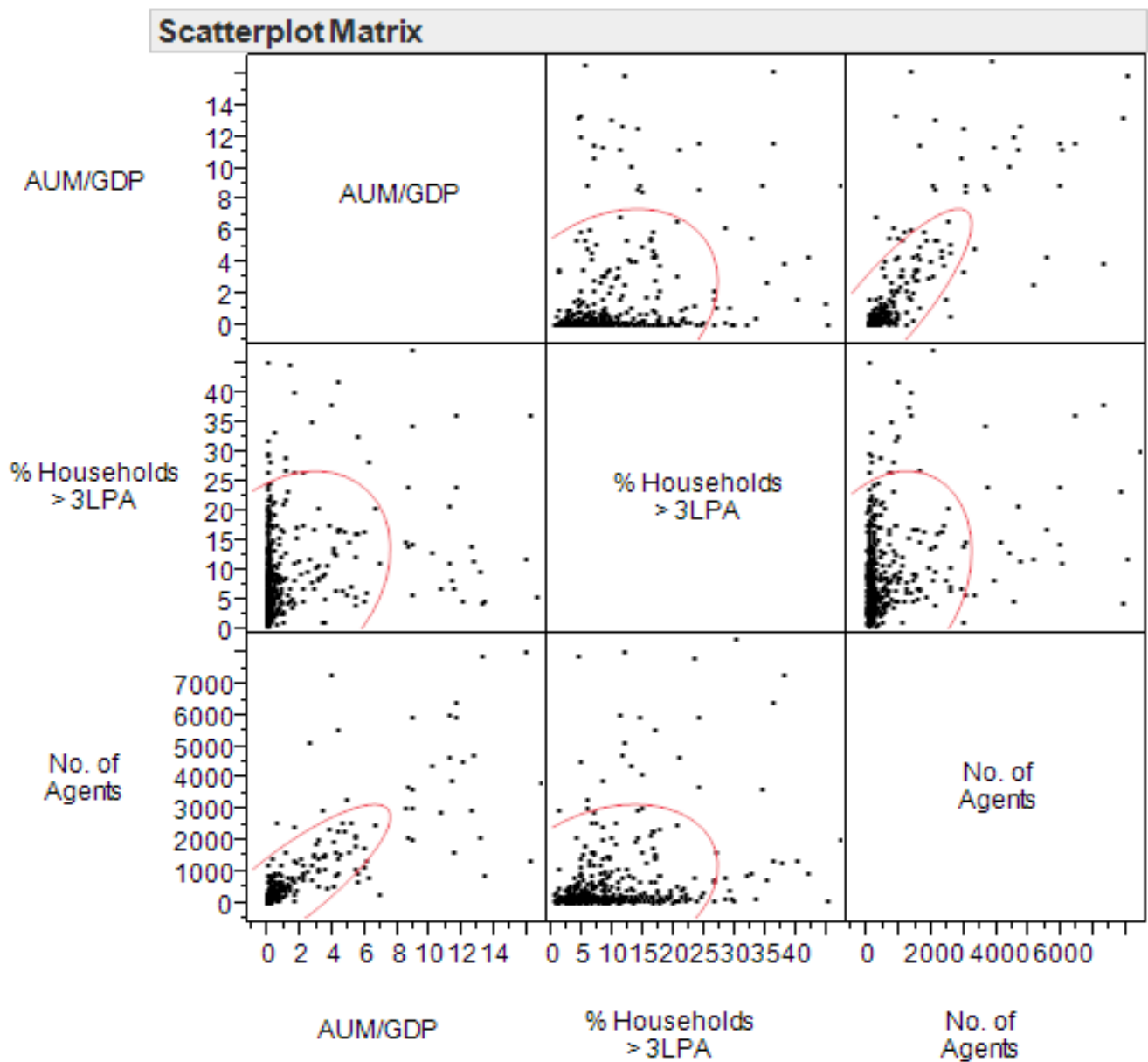
$$\frac{AUM}{GDP} = f(3LPA, MFA)$$

We take took out the outlier categories like Mumbai and other Tier I cities since their AUM penetration levels are over a hundred times larger than the average. The correlation coefficients of these variables are shown in Table 4 followed by the scatter plot of all the three variables on the next page.

**Table 4: Multivariate Analysis on Independent Variables**

|         | AUM/GDP | 3LPA   | MFA    |
|---------|---------|--------|--------|
| AUM/GDP | 1.0000  | 0.2750 | 0.8489 |
| 3LPA    | 0.2750  | 1.0000 | 0.2549 |
| MFA     | 0.8489  | 0.2549 | 1.0000 |

**Chart 10: Scatter-plot matrix for Independent Variables**



The above multivariate plot throws some interesting revelations. Firstly, mutual fund penetration is weakly correlated with the 3LPA variable. This implies the potential market for mutual funds remains largely untapped. There are several districts in India which have households with high savings propensity but have negligible amounts of their savings invested in mutual funds. The second insight is that agents are not necessarily matched well to the households with high savings propensity. An alternative explanation to this

low relationship could be that the two variables could also be that households with high savings potential are unaware of mutual funds as investment opportunities. However, the root cause of this relationship cannot be clearly discerned with the limited data we have. At the same time, the mutual fund penetration is highly correlated with the number of agents in the district which reinforces the notion that agents comprise bulk of the mutual fund sales and remain the dominant channel for delivery.

## 6. Opinions of Fund Houses

In this final section of the report, the opinions of fund Managers on areas on which the regulator ought to focus on, and what are the causes for holding mutual funds back on increasing their presence in rural India.

### *Investor Awareness*

When fund houses were asked whether a typical investor was adequately informed about different mutual fund products, an overwhelming majority (80%) answered in negative. AMC's are of the opinion that investors in metros are significantly better informed as compared to investors in non-metro cities. However, the distinction is not as sharp when awareness levels of investors in T-15 and B-15 cities are compared. Also, within the T-15 cities, awareness levels about different mutual funds were far higher in the five metro areas than the rest of the T-15 cities. 57% of respondents think that lack of customer information is the biggest challenge they face in selling mutual fund products.

Understandably, this lack of awareness on part of investors is one of the single largest factors affecting penetration according to the fund houses. AMC's suggest novel awareness campaigns wherein partnerships with colleges can be established to inculcate financial knowledge at young age. Involving celebrities to spread financial awareness regarding mutual funds at category level is also one of the suggestions. One of the interviewed fund houses suggested opening up of MF 'education centers' in smaller towns could serve as counseling centers and provide fund updates, Net Asset Value (NAV) across AMC's.

### *Distribution Channels*

Of all the fund houses surveyed, 61% of respondents said that finding quality distributors continues to present a formidable challenge. Fund houses are of the opinion that due to the current regulations that impose a limit on the incentives, good quality distributors are hard to find. On the other hand a large majority of respondents says that even if a reasonable commission

is offered, it is difficult to recruit sufficient number of distributors which implies that there is lack of skilled distributors. Finding quality distributors especially in small towns and rural areas is a major hurdle towards increasing mutual fund penetration. This problem is more prevalent in case of AMC's with relatively lower AUM levels.

67% of fund houses opine that distribution, if carried out through post offices could be a positive step towards increasing the penetration of mutual funds. If this could be started, this would be a significant step considering the recent push by India Post of the Post Office Saving Schemes. Since India Post is a loss making enterprise, an introduction of such mutual fund sales through India Post could also help them in reducing their deficit and this could be a highly beneficial move for both parties. Furthermore, India Post through its broad network spread throughout the nation offers a distribution channel that could be leveraged. In January 2001, India Post in association with IDBI-Financial launched a pilot scheme in the Delhi, Mumbai, Kolakata and Patna. From 15th June 2001 onwards, sales of mutual funds by SBI, Principal, Franklin-Templeton and Reliance Mutual Fund were extended to cover post offices in all major capital and other cities all across the country.

Huge costs when entering new areas where there are no existing mutual funds are also a barrier for the fund houses to establish the footprint. AMC's ask for allowing differential incentives for such locations (including, possibly, upfront fees to distributors) to make it mutual fund distribution financially viable and compete with the sale of other financial products. The present regulation provides incentive to the distributors for funds mobilized beyond top 15 cities. However this benefit is effectively cancelled by the claw-back provision which needs to be revisited. AMC's also demand fiscal incentives for opening branches beyond top 15 cities as the infrastructure and set-up need to be incurred by them. At the same time, a large majority of the respondents feel that introducing new channels like transactions through ATMs would not boost AUM levels.

Smaller fund houses and those in private sector count misselling by the distributors as a major factor affecting the penetration of mutual funds. AMC's suggested making the offence of misselling more stringently punishable. An interesting insight obtained from the survey is that the fund houses do not feel that agents have a clash of interest when they sell other financial products along with mutual funds.

AMCs feel the need of using technology as much as possible to increase the reach. Facilities like mobile wallet should be introduced which could help accretions of daily SIPs particularly in small towns and help small investors participate in equity and debt markets.

In order to tackle the shortage of quality distributors, AMC's suggest that the country-wide network of stock brokers can be effectively utilized. They propose that fund houses should be allowed to pay commissions to them and their registration with AMFI should not be made compulsory. AMC's also pointed that restricting the scope of New Cadre Distributors to simple products affects penetration in non metro locations.

#### *Regulatory Framework*

Fund houses also consider "Know Your Customer" (KYC) norms, excessive paperwork and the restrictions impose on transactions by cash as roadblocks to penetration by the. Public AMC's consider the regulatory restrictions on advertisements as a reason for under-penetration.

AMCs demand that restrictions on advertisements should be relaxed and the advertising guidelines should be simplified to enable better communication. They should be allowed to compare their track record with other competing products so that the investors can better understand the benefits of investing in mutual funds.

At the time of our survey, fund houses reported that the cumbersome paper work, especially related

to KYC guidelines ought to be further refined and simplified particularly in the case of retail investors. The recent simplification of common KYC norms by SEBI by having i) Common KYC to cover entire financial services sector, ii) fetching KYC related data directly from KYC Registration Agency (KRA) and not from investors and iii) further simplification of rules around disclosure of performance are steps in the right direction. By having this standard format of application form across the industry, uniform procedures and practices like transmission, change of name, and issues with signature mistakes will make the entire investment process easier and simplified for the investor.

By making mutual funds more tax-efficient and friendly, more investors can be attracted and hence, penetration can be increased. Suggestions include introduction of new policies to make investment in mutual fund schemes qualify under Capital Saving Scheme under Income Tax, extension of ELSS Tax benefit for 3 more years in case of rollover and making mutual funds part of pension plans.

From the feedback received from the AMC's, there is a lack of level playing field as compared to other competing products in terms of tax advantages, disclosure levels, after sales support and other regulations. Unless these issues are addressed, it will be very hard for the AMC's to increase the penetration levels.

A summary of the views of fund houses is given below in Table - 5. To arrive at these interpretations, we asked managers at fund houses questions ranging across multiple issues. Fund houses which responded to the questions with "moderately agree" and "strongly agree" were grouped under the category "Agree". Similarly, we grouped "moderately disagree" and "strongly disagree" under the category "Disagree". Questions on which no responses were received were grouped in the third category of neutral.

**Table 5: Views/opinions of Fund Houses**

| No | View/Opinion  | Disagree | Neutral | Agree  |
|----|---|----------|---------|--------|
| 1  | The typical investor is not adequately informed about mutual fund products  | 8.57%    | 8.57%   | 80.00% |
| 2  | Investors in metros (tier-I cities) are significantly better informed than investors in non-metros cities               | 2.86%    | 17.14%  | 80.00% |
| 3  | Investors in T-15 cities are significantly better informed than investors in B-15 cities                                | 5.71%    | 34.29%  | 60.00% |
| 4  | Lack of customer information is the biggest hurdle in selling mutual fund products                                      | 28.57%   | 11.43%  | 57.14% |
| 5  | Quality of distributors is a challenge in selling mutual fund products  | 8.82%    | 23.53%  | 61.76% |
| 6  | Current limit permissible for incentives / commission is a constraint in recruiting quality distributors / agents       | 14.29%   | 20.00%  | 62.86% |
| 7  | Agents selling non mutual fund products along with mutual fund products is a hindrance to mutual fund penetration       | 51.43%   | 14.29%  | 31.43% |
| 8  | Regardless of reasonable incentive / commission, it is difficult to recruit sufficient number of qualified distributors | 20.00%   | 28.57%  | 48.57% |
| 9  | Whether certification courses by NISM for distributors requires improvement   | 20.00%   | 40.00%  | 37.14% |
| 10 | Penetration would increase if distribution were broadly done through bank branches                                      | 25.71%   | 11.43%  | 60.00% |
| 11 | Penetration would increase if distribution were broadly done through individual financial advisor                       | 14.29%   | 22.86%  | 57.14% |
| 12 | Facility of investing in mutual funds through ATM machine would boost the investment                                    | 40.00%   | 20.00%  | 34.29% |
| 13 | Distribution through post office would increase penetration   | 11.76%   | 17.65%  | 67.65% |

Source: Authors' Survey Data

We also asked fund managers to rank from 1 (not important) to 10 (most important) factors which in their opinion impact the sale of mutual funds. Through their responses, we list the top four factors which the maximum number of fund houses found to be important.

**Table 6: Top factors affecting mutual fund penetration**

|   |  |
|---|--|
| 1 | Lack of information/financial sophistication of the customers about mutual funds |
| 2 | Finding quality distributors / agents in small towns and villages                |
| 3 | Cost of entering new regions with no existing mutual funds                       |
| 4 | KYC / Paperwork / restrictions on cash transaction                               |

Source: Authors' Survey Data

## 7. Conclusions and Policy Recommendations

We carry out a preliminary enquiry into the nature of geographical penetration and distribution of mutual funds in India as well as their likely determinants. Using a questionnaire survey we collect qualitative and quantitative evidence from fund managers on the nature and determinants of their geographical presence throughout the country.

We confirm that mutual fund presence in the country is heavily skewed in the favor of the top 60 districts of India. Even within the 60 districts, a lion's share of the mutual fund presence originates from Mumbai. This is primarily due to the fact that Mumbai houses the headquarters (or the financial headquarters) of most of the large companies, thereby getting a bulk of investments through the non-retail or institutional

avenues. If the non-retail customers are taken out, Mumbai starts looking like the other larger metros of the country.

We confirm that independent financial agents are associated with the bulk of the sales of mutual funds in the country. We then report that the geographical distribution of the financial agents is similarly skewed (but not as much) in the favor of the top 60 districts. Agents in these top districts can expect to manage to have AUM in the range of three to seven times the amount they can expect to manage in the next 60 districts.

At the same time, the distribution costs as a function of AUM generated in the top 60 districts are far higher than the costs in the lower districts. This suggests that distribution networks have a larger throughput in the 2<sup>nd</sup> and 3<sup>rd</sup> decile of the district distribution and fund houses ought to focus on these districts *ceteris-paribus* if they did like to see the maximum amount of AUM generated for each rupee spent in distribution costs.

We report that demographic and social development factors such as adult literacy or bank penetration (savings account) do not show any strong correlation with mutual fund penetration. This lack of strong correlation is a strong indicator that banks are not being utilized as effective delivery channels.

Commissions offered to mutual fund agents appear to be significantly less attractive than those for other financial products (particularly insurance). Mutual fund agents outside T-15 cities cannot rely exclusively on the sale of mutual funds as an income source and the products compete for the “push” given to them by the agents. Low commissions could also be a reason for the difficulty in finding talent.

At the same time, the number of agents together with number of households with more than Rs. 300,000 of annual income does show a high correlation with mutual fund penetration, thereby suggesting that fund houses ought to seek out those districts where such households are present.

We finally present a brief summary on the opinions of fund house managers on what is holding mutual

funds from increasing their presence outside T-15 cities. The main concern raised by fund houses was lack of good talent for training and hiring mutual fund agents. Another major concern was about investor awareness and the lack of financial sophistication of investors outside T-15 cities.

The growth in the mutual fund industry is by and large governed by the macroeconomic factors affecting the country. Given the recent high inflation rates with a slowdown in the economic output of the nation, it is not surprising to see a slowdown in the rate of growth in the mutual fund industry as well.

However, there remains a large untapped market waiting to be explored and serviced. Some of these areas, such as Himachal Pradesh, Haryana and Manipur are already experiencing high growth rates (albeit from a smaller base). However, this growth can be sped up substantially if the proper areas are targeted.

While there is universal acknowledgement that there good talent is hard to find and AMCs face difficulty in recruiting the right distributors and agents in small towns and villages, they should take note of the large pool of Business Correspondents which number 195,000 as on March 31, 2013. This could be a talent pool waiting to be tapped to address the shortage of mutual fund agents in the nation. (Dept. of Financial Services, Ministry of Finance, 2013).

We also feel that bank channels are currently being underutilized. With several districts having high banking penetration among households, such districts ought to be a prime target for further growth. With the RBI scheduled to roll out new banking licenses by 2014, financial inclusion is set to receive a huge push, thereby signaling a possible strengthening of banks’ distribution networks. AMCs should therefore start to focus on their bank distribution channels and build robust information systems in order to take advantage of these upcoming opportunities.

The deduction of “trail commission” from investors makes mutual funds less attractive. A possibility may be explored about the sharing of the “trail

commission” between fund houses and investors – this would increase the attractiveness of mutual funds vis-a-vis other products. However, the exact mechanics of such a change should take into account the elasticity of investors to mutual fund returns.

This report is but a preliminary investigation into the delivery mechanism of mutual funds in India and offers several avenues for further research and exploration.

An area we have not looked into is the impact of advertisement and marketing costs on distribution. While fund houses did report these figures, with the exception of a few fund houses, marketing and advertisement costs were only available at the central level for the fund as a whole. It is generally held that “*You can’t manage what you don’t measure*”. By not having these costs allocated or measured at a micro level, fund houses would not know which areas to increase their marketing and advertising efforts, which could lead to inefficient marketing.

It may be helpful to explore the challenges faced by India Post’s 2001 pilot programme for the sale of mutual funds through post offices in major cities. Such a study could investigate whether such a rollout across villages would be economically feasible and meaningful.

Finally, we have treated mutual fund sales as homogenous sales by the independent financial agents. Analysis of sales data of agents would allow future research to be much more precise in determining the impact of agents on retail sales.

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## **TABLES:**

# **Impact of Increased Derivatives Trading on the Price Discovery Process**

**Table-1: Indian Stock and Index Futures and Option Segment (Rs Crore)**

| <b>Year</b>    | <b>No of Trading Days</b> | <b>Index Futures</b> | <b>Stock Futures</b> | <b>Index Options</b> | <b>Stock Options</b> | <b>Total</b> | <b>Daily Average</b> |
|----------------|---------------------------|----------------------|----------------------|----------------------|----------------------|--------------|----------------------|
| <b>2001-02</b> | 247                       | 22,758               | 51,967               | 3,849                | 25,276               | 1,03,851     | 420                  |
| <b>2002-03</b> | 251                       | 45,762               | 2,87,176             | 9,249                | 1,00,156             | 4,42,344     | 1,762                |
| <b>2003-04</b> | 254                       | 5,61,034             | 13,11,120            | 52,823               | 2,17,544             | 21,42,521    | 8,435                |
| <b>2004-05</b> | 253                       | 7,85,773             | 14,84,280            | 1,24,251             | 1,68,861             | 25,63,165    | 10,131               |
| <b>2005-06</b> | 251                       | 15,13,796            | 27,91,722            | 3,38,472             | 1,80,270             | 48,24,260    | 19,220               |
| <b>2006-07</b> | 249                       | 25,95,066            | 38,34,487            | 7,91,912             | 1,93,811             | 74,15,276    | 29,780               |
| <b>2007-08</b> | 251                       | 40,55,327            | 75,56,172            | 13,62,150            | 3,59,137             | 1,33,32,786  | 53,119               |
| <b>2008-09</b> | 243                       | 35,81,868            | 34,79,651            | 37,31,511            | 2,29,227             | 1,10,22,257  | 45,359               |
| <b>2009-10</b> | 244                       | 39,34,485            | 51,95,247            | 80,28,102            | 5,06,065             | 1,76,63,899  | 72,393               |
| <b>2010-11</b> | 254                       | 43,56,909            | 54,95,757            | 1,83,65,366          | 10,30,344            | 2,92,48,375  | 1,15,151             |
| <b>2011-12</b> | 249                       | 37,56,447            | 40,84,886            | 2,33,38,374          | 9,78,500             | 3,21,58,208  | 1,29,149             |
| <b>2012-13</b> | 249                       | 26,49,504            | 42,27,290            | 2,98,09,055          | 20,10,673            | 3,86,96,523  | 1,55,408             |

Table 2: Descriptive Statistics

| In of Land Value | NIFTY |       | ACC   |       | BHEL  |       | BICL  |       | CIPLA |       | HDFC  |       | ITC    |        | RAMBAXY |        | RELIANCE |       | SHIN   |        | TATAPOWER |        |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|---------|--------|----------|-------|--------|--------|-----------|--------|
|                  | Mean  | Std   | Mean  | Std   | Mean  | Std   | Mean  | Std   | Mean  | Std   | Mean  | Std   | Mean   | Std    | Mean    | Std    | Mean     | Std   | Mean   | Std    | Mean      | Std    |
| Observations     | 2877  | 2795  | 2877  | 2296  | 2877  | 2795  | 2060  | 2795  | 2877  | 2795  | 2877  | 2795  | 2877   | 2795   | 2877    | 2795   | 2877     | 2795  | 2877   | 2795   | 2877      | 2795   |
| Mean             | 7.98  | 8.01  | 7.95  | 6.30  | 6.18  | 6.71  | 6.76  | 6.55  | 6.00  | 6.01  | 5.81  | 6.93  | 5.83   | 5.48   | 5.83    | 6.22   | 6.26     | 6.72  | 6.69   | 6.88   | 6.91      | 5.99   |
| Median           | 8.20  | 8.23  | 8.16  | 6.60  | 6.42  | 7.16  | 7.21  | 6.61  | 5.94  | 5.95  | 5.76  | 6.65  | 6.59   | 6.44   | 6.32    | 6.22   | 6.22     | 6.72  | 6.72   | 7.03   | 7.07      | 6.14   |
| Maximum          | 8.75  | 8.78  | 8.74  | 7.31  | 7.32  | 7.96  | 7.97  | 7.95  | 6.69  | 6.69  | 7.24  | 7.25  | 7.23   | 7.24   | 7.25    | 7.15   | 7.14     | 8.08  | 8.08   | 8.16   | 8.15      | 7.40   |
| Minimum          | 6.75  | 6.83  | 6.75  | 4.86  | 4.86  | 4.59  | 4.68  | 4.91  | 4.78  | 4.78  | 5.11  | 5.70  | 5.74   | 4.90   | 4.90    | 4.50   | 4.50     | 5.32  | 5.40   | 5.32   | 4.95      | 4.40   |
| Std. Dev.        | 0.62  | 0.60  | 0.61  | 0.76  | 0.74  | 0.82  | 1.03  | 0.99  | 1.06  | 1.06  | 0.82  | 0.61  | 0.61   | 0.76   | 0.70    | 0.43   | 0.42     | 0.66  | 0.65   | 0.66   | 0.82      | 0.97   |
| Skewness         | -0.55 | -0.61 | -0.54 | -0.55 | -0.60 | -0.40 | -0.43 | -0.47 | -0.12 | -0.05 | -0.06 | -0.09 | -0.83  | 0.92   | 1.31    | -0.39  | -0.34    | -0.06 | -0.05  | -0.05  | -0.52     | -0.26  |
| Kurtosis         | 1.84  | 1.94  | 1.86  | 1.96  | 1.51  | 1.58  | 1.63  | 1.33  | 2.61  | 2.59  | 2.04  | 2.33  | 2.58   | 5.39   | 1.92    | 1.88   | 1.70     | 1.89  | 1.98   | 2.21   | 2.06      | 1.58   |
| ADF (P Value)    | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| PP (P Value)     | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| Mean             | 2876  | 2794  | 2876  | 2794  | 2177  | 2876  | 2794  | 1812  | 2794  | 1935  | 2876  | 2794  | 1935   | 2876   | 2794    | 2876   | 2794     | 2876  | 2794   | 2876   | 2794      | 2876   |
| Median           | 3000  | 3000  | 3000  | 3000  | 3000  | 3000  | 3000  | 3000  | 3000  | 3000  | 3000  | 3000  | 3000   | 3000   | 3000    | 3000   | 3000     | 3000  | 3000   | 3000   | 3000      | 3000   |
| Maximum          | 3116  | 3116  | 3116  | 3116  | 3116  | 3116  | 3116  | 3116  | 3116  | 3116  | 3116  | 3116  | 3116   | 3116   | 3116    | 3116   | 3116     | 3116  | 3116   | 3116   | 3116      | 3116   |
| Minimum          | -0.13 | -0.16 | -0.16 | -0.16 | -0.13 | -1.65 | -1.64 | -1.63 | -0.71 | -0.69 | -0.69 | -1.59 | -0.94  | -1.59  | -0.94   | -1.58  | -1.58    | -2.62 | -2.62  | -2.62  | -2.62     | -2.33  |
| Std. Dev.        | 0.02  | 0.02  | 0.03  | 0.02  | 0.02  | 0.04  | 0.04  | 0.05  | 0.03  | 0.04  | 0.04  | 0.04  | 0.04   | 0.05   | 0.05    | 0.02   | 0.02     | 0.03  | 0.03   | 0.02   | 0.02      | 0.05   |
| Skewness         | 0.29  | 0.41  | 0.09  | 0.26  | 0.33  | -0.26 | -0.28 | -0.28 | -0.14 | -0.29 | -0.28 | -0.28 | -0.28  | -0.31  | -0.31   | -0.29  | -0.29    | -0.28 | -0.28  | -0.28  | -0.28     | -0.28  |
| Kurtosis         | 12.00 | 12.84 | 8.60  | 6.98  | 7.39  | 8.19  | 8.75  | 4.80  | 8.80  | 7.52  | 7.00  | 7.52  | 7.52   | 12.91  | 17.04   | 9.93   | 8.52     | 9.00  | 9.00   | 9.00   | 9.00      | 14.65  |
| ADF (P Value)    | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| PP (P Value)     | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| Mean             | 0.90  | 0.90  | 0.89  | 0.86  | 0.80  | 0.94  | 0.91  | 1.00  | 0.52  | 0.51  | 0.58  | 0.67  | 0.66   | 0.68   | 0.68    | 0.61   | 0.61     | 0.61  | 0.61   | 0.61   | 0.61      | 0.61   |
| Median           | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90  | 0.90   | 0.90   | 0.90    | 0.90   | 0.90     | 0.90  | 0.90   | 0.90   | 0.90      | 0.90   |
| Maximum          | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00  | 1.00   | 1.00   | 1.00    | 1.00   | 1.00     | 1.00  | 1.00   | 1.00   | 1.00      | 1.00   |
| Minimum          | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| Std. Dev.        | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| Skewness         | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| Kurtosis         | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| ADF (P Value)    | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| PP (P Value)     | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| Mean             | 796   | 714   | 796   | 714   | 796   | 714   | 796   | 714   | 796   | 714   | 796   | 714   | 796    | 714    | 796     | 714    | 796      | 714   | 796    | 714    | 796       | 714    |
| Median           | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| Maximum          | 0.08  | 0.10  | 0.07  | 0.10  | 0.07  | 0.08  | 0.13  | 0.14  | 0.11  | 0.13  | 0.23  | 0.24  | 0.10   | 0.10   | 0.06    | 0.16   | 0.19     | 0.12  | 0.09   | 0.08   | 0.08      | 0.10   |
| Minimum          | -0.13 | -0.16 | -0.16 | -0.11 | -0.12 | -0.23 | -0.28 | -0.15 | -0.23 | -0.22 | -0.22 | -1.59 | -1.59  | -0.07  | -0.70   | -0.70  | -0.06    | -0.10 | -0.10  | -0.10  | -0.10     | -0.10  |
| Std. Dev.        | 0.01  | 0.01  | 0.02  | 0.02  | 0.02  | 0.03  | 0.03  | 0.03  | 0.03  | 0.06  | 0.06  | 0.03  | 0.03   | 0.03   | 0.03    | 0.03   | 0.03     | 0.03  | 0.02   | 0.02   | 0.02      | 0.02   |
| Skewness         | -1.25 | -1.71 | -1.39 | 0.13  | -0.07 | -0.08 | -0.77 | -1.41 | 0.00  | -0.59 | -0.16 | 0.09  | -23.65 | -22.96 | 0.15    | -12.62 | -13.74   | 0.45  | -0.21  | -0.25  | -0.42     | -0.42  |
| Kurtosis         | 14.20 | 25.47 | 17.86 | 4.74  | 4.59  | 4.97  | 13.05 | 24.31 | 6.63  | 10.46 | 14.67 | 16.83 | 620.92 | 302.92 | 1.73    | 7.05   | 8.40     | 6.61  | 182.75 | 203.04 | 163.45    | 103.87 |
| ADF (P Value)    | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |
| PP (P Value)     | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00   | 0.00   | 0.00    | 0.00   | 0.00     | 0.00  | 0.00   | 0.00   | 0.00      | 0.00   |

**Table-3: Annual Standard-Deviation (in %)\***

| Index/Company | Pre-Derivative | Subperiods     |       |       |        |       |       |       |       |       |        |       | Full Period |       |        |        |
|---------------|----------------|----------------|-------|-------|--------|-------|-------|-------|-------|-------|--------|-------|-------------|-------|--------|--------|
|               |                | 2001           | 2002  | 2003  | 2004   | 2005  | 2006  | 2007  | 2008  | 2009  | 2010   | 2011  |             | 2012  |        |        |
|               |                | <b>Spot</b>    |       |       |        |       |       |       |       |       |        |       |             |       |        |        |
| NIFTY         | 8.95           | 6.45           | 19.66 | 9.15  | 11.36  | 10.33 | 15.04 | 22.84 | 22.96 | 7.64  | 6.63   | 6.01  | 23.14       | 35.10 | 20.70  | 62.14  |
| ACC           | 20.57          | 7.17           | 19.81 | 7.94  | 14.10  | 20.50 | 14.37 | 22.74 | 18.51 | 8.50  | 6.89   | 7.80  | 25.69       | 43.55 | 31.40  | 76.47  |
| BHEL          | 17.39          | 7.03           | 31.88 | 11.39 | 20.73  | 14.38 | 20.90 | 19.06 | 21.37 | 3.86  | 83.21  | 9.68  | 53.61       | 45.23 | 96.71  | 102.67 |
| BPCL**        | 23.20          | 19.47          | 21.40 | 15.55 | 7.59   | 12.76 | 10.47 | 17.73 | 17.59 | 14.15 | 8.71   | 33.06 | 26.97       | 12.10 | 29.84  | 32.22  |
| CIPLA         | 16.12          | 8.20           | 20.55 | 75.99 | 16.96  | 38.33 | 12.56 | 8.67  | 18.49 | 4.89  | 6.50   | 10.64 | 50.36       | 30.36 | 20.93  | 59.31  |
| HDFC          | 11.18          | 13.38          | 19.43 | 10.15 | 15.49  | 11.57 | 20.85 | 21.76 | 25.79 | 66.84 | 4.25   | 8.95  | 22.52       | 44.19 | 60.85  | 60.63  |
| ITC           | 6.67           | 5.96           | 13.34 | 10.36 | 109.54 | 8.88  | 8.54  | 9.68  | 15.03 | 23.90 | 8.31   | 12.79 | 19.48       | 93.92 | 19.00  | 76.31  |
| RANBAXY       | 15.83          | 9.70           | 20.22 | 8.15  | 43.92  | 9.26  | 8.71  | 33.65 | 35.84 | 11.80 | 9.58   | 7.83  | 21.41       | 41.65 | 33.49  | 43.09  |
| RELIANCE      | 8.71           | 10.59          | 22.63 | 10.05 | 17.77  | 19.34 | 26.82 | 28.77 | 25.72 | 4.18  | 10.65  | 6.28  | 27.80       | 55.39 | 36.31  | 66.45  |
| SBIN          | 12.17          | 7.02           | 21.52 | 14.79 | 15.08  | 15.69 | 28.20 | 22.81 | 28.85 | 17.05 | 16.91  | 8.26  | 39.38       | 42.34 | 27.92  | 82.41  |
| TATAPOWER     | 26.37          | 9.63           | 31.40 | 17.96 | 9.13   | 9.12  | 31.37 | 25.40 | 24.76 | 4.29  | 112.69 | 6.00  | 45.66       | 42.72 | 112.46 | 97.07  |
|               |                | <b>Futures</b> |       |       |        |       |       |       |       |       |        |       |             |       |        |        |
| Nifty         | 2.62           | 6.42           | 19.73 | 9.53  | 11.46  | 10.59 | 15.24 | 22.78 | 23.15 | 7.81  | 6.65   | 6.15  | 23.11       | 35.20 | 20.84  | 60.30  |
| ACC           | 6.82           | 7.21           | 20.01 | 8.16  | 14.14  | 20.65 | 14.48 | 22.79 | 19.03 | 8.71  | 7.24   | 7.87  | 24.62       | 43.64 | 31.75  | 73.75  |
| BHEL          | 3.60           | 7.04           | 32.03 | 11.60 | 20.93  | 14.57 | 21.12 | 19.14 | 21.66 | 3.88  | 82.82  | 9.63  | 51.67       | 45.41 | 96.67  | 99.41  |
| BPCL          | 19.47          | 19.47          | 21.38 | 16.11 | 7.75   | 12.81 | 10.62 | 17.68 | 17.55 | 14.15 | 8.62   | 33.01 | 26.83       | 12.10 | 29.89  | 32.28  |
| CIPLA         | 1.10           | 8.48           | 20.60 | 76.13 | 16.89  | 38.69 | 12.42 | 8.71  | 18.55 | 4.92  | 6.53   | 10.67 | 52.29       | 30.47 | 21.02  | 57.29  |
| HDFC          | 1.50           | 13.46          | 19.45 | 10.41 | 15.67  | 11.68 | 20.93 | 21.70 | 25.80 | 66.72 | 4.05   | 9.13  | 22.71       | 44.33 | 60.50  | 61.06  |
| ITC           | 2.66           | 5.86           | 13.42 | 10.77 | 109.33 | 9.05  | 8.76  | 9.71  | 15.09 | 23.68 | 8.26   | 12.82 | 19.78       | 93.85 | 18.88  | 76.36  |
| RANBAXY       | 4.22           | 20.15          | 21.15 | 8.33  | 43.83  | 9.32  | 8.78  | 33.17 | 35.87 | 11.88 | 9.58   | 7.86  | 20.84       | 41.63 | 33.50  | 43.57  |
| RELIANCE      | 2.03           | 9.65           | 22.93 | 10.22 | 17.86  | 19.27 | 27.01 | 28.79 | 25.79 | 4.16  | 10.44  | 6.48  | 28.28       | 55.35 | 36.08  | 64.93  |
| SBIN          | 5.73           | 7.12           | 21.64 | 14.92 | 15.14  | 15.91 | 28.30 | 23.00 | 28.93 | 17.07 | 16.81  | 8.42  | 36.93       | 42.36 | 28.20  | 78.62  |
| TATAPOWER     | 6.12           | 9.59           | 31.54 | 18.15 | 9.32   | 9.68  | 31.76 | 25.27 | 24.70 | 4.38  | 112.65 | 6.18  | 46.36       | 42.71 | 112.32 | 95.83  |
|               |                | <b>Option</b>  |       |       |        |       |       |       |       |       |        |       |             |       |        |        |
| Nifty         | 7.13           | 6.44           | 19.68 | 9.67  | 11.17  | 10.89 | 15.34 | 23.85 | 23.89 | 8.77  | 8.75   | 6.67  | 23.11       | 34.25 | 22.28  | 60.58  |
| ACC           | 13.24          | 7.21           | 20.01 | 8.14  | 14.18  | 21.03 | 15.26 | 21.21 | 7.10  | 8.68  | 7.22   | 7.80  | 25.69       | 45.13 | 19.43  | 82.42  |
| BHEL          | 7.38           | 6.46           | 30.57 | 9.22  | 17.03  | 11.94 | 19.54 | 15.72 | 22.39 | 3.94  | 83.20  | 9.63  | 49.84       | 52.47 | 98.57  | 106.39 |
| BPCL          | 19.55          | 19.55          | 21.36 | 16.08 | 7.39   | 8.82  | 10.63 | 9.62  | 16.65 | 10.81 | 8.63   | 33.08 | 27.13       | 9.18  | 27.36  | 38.47  |
| CIPLA         | 6.17           | 7.39           | 19.17 | 53.52 | 15.19  | 43.63 | 10.47 | 7.56  | 14.90 | 4.94  | 6.57   | 10.64 | 51.26       | 32.78 | 13.46  | 42.10  |
| HDFC          |                |                | 3.91  | 3.14  | 4.61   | 4.33  |       | 21.02 | 25.89 | 67.63 | 4.25   | 9.15  | 32.75       | 25.10 | 60.78  | 61.04  |
| ITC           | 6.22           | 5.86           | 13.48 | 8.06  | 117.91 | 9.00  | 9.08  | 9.78  | 15.25 | 23.75 | 8.07   | 12.68 | 17.25       | 85.59 | 19.21  | 70.32  |
| RANBAXY       | 7.92           | 20.46          | 21.24 | 8.48  | 45.58  | 9.44  | 8.75  | 34.24 | 36.12 | 11.84 | 9.71   | 7.82  | 21.31       | 40.78 | 33.08  | 42.35  |
| RELIANCE      | 10.72          | 9.63           | 22.92 | 10.20 | 17.85  | 19.27 | 27.05 | 28.83 | 25.82 | 4.14  | 10.68  | 6.46  | 27.99       | 55.32 | 36.29  | 66.50  |
| SBIN          | 5.78           | 6.93           | 21.67 | 14.94 | 15.12  | 15.91 | 28.03 | 22.20 | 29.06 | 17.02 | 17.09  | 8.42  | 37.40       | 41.29 | 28.02  | 79.37  |
| TATAPOWER     | 7.89           | 10.00          | 31.62 | 18.20 | 9.69   | 9.25  | 32.15 | 15.67 | 23.62 | 4.60  | 117.45 | 6.14  | 46.57       | 28.00 | 124.52 | 96.45  |

\*Of In (price)

\*\*BPCL & started in 2002. So, for this company, pre-option period is Jan-Dec 2001. For all others, it is July 2000 to June 2001.

**Table 4: Cointegration Between Futures, Option, and Spot: Using JJ (Including Linear Trend)**

| Index/Company | Periods    | Unrestricted Cointegration Rank Test (Trace) |       |           |           | Unrestricted Cointegration Rank Test (Maximum Eigenvalue) |           |           | No of Co integrating equations |
|---------------|------------|--|-------|-----------|-----------|---|-----------|-----------|--------------------------------|
|               |            | No. of CE(s)                                 | None  | At most 1 | At most 2 | None  | At most 1 | At most 2 |                                |
| Nifty         | SP1        | Eigenvalue                                   | 0.169 | 0.036     | 0.000     | 0.169   | 0.036     | 0.000     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.001     | 0.666     | 0.000   | 0.001     | 0.666     |                                |
|               | SP2        | Eigenvalue                                   | 0.042 | 0.006     | 0.001     | 0.042   | 0.006     | 0.001     | 1                              |
|               |            | Prob.**                                      | 0.000 | 0.614     | 0.243     | 0.000   | 0.700     | 0.243     |                                |
|               | SP3        | Eigenvalue                                   | 0.040 | 0.027     | 0.002     | 0.040   | 0.027     | 0.002     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.000     | 0.124     | 0.000   | 0.000     | 0.124     |                                |
| Whole Period  | Eigenvalue | 0.034  | 0.015 | 0.001     | 0.034     | 0.015   | 0.001     | 2         |                                |
|               | Prob.**    | 0.000  | 0.000 | 0.236     | 0.000     | 0.000   | 0.236     |           |                                |
| ACC           | SP1        | Eigenvalue                                   | 0.148 | 0.050     | 0.001     | 0.148   | 0.050     | 0.001     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.000     | 0.547     | 0.000   | 0.000     | 0.547     |                                |
|               | SP2        | Eigenvalue                                   | 0.229 | 0.059     | 0.003     | 0.229   | 0.059     | 0.003     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.000     | 0.171     | 0.000   | 0.000     | 0.171     |                                |
|               | SP3        | Eigenvalue                                   | 0.146 | 0.031     | 0.003     | 0.146   | 0.031     | 0.003     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.010     | 0.194     | 0.000   | 0.012     | 0.194     |                                |
| Whole Period  | Eigenvalue | 0.096  | 0.037 | 0.000     | 0.096     | 0.037   | 0.000     | 2         |                                |
|               | Prob.**    | 0.000  | 0.000 | 0.591     | 0.000     | 0.000   | 0.591     |           |                                |
| BHEL          | SP1        | Eigenvalue                                   | 0.163 | 0.088     | 0.002     | 0.163   | 0.088     | 0.002     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.000     | 0.368     | 0.000   | 0.000     | 0.368     |                                |
|               | SP2        | Eigenvalue                                   | 0.343 | 0.034     | 0.001     | 0.343   | 0.034     | 0.001     | 0                              |
|               |            | Prob.**                                      | 0.177 | 0.996     | 0.833     | 0.030   | 0.993     | 0.833     |                                |
|               | SP3        | Eigenvalue                                   | 0.134 | 0.029     | 0.000     | 0.134   | 0.029     | 0.000     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.000     | 0.516     | 0.000   | 0.000     | 0.516     |                                |
| Whole Period  | Eigenvalue | 0.118  | 0.044 | 0.002     | 0.118     | 0.044   | 0.002     | 2         |                                |
|               | Prob.**    | 0.000  | 0.000 | 0.132     | 0.000     | 0.000   | 0.132     |           |                                |
| BPCL          | SP1        | Eigenvalue                                   | 0.178 | 0.068     | 0.002     | 0.178   | 0.068     | 0.002     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.000     | 0.247     | 0.000   | 0.000     | 0.247     |                                |
|               | SP2        | Eigenvalue                                   | 0.281 | 0.039     | 0.022     | 0.281   | 0.039     | 0.022     | 1                              |
|               |            | Prob.**                                      | 0.026 | 0.796     | 0.177     | 0.006   | 0.926     | 0.177     |                                |
|               | SP3        | Eigenvalue                                   | 0.186 | 0.112     | 0.003     | 0.186   | 0.112     | 0.003     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.000     | 0.222     | 0.000   | 0.000     | 0.222     |                                |
| Whole Period  | Eigenvalue | 0.168  | 0.074 | 0.002     | 0.168     | 0.074   | 0.002     | 2         |                                |
|               | Prob.**    | 0.000  | 0.000 | 0.092     | 0.000     | 0.000   | 0.092     |           |                                |
| CIPLA         | SP1        | Eigenvalue                                   | 0.950 | 0.382     | 0.111     | 0.950   | 0.382     | 0.111     | 1                              |
|               |            | Prob.**                                      | 0.000 | 0.190     | 0.135     | 0.000   | 0.275     | 0.135     |                                |
|               | SP2        | Eigenvalue                                   | 0.178 | 0.072     | 0.007     | 0.178   | 0.072     | 0.007     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.001     | 0.127     | 0.000   | 0.001     | 0.127     |                                |
|               | SP3        | Eigenvalue                                   | 0.165 | 0.097     | 0.003     | 0.165   | 0.097     | 0.003     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.000     | 0.123     | 0.000   | 0.000     | 0.123     |                                |
| Whole Period  | Eigenvalue | 0.153  | 0.082 | 0.000     | 0.153     | 0.082   | 0.000     | 2         |                                |
|               | Prob.**    | 0.000  | 0.000 | 0.731     | 0.000     | 0.000   | 0.731     |           |                                |
| HDFC          | SP3        | Eigenvalue                                   | 0.116 | 0.034     | 0.004     | 0.116   | 0.034     | 0.004     | 2                              |
|               |            | Prob.**                                      | 0.000 | 0.000     | 0.080     | 0.000   | 0.000     | 0.080     |                                |
| Whole Period  | Eigenvalue | 0.116  | 0.034 | 0.004     | 0.116     | 0.034   | 0.004     | 2         |                                |
|               | Prob.**    | 0.000  | 0.000 | 0.080     | 0.000     | 0.000   | 0.080     |           |                                |
| ITC           | SP1        | Eigenvalue                                   | 0.163 | 0.057     | 0.007     | 0.163   | 0.057     | 0.007     | 0                              |
|               |            | Prob.**                                      | 0.768 | 0.894     | 0.495     | 0.641   | 0.894     | 0.495     |                                |
|               | SP2        | Eigenvalue                                   | 0.043 | 0.014     | 0.001     | 0.043   | 0.014     | 0.001     | 0                              |
|               |            | Prob.**                                      | 0.995 | 0.993     | 0.742     | 0.975   | 0.991     | 0.742     |                                |
|               | SP3        | Eigenvalue                                   | 0.120 | 0.029     | 0.001     | 0.120   | 0.029     | 0.001     | 1                              |
|               |            | Prob.**                                      | 0.000 | 0.194     | 0.651     | 0.000   | 0.150     | 0.651     |                                |
| Whole Period  | Eigenvalue | 0.058  | 0.023 | 0.002     | 0.058     | 0.023   | 0.002     | 1         |                                |
|               | Prob.**    | 0.000  | 0.065 | 0.324     | 0.000     | 0.060   | 0.324     |           |                                |

|              |            |            |       |       |       |       |       |       |   |
|--------------|------------|------------|-------|-------|-------|-------|-------|-------|---|
| Ranbaxy      | SP1        | Eigenvalue | 0.175 | 0.064 | 0.003 | 0.175 | 0.064 | 0.003 | 2 |
|              |            | Prob.**    | 0.000 | 0.000 | 0.226 | 0.000 | 0.000 | 0.226 |   |
|              | SP2        | Eigenvalue | 0.125 | 0.045 | 0.003 | 0.125 | 0.045 | 0.003 | 2 |
|              |            | Prob.**    | 0.000 | 0.006 | 0.270 | 0.000 | 0.005 | 0.270 |   |
|              | SP3        | Eigenvalue | 0.097 | 0.024 | 0.000 | 0.097 | 0.024 | 0.000 | 2 |
|              |            | Prob.**    | 0.000 | 0.001 | 0.525 | 0.000 | 0.001 | 0.525 |   |
| Whole Period | Eigenvalue | 0.096      | 0.025 | 0.000 | 0.096 | 0.025 | 0.000 | 2     |   |
|              | Prob.**    | 0.000      | 0.000 | 0.476 | 0.000 | 0.000 | 0.476 |       |   |
| Reliance     | SP1        | Eigenvalue | 0.120 | 0.035 | 0.000 | 0.120 | 0.035 | 0.000 | 2 |
|              |            | Prob.**    | 0.000 | 0.001 | 0.629 | 0.000 | 0.001 | 0.629 |   |
|              | SP2        | Eigenvalue | 0.132 | 0.061 | 0.000 | 0.132 | 0.061 | 0.000 | 2 |
|              |            | Prob.**    | 0.000 | 0.000 | 0.686 | 0.000 | 0.000 | 0.686 |   |
|              | SP3        | Eigenvalue | 0.079 | 0.021 | 0.004 | 0.079 | 0.021 | 0.004 | 3 |
|              |            | Prob.**    | 0.000 | 0.000 | 0.024 | 0.000 | 0.001 | 0.024 |   |
| Whole Period | Eigenvalue | 0.055      | 0.022 | 0.001 | 0.055 | 0.022 | 0.001 | 2     |   |
|              | Prob.**    | 0.000      | 0.000 | 0.113 | 0.000 | 0.000 | 0.113 |       |   |
| SBI          | SP1        | Eigenvalue | 0.142 | 0.060 | 0.000 | 0.142 | 0.060 | 0.000 | 2 |
|              |            | Prob.**    | 0.000 | 0.000 | 0.605 | 0.000 | 0.000 | 0.605 |   |
|              | SP2        | Eigenvalue | 0.132 | 0.036 | 0.003 | 0.132 | 0.036 | 0.003 | 2 |
|              |            | Prob.**    | 0.000 | 0.000 | 0.117 | 0.000 | 0.000 | 0.117 |   |
|              | SP3        | Eigenvalue | 0.102 | 0.027 | 0.003 | 0.102 | 0.027 | 0.003 | 2 |
|              |            | Prob.**    | 0.000 | 0.000 | 0.078 | 0.000 | 0.000 | 0.078 |   |
| Whole Period | Eigenvalue | 0.060      | 0.034 | 0.001 | 0.060 | 0.034 | 0.001 | 2     |   |
|              | Prob.**    | 0.000      | 0.000 | 0.223 | 0.000 | 0.000 | 0.223 |       |   |
| Tata Power   | SP1        | Eigenvalue | 0.109 | 0.080 | 0.000 | 0.109 | 0.080 | 0.000 | 2 |
|              |            | Prob.**    | 0.000 | 0.000 | 0.591 | 0.000 | 0.000 | 0.591 |   |
|              | SP2        | Eigenvalue | 0.110 | 0.016 | 0.006 | 0.110 | 0.016 | 0.006 | 0 |
|              |            | Prob.**    | 0.216 | 0.918 | 0.312 | 0.075 | 0.960 | 0.312 |   |
|              | SP3        | Eigenvalue | 0.122 | 0.061 | 0.002 | 0.122 | 0.061 | 0.002 | 2 |
|              |            | Prob.**    | 0.000 | 0.000 | 0.337 | 0.000 | 0.000 | 0.337 |   |
| Whole Period | Eigenvalue | 0.069      | 0.057 | 0.002 | 0.069 | 0.057 | 0.002 | 2     |   |
|              | Prob.**    | 0.000      | 0.000 | 0.127 | 0.000 | 0.000 | 0.127 |       |   |

\*\*MacKinnon-Haug-Michelis (1999) p-values

Table-5: Causality Analysis: Sub-Periods\*

| Index/Company | SP-1  |             |       |           | SP-2  |             |       |           | SP-3 |             |        |           |       |
|---------------|-------|-------------|-------|-----------|-------|-------------|-------|-----------|------|-------------|--------|-----------|-------|
|               | Obs   | F-Statistic | Prob. | Causality | Obs   | F-Statistic | Prob. | Causality | Obs  | F-Statistic | Prob.  | Causality |       |
| NIFTY         | O → F | 3.960       | 0.020 | O → F     | O → F | 3.116       | 0.045 | O → F     | F    | 1163        | 0.300  | O → F     |       |
|               | F → O | 124.622     | 0.000 | S → F     | F → O | 74.818      | 0.000 | S → F     | O    | 1163        | 0.741  | O → F     |       |
|               | S → F | 7.138       | 0.001 | S → F     | F → O | 1.389       | 0.250 | S → F     | F    | 1163        | 0.241  | S → F     |       |
|               | F → S | 1.856       | 0.157 | S → O     | F → O | 0.217       | 0.805 | S → O     | F    | 1163        | 0.877  | S → O     |       |
|               | O → S | 144.608     | 0.000 | S → O     | O → S | 71.514      | 0.000 | S → O     | S    | 1163        | 0.000  | S → O     |       |
| ACC           | O → F | 4.819       | 0.008 | O → F     | O → F | 2.591       | 0.076 | O → F     | O    | 635         | 0.144  | O → F     |       |
|               | F → O | 0.158       | 0.854 | O → F     | F → O | 0.327       | 0.721 | O → F     | F    | 635         | 0.909  | O → F     |       |
|               | S → F | 5.242       | 0.006 | S → F     | F → O | 19.541      | 0.000 | S → F     | O    | 635         | 0.005  | O → F     |       |
|               | F → S | 6.352       | 0.002 | S → F     | F → O | 1.323       | 0.267 | S → F     | F    | 1163        | 7.923  | 0.000     | S → F |
|               | O → S | 13.237      | 0.000 | S → O     | F → O | 0.570       | 0.566 | S → O     | F    | 635         | 0.614  | 0.541     | S → O |
| BHEL          | O → F | 7.974       | 0.000 | O → F     | O → F | 0.537       | 0.585 | O → F     | O    | 985         | 0.857  | 0.425     | O → F |
|               | F → O | 0.752       | 0.472 | O → F     | F → O | 0.340       | 0.713 | O → F     | F    | 985         | 3.670  | 0.026     | O → F |
|               | S → F | 17.535      | 0.000 | S → F     | F → O | 8.189       | 0.001 | S → F     | F    | 1163        | 0.555  | 0.574     | S → F |
|               | F → S | 3.865       | 0.021 | S → F     | F → O | 0.810       | 0.445 | S → F     | F    | 1163        | 8.593  | 0.000     | S → F |
|               | O → S | 3.745       | 0.024 | S → O     | F → O | 1.463       | 0.232 | S → O     | F    | 985         | 1.008  | 0.365     | S → O |
| BPCL          | O → F | 31.045      | 0.000 | S → O     | O → F | 8.129       | 0.001 | S → O     | O    | 776         | 0.173  | 0.841     | O → F |
|               | F → O | 0.117       | 0.890 | O → F     | F → O | 0.215       | 0.807 | O → F     | F    | 776         | 0.591  | 0.554     | O → F |
|               | S → F | 5.846       | 0.003 | O → F     | F → O | 0.328       | 0.721 | O → F     | F    | 1163        | 4.512  | 0.011     | S → F |
|               | F → S | 33.447      | 0.000 | S → F     | F → O | 3.706       | 0.028 | S → F     | F    | 1163        | 0.655  | 0.520     | S → F |
|               | O → S | 1.289       | 0.276 | S → F     | F → O | 0.859       | 0.424 | S → F     | F    | 616         | 2.446  | 0.087     | S → O |
| CIPLA         | O → F | 17.446      | 0.000 | S → O     | O → F | 1.328       | 0.265 | S → O     | O    | 776         | 0.656  | 0.520     | O → F |
|               | F → O | 10.808      | 0.000 | S → O     | F → O | 1.744       | 0.180 | S → O     | F    | 776         | 2.717  | 0.067     | S → O |
|               | S → F | 3.330       | 0.037 | S → O     | F → O | 0.624       | 0.538 | S → O     | F    | 776         | 0.368  | 0.692     | O → F |
|               | F → S | 0.087       | 0.917 | O → F     | F → O | 0.070       | 0.933 | O → F     | F    | 776         | 0.614  | 0.541     | O → F |
|               | O → S | 0.423       | 0.660 | O → F     | F → O | 3.887       | 0.021 | O → F     | F    | 1163        | 34.336 | 0.000     | O → F |
| HDRC          | O → F | 0.539       | 0.583 | S → F     | F → O | 0.218       | 0.804 | S → F     | F    | 881         | 0.089  | 0.915     | S → F |
|               | F → O | 0.015       | 0.985 | S → F     | F → O | 2.502       | 0.083 | S → F     | F    | 881         | 3.028  | 0.049     | S → F |
|               | S → F | 0.750       | 0.482 | S → O     | F → O | 2.873       | 0.058 | S → O     | F    | 881         | 4.243  | 0.015     | S → O |
|               | F → S | 1.383       | 0.267 | S → O     | F → O | 0.150       | 0.878 | S → O     | F    | 881         | 0.250  | 0.779     | S → O |
|               | O → S | 3.149       | 0.044 | S → F     | F → O | 1.271       | 0.281 | S → F     | F    | 531         | 5.009  | 0.007     | O → F |
| ITC           | O → F | 3.573       | 0.031 | O → F     | O → F | 0.155       | 0.856 | O → F     | O    | 531         | 0.570  | 0.566     | O → F |
|               | F → O | 1.256       | 0.289 | S → F     | F → O | 8.463       | 0.000 | S → F     | F    | 1163        | 7.362  | 0.001     | S → F |
|               | S → F | 1.005       | 0.366 | S → F     | F → O | 0.221       | 0.801 | S → F     | F    | 531         | 0.079  | 0.925     | S → F |
|               | F → S | 0.525       | 0.592 | S → O     | F → O | 0.008       | 0.992 | S → O     | F    | 531         | 20.643 | 0.000     | S → O |
|               | O → S | 0.901       | 0.409 | S → O     | F → O | 4.364       | 0.014 | S → O     | F    | 531         | 1.356  | 0.259     | S → O |
| RANBAXY       | O → F | 0.680       | 0.507 | O → F     | O → F | 0.476       | 0.622 | O → F     | O    | 1093        | 1.994  | 0.137     | O → F |
|               | F → O | 22.091      | 0.000 | S → F     | F → O | 14.246      | 0.000 | S → F     | F    | 1093        | 27.928 | 0.000     | S → F |
|               | S → F | 0.516       | 0.597 | S → F     | F → O | 0.706       | 0.494 | S → F     | F    | 1163        | 0.731  | 0.482     | S → F |
|               | F → S | 0.714       | 0.490 | S → O     | F → O | 0.145       | 0.865 | S → O     | F    | 1093        | 0.207  | 0.813     | S → O |
|               | O → S | 18.610      | 0.000 | S → O     | F → O | 11.122      | 0.000 | S → O     | F    | 1093        | 58.818 | 0.000     | S → O |
| RELIANCE      | O → F | 0.282       | 0.755 | O → F     | O → F | 0.794       | 0.453 | O → F     | O    | 1150        | 1.933  | 0.145     | O → F |
|               | F → O | 1.800       | 0.166 | O → F     | F → O | 0.419       | 0.658 | O → F     | F    | 1150        | 0.697  | 0.498     | O → F |
|               | S → F | 5.706       | 0.004 | S → F     | F → O | 4.069       | 0.017 | S → F     | F    | 1163        | 1.007  | 0.366     | S → F |
|               | F → S | 0.909       | 0.404 | S → O     | F → O | 0.762       | 0.467 | S → O     | F    | 1163        | 9.816  | 0.000     | S → F |
|               | O → S | 2.584       | 0.076 | S → O     | F → O | 0.364       | 0.695 | S → O     | F    | 1150        | 1.105  | 0.332     | S → O |
| SBI           | O → F | 3.377       | 0.035 | S → O     | O → F | 4.238       | 0.015 | S → O     | O    | 1147        | 12.440 | 0.000     | S → O |
|               | F → O | 0.436       | 0.647 | O → F     | F → O | 0.557       | 0.573 | O → F     | F    | 1147        | 0.858  | 0.424     | O → F |
|               | S → F | 1.920       | 0.147 | O → F     | F → O | 1.808       | 0.165 | O → F     | F    | 1147        | 7.192  | 0.001     | O → F |
|               | F → S | 3.930       | 0.020 | S → F     | F → O | 11.275      | 0.000 | S → F     | F    | 1147        | 2.982  | 0.051     | O → F |
|               | O → S | 2.317       | 0.099 | S → F     | F → O | 1.627       | 0.197 | S → F     | F    | 1163        | 35.143 | 0.000     | S → F |
| TATAPOWER     | O → F | 3.922       | 0.020 | S → O     | O → F | 0.836       | 0.434 | O → F     | O    | 1147        | 36.410 | 0.000     | S → O |
|               | F → O | 3.607       | 0.028 | S → O     | F → O | 12.599      | 0.000 | S → O     | F    | 1147        | 2.000  | 0.156     | S → O |
|               | S → F | 1.631       | 0.196 | O → F     | F → O | 1.958       | 0.142 | O → F     | F    | 493         | 2.024  | 0.133     | O → F |
|               | F → S | 0.143       | 0.867 | O → F     | F → O | 1.184       | 0.308 | O → F     | F    | 493         | 2.027  | 0.133     | O → F |
|               | O → S | 22.744      | 0.000 | O → F     | F → O | 11.477      | 0.000 | O → F     | F    | 1163        | 1.730  | 0.178     | S → F |

**Table-6: Overall Causality Directions: Sub-Periods\***

|                             | <u>SP-1</u> | <u>SP-2</u> | <u>SP-3</u> |    |
|-----------------------------|-------------|-------------|-------------|----|
| <b>Panel-A</b>              |             |             |             |    |
| O                           | →           | 0           | 0           | 4  |
| F                           | →           | 7           | 9           | 5  |
| F                           | ↑           | 9           | 9           | 11 |
| S                           | →           | 4           | 0           | 6  |
| F                           | →           | 5           | 3           | 3  |
| F                           | ↑           | 11          | 17          | 11 |
| S                           | →           | 6           | 8           | 9  |
| O                           | →           | 2           | 0           | 1  |
| O                           | ↑           | 10          | 10          | 10 |
| Missing Data                |             | 4           | 4           | 0  |
| TOTAL                       | 60          | 60          | 60          | 60 |
| <b>Panel-B</b>              |             |             |             |    |
| O → F                       | 1           | 0           | 0           | 2  |
| O ← F                       | 6           | 9           | 9           | 3  |
| O ↔ F                       | 1           | 0           | 0           | 2  |
| O ↑ F                       | 1           | 0           | 0           | 3  |
| S → F                       | 1           | 0           | 0           | 6  |
| S ← F                       | 2           | 3           | 3           | 3  |
| S ↔ F                       | 3           | 0           | 0           | 0  |
| S ↑ F                       | 4           | 7           | 7           | 1  |
| S → O                       | 5           | 8           | 8           | 8  |
| S ← O                       | 1           | 0           | 0           | 0  |
| S ↔ O                       | 1           | 0           | 0           | 1  |
| S ↓ O                       | 2           | 1           | 1           | 1  |
| Missing Contracts           | 2           | 2           | 2           | 0  |
| TOTAL                       | 30          | 30          | 30          | 30 |
| <b>Panel-C</b>              |             |             |             |    |
| S causes F or O             | 10          | 8           | 8           | 15 |
| F causes S or O             | 12          | 12          | 12          | 8  |
| O causes S or F             | 4           | 0           | 0           | 5  |
| No causality                | 30          | 36          | 36          | 32 |
| Missing Data                | 4           | 4           | 4           | 0  |
| TOTAL                       | 60          | 60          | 60          | 60 |
| <b>Panel-D</b>              |             |             |             |    |
| Only S causes F or O        | 6           | 8           | 8           | 14 |
| Only F causes S or O        | 8           | 12          | 12          | 6  |
| Only O causes S or F        | 2           | 0           | 0           | 2  |
| S bidirectional with F & O  | 4           | 4           | 4           | 1  |
| F bidirectional with S & O  | 4           | 0           | 0           | 2  |
| O bidirectional with S & F  | 2           | 0           | 0           | 3  |
| F, S, and O are Independent | 7           | 8           | 8           | 5  |
| SUBTOTAL                    | 28          | 28          | 28          | 30 |
| Missing No of Contracts     | 2           | 2           | 2           | 0  |
| TOTAL No of Contracts       | 30          | 30          | 30          | 30 |

\* Symbol Meaning

- Causes
- ← Is caused by
- ↔ Bidirectional Causality
- ↑ Are independent

**Table-7: Causality Analysis, Directions, and Dominance: Full-Period\***

| Panel-A | SPI+SP2+SP3   |   |  | Whole Period                   |                         |     |             |         |           |                       |                                      |
|---------|---------------|---|--|--------------------------------|-------------------------|-----|-------------|---------|-----------|-----------------------|--------------------------------------|
|         | Index/Company | Relative Relationship                         | Overall Observation  | Dominance                      | Causes( $\rightarrow$ ) | Obs | F-Statistic | Prob.   | Causality | Dominance             |                                      |
| NIFTY   |               | F shows increasing dominance over O over time | PD stopped in O but continued in S & F, but they became independent                      | Dominance of S and F increased | O                       | F   | 2788        | 0.011   | 0.989     | O $\leftarrow$ F      | S dominates F & O, and F dominates O |
|         |               |   |  |                                | F                       | O   |             | 250.267 | 0.000     |                       |                                      |
|         |               |   |  |                                | S                       | F   | 2788        | 6.109   | 0.002     | S $\rightarrow$ F     |                                      |
|         |               |   |  |                                | F                       | S   |             | 0.298   | 0.742     |                       |                                      |
|         |               |   |  |                                | S                       | O   | 2870        | 263.602 | 0.000     | S $\rightarrow$ O     |                                      |
|         |               |   |  |                                | O                       | S   |             | 0.138   | 0.871     |                       |                                      |
| ACC     |               | F shows decreasing dominance over O over time | S started feeding O instead of the reverse, O started feeding F, but F stopped feeding S | Dominance of S increased       | O                       | F   | 1959        | 2.827   | 0.059     | O $\leftrightarrow$ F | All bidirectional causality          |
|         |               |   |  |                                | F                       | O   |             | 24.183  | 0.000     |                       |                                      |
|         |               |   |  |                                | S                       | F   | 2788        | 3.215   | 0.040     | S $\leftrightarrow$ F |                                      |
|         |               |   |  |                                | F                       | S   |             | 5.117   | 0.006     |                       |                                      |
|         |               |   |  |                                | S                       | O   | 2041        | 23.257  | 0.000     | S $\leftrightarrow$ O |                                      |
|         |               |   |  |                                | O                       | S   |             | 5.245   | 0.005     |                       |                                      |
| BHEL    |               | F shows decreasing dominance over O over time | O started feeding S, S continued feeding F, and O started feeding F                      | Dominance of O increased       | O                       | F   | 1543        | 3.665   | 0.026     | O $\leftrightarrow$ F | All bidirectional causality          |
|         |               |   |  |                                | F                       | O   |             | 4.331   | 0.013     |                       |                                      |
|         |               |   |  |                                | S                       | F   | 2788        | 13.535  | 0.000     | S $\rightarrow$ F     |                                      |
|         |               |   |  |                                | F                       | S   |             | 0.508   | 0.602     |                       |                                      |
|         |               |   |  |                                | S                       | O   | 1560        | 16.452  | 0.000     | S $\leftrightarrow$ O |                                      |
|         |               |   |  |                                | O                       | S   |             | 2.951   | 0.053     |                       |                                      |
| BPCL    |               | F shows increasing dominance over O over time | O stopped feeding S and F  | Dominance of O decreased       | O                       | F   | 1293        | 0.719   | 0.488     | O $\leftarrow$ F      | All bidirectional causality          |
|         |               |   |  |                                | F                       | O   |             | 32.585  | 0.000     |                       |                                      |

|       |  |   |     |        |        |       |       |  |
|-------|--|---|-----|--------|--------|-------|-------|--|
| CIPLA | F shows increasing dominance over S over time      | S | F   | 2746   | 1.051  | 0.350 | S ← F |  |
|       | S shows increasing dominance over O over time      | F | S   |        | 17.141 | 0.000 |       |  |
|       |  | S | O   | 1293   | 13.480 | 0.000 | S ↔ O |  |
|       |  | O | S   |        | 3.969  | 0.019 |       |  |
| HDFC  | F and S started feeding O, and F started feeding S | O | F   | 1175   | 0.051  | 0.951 | O ← F | S & F are independent but dominate O                           |
|       | F shows increasing dominance over S over time      | F | O   |        | 18.767 | 0.000 |       |  |
|       |  | S | F   | 2788   | 0.474  | 0.623 | S ↓ F |  |
|       | S shows increasing dominance over O over time      | F | S   |        | 1.835  | 0.160 |       |  |
|       |  | S | O   | 1180   | 14.653 | 0.000 | S → O |  |
| ITC   | O and F became more independent over time          | O | F   | 881    | 0.614  | 0.541 | O ↑ F | O & F are independent but dominated by S                       |
|       | S shows increasing dominance over F over time      | F | O   |        | 0.821  | 0.440 |       |  |
|       |  | S | F   | 2788   | 7.117  | 0.001 | S → F |  |
|       | S shows increasing dominance over O over time      | F | S   |        | 0.046  | 0.955 |       |  |
|       |  | S | O   | 881    | 4.243  | 0.015 | S → O |  |
| ITC   | F shows decreasing dominance over O over time      | O | S   |        | 0.250  | 0.779 |       | S dominates O but is independent of F; F & O affect each other |
|       | S started feeding F, O, and O continued feeding F  | O | F   | 914    | 4.335  | 0.013 | O ↔ F |  |
|       | S shows increasing dominance over F over time      | F | O   |        | 5.645  | 0.004 |       |  |
|       |  | S | F   | 2788   | 2.249  | 0.106 | S ↓ F |  |
|       | S shows increasing dominance over O over time      | F | S   |        | 0.017  | 0.984 |       |  |
|       | S  | O | 936 | 15.293 | 0.000  | S → O |       |  |
|       | O  | S |     | 1.007  | 0.366  |       |       |  |

|           |   |   |  |   |   |      |        |       |       |   |
|-----------|---|---|--|---|---|------|--------|-------|-------|---|
| RANBAXY   | F shows decreasing dominance over O over time | PD Continued in S & F, but they remained independent            | Dominance of S and F continued                 | O | F | 2181 | 2.236  | 0.107 | O ← F | S & F are independent but dominate O            |
|           | S and F became more independent over time     |   |  | F | O |      | 57.166 | 0.000 |       |   |
|           | S shows increasing dominance over O over time |   |  | S | F | 2788 | 0.728  | 0.483 | S ↑ F |   |
|           |   |   |  | F | S |      | 0.285  | 0.752 |       |   |
|           |   |   |  | S | O | 2250 | 87.594 | 0.000 | S → O |   |
|           |   |   |  | O | S |      | 1.166  | 0.312 |       |   |
| RELIANCE  | O and F became more independent over time     | PD Continued in S, but stopped in F                             | Dominance of S increased but F decreased       | O | F | 2775 | 0.403  | 0.668 | O ← F | S dominates F & O, and F dominates O            |
|           | S shows increasing dominance over F over time |   |  | F | O |      | 5.916  | 0.003 |       |   |
|           | S shows increasing dominance over O over time |   |  | S | F | 2788 | 12.216 | 0.000 | S → F |   |
|           |   |   |  | F | S |      | 2.138  | 0.118 |       |   |
|           |   |   |  | S | O | 2857 | 22.787 | 0.000 | S → O |   |
|           |   |   |  | O | S |      | 1.048  | 0.351 |       |   |
| SBI       | F shows decreasing dominance over O over time | PD Continued in S, and started in O                             | Dominance of S and O increased but F decreased | O | F | 2693 | 5.146  | 0.006 | O ↔ F | S dominates F & O, and F and O cause each other |
|           | S shows increasing dominance over F over time |   |  | F | O |      | 12.282 | 0.000 |       |   |
|           |   |   |  | S | F | 2788 | 36.410 | 0.000 | S → F |   |
|           | S shows increasing dominance over O over time |   |  | F | S |      | 1.770  | 0.170 |       |   |
|           |   |   |  | S | O | 2698 | 51.913 | 0.000 | S → O |   |
|           |   |   |  | O | S |      | 0.879  | 0.415 |       |   |
| TATAPOWER | O and F became more independent over time     | Dominance of S and F over O reduced, but F started dominating S | Dominance of S reduced                         | O | F | 1316 | 1.905  | 0.149 | O ← F | F dominates S & O, and S dominates O            |
|           | F shows increasing dominance over S over time |   |  | F | O |      | 4.846  | 0.008 |       |   |
|           |   |   |  | S | F | 2788 | 0.334  | 0.716 | S ← F |   |
|           | S and O became more independent over time     |   |  | F | S |      | 2.786  | 0.062 |       |   |
|           |   |   |  | S | O | 1325 | 2.730  | 0.066 | S → O |   |
|           |   |   |  | O | S |      |        |       |       |   |



|       |    |              |    |
|-------|----|--------------|----|
| TOTAL | 30 | Independence | 4  |
|       |    | TOTAL        | 30 |

**Panel-F**

Dominance of Option Continued  
 Dominance of Option Increased  
 Dominance of Option Decreased  
 Dominance of Futures Continued  
 Dominance of Futures Increased  
 Dominance of Futures Decreased  
 Dominance of Spot Continued  
**Dominance of Spot Increased**  
 Dominance of Spot Decreased

\* Symbols Used

→  
 ←  
 ↔  
 ↑

**TABLE-8: VAR Analysis**

| Index/Company | Full Period |            |            |            |            |            | SP-1       |            |            | SP-2      |            |            | SP-3       |            |            |            |      |
|---------------|-------------|------------|------------|------------|------------|------------|------------|------------|------------|-----------|------------|------------|------------|------------|------------|------------|------|
|               | Futures     |            | Option     |            | Spot       | Futures    | Option     |            | Spot       | Futures   | Option     |            | Spot       | Futures    | Option     |            | Spot |
|               |             |            |            |            |            |            |            |            |            |           |            |            |            |            |            |            |      |
| Nifty         | F(-1)       | -0.381578* | 0.252578   | 0.031908   | -0.40049*  | 0.170985   | -0.082881  | -0.339652* | 0.647417*  | 0.115687  | -0.130056  | 0.054314   | 0.322049   | -0.130056  | 0.054314   | 0.322049   |      |
|               | F(-2)       | -0.238365* | 0.027891   | -0.059677  | -0.431827* | -0.201677  | -0.212799  | -0.125147  | 0.136513   | 0.038878  | -0.126046  | 0.227405   | 0.044581   | -0.126046  | 0.227405   | 0.044581   |      |
|               | O(-1)       | -0.000687  | -0.604498* | -0.000205  | -0.196455* | -0.79754*  | -0.169732* | 0.066025*  | -0.498555* | 0.058120* | -0.015601  | -0.632274* | -0.012825  | -0.015601  | -0.632274* | -0.012825  |      |
|               | O(-2)       | -0.002151  | -0.289498* | -0.005071  | -0.05305   | -0.292087* | -0.079815  | 0.008678   | -0.211815* | 0.004274  | -0.001753  | -0.32781*  | -0.00202   | -0.001753  | -0.32781*  | -0.00202   |      |
|               | S(-1)       | 0.427240*  | 0.466578*  | 0.032684   | 0.631231*  | 0.808943*  | 0.317877*  | 0.306368   | 0.021667   | -0.120209 | 0.179989   | 0.607981   | -0.263249  | 0.179989   | 0.607981   | -0.263249  |      |
|               | S(-2)       | 0.199751*  | 0.303339*  | 0.024109   | 0.388080*  | 0.470584*  | 0.182163   | 0.106396   | 0.150954   | -0.051276 | 0.100993   | 0.153032   | -0.065896  | 0.100993   | 0.153032   | -0.065896  |      |
|               | C           | 0.000603   | 0.000515   | 0.000587   | 0.000682   | 0.000528   | 0.000673   | 0.001072*  | 0.000516   | 0.001046* | 0.000206   | 0.000473   | 0.000188   | 0.000206   | 0.000473   | 0.000188   |      |
|               |             |            |            |            |            |            |            |            |            |           |            |            |            |            |            |            |      |
| ACC           | F(-1)       | -0.2389*   | 0.253069*  | 0.217640*  | 0.622284*  | 1.126477*  | 1.000626*  | -0.140843  | 0.577811*  | 0.170729  | -0.554621* | -0.112107  | -0.039613  | -0.554621* | -0.112107  | -0.039613  |      |
|               | F(-2)       | -0.178861* | 0.161837   | 0.037890   | -0.050793  | 0.147419   | 0.119828   | -0.337012  | 0.186804   | -0.185197 | -0.096233  | 0.190510   | 0.181508   | -0.096233  | 0.190510   | 0.181508   |      |
|               | O(-1)       | 0.126336*  | -0.417154* | 0.078436   | 0.131088   | -0.470432* | 0.072781   | 0.075588   | -0.513639* | 0.067670  | 0.124811   | -0.343544* | 0.065451   | 0.124811   | -0.343544* | 0.065451   |      |
|               | O(-2)       | 0.019431   | -0.380201* | -0.002144  | 0.026768   | -0.245268  | 0.013981   | 0.012237   | -0.465197* | 0.066520  | -0.046348  | -0.414941* | -0.175034* | -0.046348  | -0.414941* | -0.175034* |      |
|               | S(-1)       | 0.152594*  | 0.198427*  | -0.267461* | -0.754049* | -0.656033* | -1.071636* | 0.120547   | -0.05196   | -0.188509 | 0.482251*  | 0.546037*  | -0.011584  | 0.482251*  | 0.546037*  | -0.011584  |      |
|               | S(-2)       | 0.117305   | 0.185479*  | -0.087192  | -0.07168   | 0.016935   | -0.22357   | 0.317967   | 0.295649   | 0.108143  | 0.201974*  | 0.255145*  | 0.005619   | 0.201974*  | 0.255145*  | 0.005619   |      |
|               | C           | 0.001004   | 0.001016   | 0.001090   | 0.000683   | 0.000680   | 0.000682   | 0.001873*  | 0.001985*  | 0.001966* | 0.000395   | 0.000370   | 0.000583   | 0.000395   | 0.000370   | 0.000583   |      |
|               |             |            |            |            |            |            |            |            |            |           |            |            |            |            |            |            |      |
| BHCL          | F(-1)       | -0.703088* | -0.179744  | -0.147156  | -0.320581* | 0.154797   | -0.022303  | 0.075935   | 0.374397   | 0.791367* | -0.754778* | -0.25962   | -0.139193  | -0.754778* | -0.25962   | -0.139193  |      |
|               | F(-2)       | -0.295929* | 0.006021   | -0.05618   | -0.229101  | -0.266363  | -0.360921* | -0.997644* | -0.82311   | -0.601484 | -0.489894* | -0.110088  | -0.157429  | -0.489894* | -0.110088  | -0.157429  |      |
|               | O(-1)       | 0.019146   | -0.536192* | 0.049967   | 0.015967   | -0.630858* | 0.068039   | -0.063808  | -0.717248* | -0.067885 | -0.027344  | -0.454768* | 0.002072   | -0.027344  | -0.454768* | 0.002072   |      |
|               | O(-2)       | 0.299343*  | -0.071468  | 0.291570*  | 0.073139   | -0.264544* | 0.121541   | 0.055431   | -0.410793* | -0.013446 | 0.641553*  | 0.258106   | 0.585516*  | 0.641553*  | 0.258106   | 0.585516*  |      |
|               | S(-1)       | 0.690892*  | 0.726370*  | 0.106017   | 0.297385   | 0.490226*  | -0.038587  | 0.166992   | 0.430561   | -0.511697 | 0.788188*  | 0.724738*  | 0.144399   | 0.788188*  | 0.724738*  | 0.144399   |      |
|               | S(-2)       | 0.004747   | 0.078079   | -0.223519  | 0.164235   | 0.539435*  | 0.213405   | 0.729671*  | 1.016363*  | 0.407649  | -0.14222   | -0.135239  | -0.413288* | -0.14222   | -0.135239  | -0.413288* |      |
|               | C           | -0.001101  | -0.000914  | -0.001064  | 0.001634   | 0.002211*  | 0.001759*  | 0.002946   | 0.004441*  | 0.002993  | -0.00275   | -0.002803  | -0.00273   | -0.00275   | -0.002803  | -0.00273   |      |
|               |             |            |            |            |            |            |            |            |            |           |            |            |            |            |            |            |      |
| BPCL          | F(-1)       | 0.149265   | 0.925342*  | 0.636667*  | 0.295266*  | 1.065860*  | 0.742043*  | 0.442032   | 1.468363*  | 0.687135  | 0.448128   | 1.002644*  | 0.794098   | 0.448128   | 1.002644*  | 0.794098   |      |
|               | F(-2)       | -0.178198  | 0.178487   | 0.070927   | -0.415812* | 0.069539   | -0.135514  | 0.312715   | 0.657786   | 0.323045  | 0.733030   | 0.729809   | 0.798855   | 0.733030   | 0.729809   | 0.798855   |      |
|               | O(-1)       | -0.083922  | -0.706475* | -0.014765  | -0.299454* | -0.926694* | -0.149654  | 0.139866   | -0.45756*  | 0.147543  | 0.083534   | -0.529998* | 0.069034   | 0.083534   | -0.529998* | 0.069034   |      |
|               | O(-2)       | 0.008899   | -0.317902* | 0.027921   | 0.143380   | -0.296217* | 0.161362   | 0.048600   | -0.252678  | 0.045731  | -0.126456  | -0.309371* | -0.118122  | -0.126456  | -0.309371* | -0.118122  |      |
|               | S(-1)       | -0.065637  | -0.191222  | -0.615684* | 0.045057   | -0.074621  | -0.555046* | -0.642165  | -0.983832* | -0.894679 | -0.527687  | -0.449626  | -0.857394* | -0.527687  | -0.449626  | -0.857394* |      |
|               | S(-2)       | 0.150868   | 0.145628   | -0.104819  | 0.230576*  | 0.233416*  | -0.038186  | -0.385248  | -0.387894  | -0.421523 | -0.596955  | -0.403465  | -0.670244  | -0.596955  | -0.403465  | -0.670244  |      |
|               | C           | -0.00051   | -0.000458  | -0.00033   | -0.000498  | -0.00049   | -0.000275  | 0.001211   | 0.001517   | 0.001638  | -0.000648  | -0.000687  | -0.0006    | -0.000648  | -0.000687  | -0.0006    |      |
|               |             |            |            |            |            |            |            |            |            |           |            |            |            |            |            |            |      |
| CIPLA         | F(-1)       | 0.401087   | 0.990498*  | 0.852341*  | 0.480509   | 0.090400   | 0.051760   | 0.773485   | 1.242223   | 1.285905  | 0.053525   | 0.784918*  | 0.485089*  | 0.053525   | 0.784918*  | 0.485089*  |      |
|               | F(-2)       | 0.176692   | 0.334746   | 0.311227   | 2.608630   | 1.784877   | 2.035807   | 0.237306   | 0.293206   | 0.360816  | 0.187137   | 0.439222*  | 0.329632   | 0.187137   | 0.439222*  | 0.329632   |      |
|               | O(-1)       | -0.030462  | -0.718356* | -0.046023  | -0.222943  | -0.578287  | -0.227722  | -0.057291  | -0.727983* | -0.08618  | -0.055463  | -0.751798* | -0.050321  | -0.055463  | -0.751798* | -0.050321  |      |
|               | O(-2)       | 0.003780   | -0.274591* | 0.001372   | 0.794522   | 0.878231   | 0.717835   | 0.033327   | -0.245931  | 0.029321  | -0.073572  | -0.337907* | -0.073772  | -0.073572  | -0.337907* | -0.073772  |      |
|               | S(-1)       | -0.323996  | -0.232602  | -0.756266* | -0.214181  | 0.561242   | 0.252407   | -0.660782  | -0.470174  | -1.143655 | -0.035837  | -0.048386  | -0.45969*  | -0.035837  | -0.048386  | -0.45969*  |      |
|               | S(-2)       | -0.207506  | -0.071566  | -0.344991  | -2.872082  | -2.134495  | -2.211025  | -0.303455  | -0.063688  | -0.425937 | -0.138296  | -0.10538   | -0.296928  | -0.138296  | -0.10538   | -0.296928  |      |
|               | C           | 0.000112   | 4.02E-05   | 7.88E-05   | 0.005565   | 0.004407   | 0.004499   | -0.001303  | -0.001267  | -0.00123  | 0.000603   | 0.000476   | 0.000531   | 0.000603   | 0.000476   | 0.000531   |      |
|               |             |            |            |            |            |            |            |            |            |           |            |            |            |            |            |            |      |

|       |            |            |             |             |            |            |            |
|-------|------------|------------|-------------|-------------|------------|------------|------------|
| HDFC  | F(-1)      | -0.677057* | -0.165406   | -0.677057*  | -0.165406  | -0.100467  | -0.100467  |
|       | F(-2)      | -0.423512  | -0.153491   | -0.423512   | -0.153491  | -0.213972  | -0.213972  |
|       | O(-1)      | -0.032592  | -0.620933*  | -0.032592   | -0.620933* | -0.045099  | -0.045099  |
|       | O(-2)      | 0.215066   | -0.113493   | 0.215066    | -0.113493  | 0.199063   | 0.199063   |
|       | S(-1)      | 0.686201*  | 0.762133*   | 0.686201*   | 0.762133*  | 0.115192   | 0.115192   |
|       | S(-2)      | 0.215705   | 0.270228    | 0.215705    | 0.270228   | 0.015399   | 0.015399   |
|       | C          | -0.0008    | -0.000875   | -0.0008     | -0.000875  | -0.00084   | -0.00084   |
|       | F(-1)      | -0.765137* | -0.127765   | -0.226866*  | -0.226866* | -0.326303  | -0.326303  |
|       | F(-2)      | -0.320092* | 0.069514    | -0.212299   | -0.212299  | -0.936809* | -0.936809* |
|       | O(-1)      | 0.166107*  | -0.430392*  | 0.107203    | 0.107203   | 0.475539*  | 0.475539*  |
| O(-2) | 0.038440   | -0.305576* | -0.01927    | -0.01927    | 0.228667   | 0.228667   |            |
| S(-1) | 0.588519*  | 0.575746*  | 0.087986    | 0.087986    | 0.184119   | 0.184119   |            |
| S(-2) | 0.211389*  | 0.202381*  | 0.140815    | 0.140815    | 0.401609   | 0.401609   |            |
| C     | 0.000558   | 0.000216   | 0.000871    | 0.000871    | 7.15E-07   | -0.000468  |            |
| F(-1) | 0.083740   | 0.131517*  | 0.127353    | 0.127353    | 0.459695   | 1.040209*  |            |
| F(-2) | 0.058062   | 0.053861   | 0.015018    | 0.015018    | -0.314106  | 0.025843   |            |
| O(-1) | -0.1198*   | -0.736479* | -0.095539   | -0.095539   | -0.150736  | -0.913803* |            |
| O(-2) | -0.133565* | -0.347643* | -0.093113   | -0.093113   | -0.037965  | -0.522086* |            |
| S(-1) | 0.082130   | 0.659268*  | 0.025022    | 0.025022    | -0.254674  | -0.078521  |            |
| S(-2) | 0.094359   | 0.342600*  | 0.095200    | 0.095200    | 0.356477   | 0.511055   |            |
| C     | -0.0000313 | 5.24E-05   | -0.00000498 | -0.00000498 | 0.000338   | 0.000368   |            |
| F(-1) | -0.327364* | 0.189372   | 0.246759*   | 0.246759*   | 0.280127   | 0.783627*  |            |
| F(-2) | -0.24833*  | -0.039171  | -0.044394   | -0.044394   | -0.504127* | -0.214285  |            |
| O(-1) | -0.193974  | -0.761733* | -0.221959   | -0.221959   | -0.171007  | -0.682426* |            |
| O(-2) | -0.05325   | -0.304119* | -0.120098   | -0.120098   | 0.293621   | -0.007072  |            |
| S(-1) | 0.548192*  | 0.600479*  | 0.003470    | 0.003470    | -0.108455  | -0.099935  |            |
| S(-2) | 0.287550*  | 0.333655*  | 0.137700    | 0.137700    | 0.145029   | 0.162228   |            |
| C     | 0.000349   | 0.000342   | 0.000342    | 0.000342    | 0.000747   | 0.000749   |            |
| F(-1) | -0.625943* | -0.082506  | -0.154421   | -0.154421   | -0.283613  | 0.288007   |            |
| F(-2) | -0.328907* | -0.104483  | -0.163293*  | -0.163293*  | -0.883507* | -0.72308*  |            |
| O(-1) | 0.046068   | -0.546543* | 0.048865    | 0.048865    | 0.301675*  | -0.348485* |            |
| O(-2) | 0.033878   | -0.268607* | -0.005844   | -0.005844   | 0.203155   | -0.130241  |            |
| S(-1) | 0.666414*  | 0.721016*  | 0.188124*   | 0.188124*   | 0.055641   | 0.129395   |            |
| S(-2) | 0.269950*  | 0.378672*  | 0.130045    | 0.130045    | 0.570969*  | 0.792953*  |            |
| C     | 0.000760   | 0.000700   | 0.000797    | 0.000797    | 0.000975   | 0.000952   |            |
| F(-1) | 0.049144   | 0.602822   | 0.264646    | 0.264646    | 0.187040   | 0.675316*  |            |
| F(-2) | 0.923037*  | 1.224639*  | 0.942082*   | 0.942082*   | -0.001048  | 0.290788   |            |
| O(-1) | 0.142091   | -0.59059*  | 0.136012    | 0.136012    | -0.01861   | -0.621725* |            |
| O(-2) | -0.229412  | -0.502642* | -0.236564   | -0.236564   | 0.049998   | -0.191884  |            |
| S(-1) | -0.206091  | -0.014545  | -0.415592   | -0.415592   | -0.07005   | 0.093726   |            |
| S(-2) | -0.695355  | -0.717667  | -0.708273   | -0.708273   | -0.131703  | -0.174117  |            |
| C     | -0.000573  | -0.000384  | -0.000607   | -0.000607   | 0.001598*  | 0.001518   |            |
| F(-1) | -0.876449* | -0.421417* | -0.876449*  | -0.421417*  | -0.282638  | 1.007314*  |            |
| F(-2) | -0.337715* | -0.021778  | -0.337715*  | -0.021778   | 0.031342   | 0.731765*  |            |
| O(-1) | 0.196567   | -0.360736* | 0.196567    | -0.360736*  | -0.032354  | -0.768194* |            |
| O(-2) | 0.071938   | -0.276201* | 0.071938    | -0.276201*  | -0.088565  | -0.512411* |            |
| S(-1) | 0.728926*  | 0.832426*  | 0.728926*   | 0.832426*   | 0.236782   | -0.263809  |            |
| S(-2) | 0.234119*  | 0.268994*  | 0.234119*   | 0.268994*   | -0.037168  | -0.234564  |            |
| C     | 0.001135   | 0.001147   | 0.001135    | 0.001147    | -0.000363  | -0.001054  |            |
| F(-1) | 0.060421   | 0.057357   | 0.060421    | 0.057357    | 0.183410   | 0.655480*  |            |
| F(-2) | 0.076524   | 0.042587   | 0.076524    | 0.042587    | 0.175624   | 0.498755   |            |
| O(-1) | -0.190867* | -0.779027* | -0.190867*  | -0.779027*  | 0.071519   | -0.562589* |            |
| O(-2) | -0.193919* | -0.309064* | -0.193919*  | -0.309064*  | -0.058136  | -0.351252* |            |
| S(-1) | 0.182047*  | 0.797058*  | 0.182047*   | 0.797058*   | -0.223935  | -0.061214  |            |
| S(-2) | 0.140919   | 0.331292*  | 0.140919    | 0.331292*   | -0.100569  | -0.094244  |            |
| C     | -0.0000121 | 2.44E-05   | -0.0000121  | 2.44E-05    | -0.000423  | -0.000164  |            |
| F(-1) | -0.315649  | 0.164782   | -0.315649   | 0.164782    | -0.110002  | 0.465151   |            |
| F(-2) | -0.285486  | -0.028354  | -0.285486   | -0.028354   | -0.016496  | 0.075906   |            |
| O(-1) | -0.348378  | -0.869533* | -0.348378   | -0.869533*  | -0.110105  | -0.757169* |            |
| O(-2) | -0.068099  | -0.39298   | -0.068099   | -0.39298    | -0.24575   | -0.375204  |            |
| S(-1) | 0.724242*  | 0.763536*  | 0.724242*   | 0.763536*   | 0.175942   | 0.255964   |            |
| S(-2) | 0.320570*  | 0.391986*  | 0.320570*   | 0.391986*   | 0.326264   | 0.366669   |            |
| C     | -0.000847  | -0.000858  | -0.000847   | -0.000858   | 0.001594*  | 0.001573*  |            |
| F(-1) | -0.709981* | -0.139234  | -0.709981*  | -0.139234   | -0.029789  | 0.358109   |            |
| F(-2) | -0.256991* | -0.022801  | -0.256991*  | -0.022801   | 0.038138   | 0.271073   |            |
| O(-1) | 0.046466   | -0.569226* | 0.046466    | -0.569226*  | -0.269867  | -0.744211* |            |
| O(-2) | -0.073917  | -0.381361* | -0.073917   | -0.381361*  | 0.080792   | -0.176254  |            |
| S(-1) | 0.775103*  | 0.826411*  | 0.775103*   | 0.826411*   | 0.334000   | 0.435356*  |            |
| S(-2) | 0.339230*  | 0.442639*  | 0.339230*   | 0.442639*   | -0.128126  | -0.088915  |            |
| C     | 0.000418   | 0.000373   | 0.000418    | 0.000373    | 0.001158   | 0.001059   |            |
| F(-1) | 0.632587   | 1.247388   | 0.632587    | 1.247388    | -0.649888* | -0.09197   |            |
| F(-2) | 3.194609*  | 3.349441*  | 3.194609*   | 3.349441*   | -0.341836  | 0.156666   |            |
| O(-1) | 0.354709   | -0.415788  | 0.354709    | -0.415788   | 0.194891   | -0.619379* |            |
| O(-2) | -0.541348  | -0.881565* | -0.541348   | -0.881565*  | 0.214215   | 0.009375   |            |
| S(-1) | -1.004152  | -0.839559  | -1.004152   | -0.839559   | 0.377673   | 0.732541*  |            |
| S(-2) | -2.661725* | -2.469928* | -2.661725*  | -2.469928*  | 0.189961   | -0.16048   |            |
| C     | -0.003962  | -0.003757  | -0.003962   | -0.003757   | 0.000567   | 0.001198   |            |

**TABLE-9: VAR Analysis Summary**

|  | <u>Full Period</u> | <u>SP-1</u> | <u>SP-2</u> | <u>SP-3</u> |
|--|--------------------|-------------|-------------|-------------|
| Past Futures Affects Current Futures       | 7                  | 6           | 2           | 6           |
| <b>Past Futures Affects Current Option</b> | <b>5</b>           | <b>6</b>    | <b>4</b>    | <b>4</b>    |
| <b>Past Futures Affects Current Spot</b>   | <b>7</b>           | <b>7</b>    | <b>1</b>    | <b>4</b>    |
| Past Option Affects Current Futures        | 4                  | 3           | 0           | 2           |
| Past Option Affects Current Option         | 10                 | 7           | 9           | 10          |
| Past Option Affects Current Spot           | 1                  | 1           | 1           | 3           |
| <b>Past Spot Affects Current Futures</b>   | <b>6</b>           | <b>3</b>    | <b>1</b>    | <b>8</b>    |
| <b>Past Spot Affects Current Option</b>    | <b>7</b>           | <b>4</b>    | <b>4</b>    | <b>8</b>    |
| Past Spot Affects Current Spot             | 4                  | 4           | 1           | 6           |
| Past Does Not Affect Current               | 39                 | 49          | 67          | 39          |
| <b>TOTAL</b>                               | <b>90</b>          | <b>90</b>   | <b>90</b>   | <b>90</b>   |

**Table 10: Trade Value (Rupees Crore)**

| Stocks -->     | NIFTY    | ACC    | BHEL   | BPCL  | CIPLA | HDFC   | ITC    | RANBAXY | RELIANCE | SBIN   | TATAPOWER |
|----------------|----------|--------|--------|-------|-------|--------|--------|---------|----------|--------|-----------|
| <b>Spot</b>    |          |        |        |       |       |        |        |         |          |        |           |
| 2001           | 2866.73  | 27.38  | 6.23   |       | 7.04  | 2.55   | 28.28  | 33.49   | 61.54    | 5.95   | 2.28      |
| 2002           | 2487.35  | 12.88  | 9.56   | 37.86 | 4.05  | 3.63   | 20.32  | 27.58   | 91.55    | 19.55  | 3.29      |
| 2003           | 3574.34  | 40.28  | 21.49  | 39.61 | 9.65  | 9.09   | 25.19  | 55.51   | 198.16   | 136.55 | 20.54     |
| 2004           | 4626.61  | 61.69  | 39.98  | 37.04 | 12.90 | 19.91  | 36.08  | 50.35   | 349.29   | 223.19 | 64.25     |
| 2005           | 5530.37  | 40.09  | 26.95  | 17.64 | 20.14 | 34.51  | 75.61  | 57.77   | 377.14   | 193.37 | 22.48     |
| 2006           | 7664.91  | 108.48 | 84.68  | 16.97 | 49.49 | 61.52  | 105.40 | 57.96   | 519.16   | 147.71 | 19.00     |
| 2007           | 12425.63 | 80.34  | 173.93 | 18.54 | 32.18 | 121.12 | 95.95  | 44.86   | 584.03   | 224.29 | 59.91     |
| 2008           | 12961.42 | 30.89  | 257.04 | 24.38 | 25.13 | 242.91 | 111.80 | 112.59  | 869.07   | 269.71 | 82.75     |
| 2009           | 15687.37 | 42.69  | 201.39 | 34.39 | 42.42 | 229.63 | 110.47 | 60.60   | 751.73   | 422.04 | 57.76     |
| 2010           | 14513.97 | 39.06  | 128.86 | 71.50 | 44.81 | 185.34 | 105.17 | 57.06   | 493.09   | 454.36 | 44.64     |
| 2011           | 11187.36 | 29.03  | 130.07 | 33.34 | 38.97 | 173.17 | 138.96 | 38.62   | 392.34   | 545.55 | 33.91     |
| 2012           | 11193.03 | 44.31  | 121.32 | 34.58 | 53.57 | 254.72 | 155.54 | 39.31   | 271.76   | 557.25 | 36.71     |
| <b>Futures</b> |          |        |        |       |       |        |        |         |          |        |           |
| 2001           | 41.04    | 8.01   | 1.38   |       | 0.35  | 0.07   | 2.94   | 5.49    | 8.35     | 1.13   | 0.89      |
| 2002           | 45.82    | 6.67   | 5.02   | 20.43 | 0.78  | 0.19   | 5.62   | 10.84   | 28.39    | 10.07  | 2.82      |
| 2003           | 384.83   | 43.03  | 24.48  | 28.33 | 6.59  | 2.17   | 13.98  | 60.68   | 107.16   | 126.04 | 33.49     |
| 2004           | 1063.10  | 89.00  | 35.67  | 25.58 | 12.33 | 7.37   | 24.13  | 46.37   | 245.49   | 191.97 | 75.95     |
| 2005           | 1625.24  | 76.49  | 35.58  | 15.70 | 24.81 | 14.37  | 49.82  | 43.46   | 348.51   | 268.11 | 31.63     |
| 2006           | 3085.34  | 190.48 | 118.16 | 18.12 | 65.83 | 27.27  | 79.85  | 45.77   | 538.65   | 285.18 | 33.98     |
| 2007           | 4468.63  | 117.94 | 128.35 | 22.44 | 31.95 | 42.90  | 61.20  | 53.25   | 599.98   | 388.04 | 53.10     |
| 2008           | 5178.75  | 22.38  | 94.67  | 16.11 | 17.38 | 67.50  | 59.18  | 84.61   | 506.18   | 244.54 | 43.63     |
| 2009           | 4574.59  | 39.41  | 119.02 | 25.73 | 30.92 | 99.66  | 62.16  | 41.70   | 431.34   | 262.37 | 35.98     |
| 2010           | 4620.88  | 43.34  | 92.17  | 68.47 | 43.12 | 96.84  | 64.97  | 49.62   | 284.36   | 305.01 | 31.39     |
| 2011           | 4420.70  | 26.40  | 76.10  | 0.00  | 0.00  | 88.68  | 75.14  | 0.00    | 204.62   | 337.01 | 0.00      |
| 2012           | 2830.23  | 34.12  | 83.91  | 28.16 | 37.80 | 97.68  | 72.95  | 36.74   | 135.37   | 378.13 | 22.61     |
| <b>Option</b>  |          |        |        |       |       |        |        |         |          |        |           |
| 2001           | 1.83     | 0.63   | 0.15   |       | 0.07  | 0.02   | 0.17   | 0.52    | 0.61     | 0.12   | 0.13      |
| 2002           | 2.42     | 0.50   | 0.30   | 1.11  | 0.07  | 0.03   | 0.28   | 0.49    | 1.46     | 0.71   | 0.24      |
| 2003           | 7.35     | 1.06   | 0.57   | 0.92  | 0.10  | 0.16   | 0.38   | 1.18    | 2.80     | 3.96   | 0.83      |
| 2004           | 14.62    | 1.52   | 0.35   | 0.28  | 0.38  | 0.57   | 0.37   | 0.69    | 3.33     | 2.06   | 0.93      |
| 2005           | 35.74    | 1.60   | 0.17   | 0.14  | 0.37  | 0.20   | 0.69   | 0.29    | 5.79     | 3.44   | 0.31      |
| 2006           | 80.99    | 1.10   | 0.37   | 0.22  | 0.57  | 0.63   | 1.11   | 0.43    | 8.13     | 3.47   | 0.37      |
| 2007           | 138.21   | 0.47   | 0.24   | 0.17  | 0.41  | 0.19   | 1.16   | 0.51    | 8.64     | 3.69   | 0.14      |
| 2008           | 204.48   | 0.09   | 0.69   | 0.11  | 0.14  | 1.05   | 0.59   | 2.20    | 5.23     | 1.15   | 0.60      |
| 2009           | 351.83   | 0.20   | 0.88   | 0.19  | 0.38  | 0.58   | 0.90   | 0.58    | 8.36     | 2.45   | 0.48      |
| 2010           | 792.59   | 0.30   | 1.14   | 1.44  | 0.95  | 0.86   | 1.59   | 1.08    | 11.40    | 9.00   | 0.21      |
| 2011           | 996.55   | 0.26   | 1.45   | 0.50  | 0.56  | 1.65   | 3.21   | 0.82    | 8.21     | 12.43  | 0.16      |
| 2012           | 932.42   | 1.21   | 3.56   | 0.76  | 1.99  | 3.58   | 3.99   | 1.67    | 11.52    | 28.86  | 0.62      |





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