How Do Small Investors Impact Derivative Markets?: Evidence From A Policy Experiment

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Abstract

Using the policy of rule based determination of equity derivative lot sizes in India as an economic setting, we examine the impact of entry of small investors into derivatives markets. We find that the entry of small investors leads to increased stock valuation both in spot as well as derivative markets. Measures of price efficiency as well liquidity improve significantly. Contrary to the perception of regulators world over, we do not detect significant increase in volatility. Our results suggest that the entry of small investors impacts the equity spot and derivative markets positively.

1 Introduction

Regulators all over the world, time and again, have expressed concern regarding participation of unsophisticated small investors, either directly or through unconventional funds, in derivative markets. For example, Securities and Exchange Commission in its public statement on pro-active regulation of derivatives issued on December 11^{th}, 2015 stated that the "retail investors might find it challenging and difficult to comprehend and appropriately weigh the trade-offs posed by sophisticated and complex investment strategies.[1] The South Korean market regulator-Financial Services Commission- recently tightened qualification criteria for participation in derivative markets. One of the key officials said that the purpose of these regulations was to "prevent retail investors from making reckless investments and incurring huge losses." [2] The qualification criteria included a compulsory education program and a high initial margin.[3] Indian market regulator- Securities Exchange Board of India(SEBI hereafter)-echoing a similar view, recently more than doubled the minimum lot size applicable to equity derivatives.[4] A common theme underlying all the above regulatory actions is that small investors are not sophisticated enough to understand the working of derivatives markets, and hence by indulging in "reckless noise trading" in derivatives such investors not only lose money but also damage market fundamentals by increasing volatility and reducing informativeness of prices.[5]

Despite there being a high level of regulatory and practitioner interest on the issue of the impact of small investors on derivatives market, surprisingly, to the best of our knowledge, very little academic work has been done on the subject. Much of the focus has been on the role played by small investors in the spot markets (Merton (1987), Amihud et al. (1999), Hauser and Lauterbach (2003), Ahn et al. (2014)). While some scholars view such participation positively from the point of view of market fundamentals (Black (1986), Amihud

[1] Source: https://www.sec.gov/news/statement/protecting-investors-through-proactive-regulation-derivatives.html

[2] Source:https://secure.fia.org/files/css/magazineArticles/article-1637.pdf

[3] The margin stipulated was 30 million Korean won, which worked out to be USD 29,000

[4] Source: SEBI website

[5] Stiglitz (1989) argue that noise traders may even reduce liquidity by discouraging participation of informed investors.

et al. (1999)), others show that such trading harms market efficiency and increases volatility (Stambaugh (2014), De Long et al. (1990a,b), DeLong et al. (1988)) . However, findings from the above studies cannot be straightaway applied to derivatives as, by design, derivative contracts have some peculiar features that are not present in the spot markets. For example; most derivatives work on margin, have specific expiry dates and are amenable to complex strategies. Therefore, it is interesting to examine the impact of participation of small investors on derivatives markets.

As in most empirical studies, identification remains a key challenge here. Studies that examine the impact on spot markets either use stock splits (Lamoureux and Poon (1987)) or definition or redefinition of minimum trading units (Amihud et al. (1999), Hauser and Lauterbach (2003)) to identify exogenous entry or exit of small investors. However, in most cases, event under consideration is either a result of a plausibly endogenous corporate action or is applicable to the entire market, and hence, it is difficult to disentangle the impact caused by small investors. An appropriate economic setting for studying the question under consideration is one where arbitrarily defined limits govern the entry of small investors and such entry or exit happens a number of times. The rules governing equity derivative lot sizes introduced in India in the year 2010 provide such a setting.

On 8^{th} January 2010, SEBI issued new rules for determination of trading lots for equity derivatives in India. Hitherto, trading lot size was determined by the respective exchanges. The main purpose of the regulation was to keep the minimum contract value of a single derivative contract close to Rupees 400,000 [6]. The manner in which the rule was implemented greatly facilitates identification. First for all stocks with prices between 0 and 50, the applicable lot size was determined to be 8000. Similarly for stocks with prices between 50 and 100, 100 and 200, 200 and 400, 400 and 800, and 800 and 1600 the lot size was determined to be 4000, 2000, 1000, 500 and 250 respectively. Finally, for stocks with price above 1600, the lot size was determined to be 125. SEBI, also specified that the lot sizes should be reviewed once in six months during March and September and lot size should be

[6] Approximately USD8000 at the then prevailing exchange rate

adjusted based on average price in those two months. The minimum lot size of those stocks whose average price calculated as per rules cross the threshold limit from below are required to be cut by 50%. In case the threshold is breached from above, the lot size is doubled. While the downward revision is carried on immediately, the upward revision is done with a lag of three months.

An example would make the point clear. Suppose there are four stocks whose prices were 199, 399, 799 and 1599 at the time of the implementation of the SEBI rule. The stocks would have a lot size of 2000, 1000, 500 and 250 respectively. At the end of nearest six months, the exchange calculates the average price. Suppose the average price works out to be more than the nearest threshold, which is one rupee more than the price mentioned above. The lot size will be immediately revised to 1000, 500, 250 and 125 respectively. Similarly, when a stock crosses the threshold from above, the lot size is doubled.

In this paper, we focus exclusively on splits as lot size splits are implemented immediately starting from the first derivative settlement date after either March 31^st or September 30^th as the case may be. However, in case of lot size consolidation, the change is implemented with a lag of three months. Changes announced in March are implemented starting from July contract and changes announced in September are implemented starting from January contract. This creates a situation where at the end of April (and October), while near and mid month contracts trade at the old lot size, the far month contract trades at the new increased lot size. Therefore, it is very difficult to ascertain when and from which contract, small investors exit. Therefore, we do not consider such cases.

The identifying assumption we make is that an average stock that barely crosses any of the six thresholds from below is unlikely to be systematically different on unobservable characteristics when compared to an average stock that comes close to the threshold but fails to cross the same. Note that there are six thresholds and eight revisions in our setting. We cannot think of a confounding factor that systematically varies between stocks that are close to each other in terms of price but fall on the opposite sides of the threshold. The setting, therefore, lends itself nicely for regression discontinuity (RD henceforth) test. We use robust regression discontinuity design developed by Calonico et al. (2014) in order to examine the impact of entry of small investors on the functioning of the derivatives markets. Note that irrespective of the threshold used, the lot size is changed when the gross contract value reaches Rupess 400,000 from below. Therefore, in our RD tests, we use the gross contract value of a lot as the running variable with Rupees 400,000 as the cut-off.

We first verify that the event indeed leads to increase in the proportion of trades executed by retail investors in treated stocks. This shows that the event did have the expected impact. Next we examine the impact of the lot size change and consequent entry of small investors into derivative trading on stock prices in both spot and derivative segments. For the purpose of this test, we leave out stocks whose lot size changed due to corporate actions. We first calculate abnormal returns for all stocks in the sample for 3 and 5 days around the event date and then estimate the RD results using the 3 day and 5 day cumulative abnormal returns (CAR) as the dependent variable. We find that a split in lot size leads to a positive reaction both in equity derivatives market as well as in spot markets. The CAR for treated stocks is higher by 2.4%(2.8%) in spot(futures) markets when compared to comparable stocks that barely missed the treatment. The positive reaction of spot prices is not surprising as they are directly linked to futures prices and also because increased investor activity in derivative segment is likely to lead to increased activity in spot segment due to hedging and speculative trading strategies (Hu (2014)).

In the second part of the paper, we investigate the plausible reasons for the positive reaction documented in the first part. We test for change in liquidity using the illiquidity measure developed by Amihud and Mendelson (1986). Expectedly, we find that liquidity improves significantly in the derivatives markets. The spill over effect extends to spot markets which also experience increased liquidity. We next focus on price efficiency. Here, the prediction is not straight forward. If small investors are unsophisticated noise traders (Shleifer and Vishny (1997)) then they may distort prices and hence hamper price efficiency. On the other hand, if presence of such traders leads to more information accumulation as in Merton (1987) or provides an opportunity for the informed investors to profit from their information without disclosing their identity as in Kyle (1985), then informativeness of stock and derivative prices might increase. In order to test the above conflicting hypotheses, we use the price efficiency measures developed by Hou and Moskowitz (2005). The broad idea underlying the measures we use is the following: if prices are efficient, then market wide events are likely to be priced in quickly. In such a scenario, after controlling for the impact of contemporaneous market returns, lagged market returns are not expected to explain current stock returns in a significant way. In case they do, then it is a sign of inefficiency. We find that price efficiency of treated stocks increases by 5.9%(5.8%) in the spot(derivatives) markets.

We then move on to test the impact of entry of small investors on volatility. If the concerns expressed by the regulators are correct, then one would expect to see an increase in volatility. We test the impact on volatility using the volatility measures used in (Das et al. (2014)). We detect a marginal increase in standard deviation of returns in derivative markets and no signficant change in other measures such as skewness and kurtosis. All measures of volatility remain unchanged in the spot market. Our results suggests that concerns expressed by regulators regarding the "distortionary" impact of small investor participation seems to be misplaced. On the contrary, our findings suggest that entry of small investors is likely to lead to increased valuations both in spot as well as derivatives markets on the back of improved liquidity and price efficiency. Measures of volatility do not change significantly.

Finally, we attempt to link the the impact on fundamental characteristics of stocks and the entry of retail investors. We find that the increase in price efficiency and liquidity is higher for stocks that see higher proportion of retail treading as a result of the event under study. In line with the earlier results, volatility is not significantly of associated with the entry of retail traders.

Admittedly, we use an emerging market setting with its own peculiarities and inefficiencies which may not be found in developed markets. However, note that the question is about the impact of letting small investors participate in the derivative segment. Given that the investors in the emerging markets are likely to be less sophisticated our setting is biased against finding a positive impact. Therefore, we interpret our results as the net positive effect created by increased liquidity and price efficiency over and above any unobserved negative effects. Given our results, we expect the impact to be even more positive for developed markets.

To the best of our knowledge, this is the first paper to examine the role played by small investors in the derivative markets. This paper contributes to the literature that deals with impact of retail investors on financial markets (Amihud et al. (1999), De Long et al. (1990b), Stambaugh et al. (2012), Bloomfield et al. (2009)) by showing that increased small investor participation is likely to lead to increased valuations, higher liquidity and increased price efficiency. The paper also contributes to the large body of financial economics literature that investigates the impact of derivatives on financial markets (Muravyev et al. (2013), Roll et al. (2010), Cao (1999), Hu (2014)). We burrow a layer further and examine the consequences of change in the investor composition in the derivative markets.

The ret of the paper is organised as follows. Section 2 describes the institutional background. Section 3 explains the SEBI rule in detail. Section 4 describes our data and summary statistics. Section 5 describes our empirical strategy and results. Section 6 concludes.

2 Background

In this Section, we describe the relevant institutional background.

2.1 Brief History

Stock trading in India has a history of more than 140 years.[7] Bombay Stock Exchange(BSE), which is the oldest stock exchange in Asia, was established in the year 1875. In 1956, the Government of India, after passing the Securities Contract Regulation Act, recognized BSE as a stock exchange. India's first broad-based market index the "Sensex"[8] was introduced in 1986. Another large stock exchange, the National Stock Exchange, was established in the

[7]Source: http://www.bseindia.com/static/about/heritage.aspx?expandable=0
[8]Sensex comprises of 30 large companies in India from different sectors of the economy

year 1992 by domestic as well as foreign financial institutions. The NSE soon became the largest stock exchange in India and is currently the 12th largest in the world in terms of market capitalization of listed firms and fourth largest in the world in terms of the annual number of trades in equities.[9] More than 99% of the stock trading in India is effected through these two exchanges.

2.2 Current State

India has a highly liquid stock market. Average daily volume of trading in India is to the extent of INR 3 trillion (approximately USD 50 billion).[10] A world bank report[11] shows that between 2010 and 2012, Indian stock turnover to GDP ratio stood at 45.3%, which is higher than many developed markets such as France, Germany and Italy, and almost all emerging markets other than China. The fact that India is now the fastest growing large economy in the world [12] has attracted both domestic as well as foreign institutional capital to Indian markets. Net investment by Foreign Institutional Investors exceeded INR 1 trillion (USD 16.5 billion) in 2014. These facts indicate that India has a well functioning stock market with robust governance and regulatory mechanism in place.

2.3 Derivatives In India

Equity derivatives were introduced in India in the year 2000. Unlike the U.S (Mayhew and Mihov (2004)), India started with index futures and options and then introduced stock futures and options in the following year.[13] Very soon, the derivative segment became bigger than the underlying equity segment. One important reason for the relative popularity of derivatives is the lower taxes in that segment. As prominently noted in the literature (Diamond and Verrecchia (1987), Danielsen and Sorescu (2001)), derivatives ease short-sale

[9] NSE's market index is known as CNX Nifty. It represents 50 large companies in India. Source: NSE
[10] Source: www.moneycontrol.com
[11] Source: http://data.worldbank.org/indicator/CM.MKT.TRAD.GD.ZS/countries
[12] Source: IMF, World Bank
[13] Source: www.nseindia.com

constraints. Given that the short-sale constraints are severe in Indian spot markets (Berkman et al. (1998)), derivatives are relatively more attractive compared to other markets. Roll et al. (2009) note that in order for the derivatives to have any impact, volume of trading is more important than mere listing of derivatives. Given the high proportion of trading in derivatives, India offers an excellent setting to study the impact of derivative securities. Another important feature of Indian markets is that the derivative segment is dominated by single stock futures and not by options as in developed countries. Futures account for more than 70% of total derivative trading in India (Agrawal et al. (2015)).

2.3.1 Working of Equity Derivatives Markets India

Stock Exchanges, based on qualification criteria laid down by SEBI from time to time, chose the stocks that are eligible for trading in the derivative segment. The minimum margin amount is decided based on value at risk. It varies between 13% to 21% of the gross contract value. Every stock listed on the derivative segment will have three contracts- near month, mid month and far month- operational at any point of time. For example; as on 15^{th} March 2010, March, April and May contracts will be active. These contracts are settled on last Thursday of each month. Continuing on the above example, March contract expires on last Thursday of March i.e on 25^{th} of March, 2010. Starting from March 26^{th}, 2010, July contract is activated. If the last Thursday is a public holiday, then the settlement is done one day before. Please note that all lot size revisions, other than those arising out of corporate actions are effected to only on settlement dates.

2.4 Regulation

The Securities and Exchange Board of India (SEBI), was formed on April 12, 1992 [14] with the objective of "protecting the interests of investors in securities and to promote the development of, and to regulate the securities market and for matters connected therewith or

[14] It was formed in accordance with the provisions of the Securities and Exchange Board of India Act, 1992.

incidental thereto." All kinds of stock derivative products fall under the regulatory purview of SEBI. SEBI, over the years, has earned a reputation as a responsive and vigilant regulator. The fact that institutional failures in India such as broker failures have been few and far between after 2001 shows the efficacy of SEBI's regulations. [15]

3 The Event

Prior to 2010, stock exchanges enjoyed considerable freedom in deciding lot sizes for equity derivative contracts. On 8^{th} January 2010, SEBI introduced a regulation to standardize the lot size of derivatives of individual stocks. SEBI divided the derivative contracts into different buckets based on the price at which the underlying security was traded. As per the regulation, the lot size is determined depending on the price band. The price bands were defined as follows :

TABLE 1: Lot Size Determination Rule
This table presents revised price bands and lot sizes specified by SEBI.

Price Band	Lot Size
Greater than 1601	125
801 - 1600	250
401 - 800	500
201 - 400	1000
101 - 200	2000
51 - 100	4000
25 50	8000

For example, a security priced at INR 650 would be included under the price band of 400-800 Rupees. Hence, the lot size for it would be 500. The lot is reviewed twice every year, in the months of March and September. The price band of the security is reviewed based on the closing price of the security averaged over the calendar month of March for the first revision and September for the second. If the price band changes, the lot size is accordingly revised. The revision in the lot size is announced via circulars (usually on the 31st day of March and the 30th day of September). If the average closing price (over the

[15]Source: The Economic Times

month) breaches the upper limit of the price band, the lot size is reduced and if the lower limit is crossed from above (i.e. the price of the underlying security falls below the lower limit of price band), the lot size is increased. Continuing from the previous example, if the price of the stock increases from INR. 650 to INR. 820 (breaching the upper limit of the price band 400-800), the lot size is decreased to 500 from 1000 and if the price falls to INR. 380, then lot size is increased to 2000 from 1000. All the limits are designed in such a way that a gross contract value of Rupees 400,000 works as the effective cut-off for lot size revisions.

In India, futures contracts are available with duration of one month (called near month contracts), two months (called mid month contracts) and three months (called far month contracts). New contracts are introduced on the trading day following the expiry of the near month contracts, for a three month duration. The previous middle month contract then becomes the new near month contract, the previous far month becomes the current middle month contract and the new contract becomes the current far month contract This way, at any point in time, three contracts are available for trading in the market (for each security) i.e., one near month, one mid month and one far month. Derivative contracts expire on the last Thursday of the expiry month. If the last Thursday is a trading holiday, the contracts expire on the previous trading day. For example on January 26^th, 2008 there would be three contracts available for trading i.e. contracts expiring on January 31^st, 2008, February 28^th, 2008 and March 27^th, 2008. On expiration date, i.e. January 31^th, 2008, new contracts having a maturity of April 24^th, 2008 would be introduced for trading.

Based on the one month average of closing price of the stock during March or September as applicable, the following revisions can take place:

1. *Derivative contract size is revised downwards* : When the price of the underlying security (averaged over the month of March or September) crosses the specified limits from below i.e. the overall value of the contract goes above Rupees.400,000, the number of securities in the lot is reduced by dividing it by a multiple of 2. This is done immediately. For announcements made on March 31^st, change in effected to on the last Thursday of April, which is the nearest settlement date. Starting from the day

following the settlement date, all active derivative contracts (near month, mid month and far month) trade with revised lot size.

2. *Derivative contract size is revised upwards*: When the price of the underlying security decreases such that it crosses one of the specified limits from above, then the lot size is increased. As noted in the Introduction, the revision is effected with a lag of three months. The revision announced in March is applicable from July contract onwards. Therefore, in case of upward revisions, different active contracts can have different lot sizes. This makes identification difficult in such cases.

3. *Derivtive contract size is unchanged.*: For stocks that do not breach any of the thresholds, lot size remains unchanged.

3.1 Sample Construction

In Table 2, we present details about sample construction. As shown in column 1, lot size revision is done once in six months on March 31^{st} and September 30^{th} of every year. As noted above, daily average futures market closing price averaged over the entire calender month serves as a basis for lot size revision. The rule based lot size determination system was introduced in the year 2010. The first revision as per new rules was done on 31st of March, 2010. Our sample period therefore starts from 31st March 2010. During the year 2014, SEBI issued a public discussion paper on increasing the lot size of all derivative contracts with a view to restrict participation of small traders in the derivative market. Therefore, we limit our sample period to 31st March, 2014.

In column 2, we present the total number of stocks eligible for trading in the derivative segment. Only those stocks that meet specified requirements in terms of float and liquidity are eligible for listing in the derivative segment. At times newly listed stocks are also included (Agrawal et al. (2015)). Therefore, the number of stocks traded in the derivative segment changes frequently. In column 3, we present the number of stock-events whose lot sizes were split because they crossed the threshold from below. In total, lot sizes were halved for 141 stock-events. Column 4 mentions the effective date. An example is useful to clarify the difference between announcement and effective dates. Lets take the period covered in row one for illustration. On March 31^{st}, 2010, following the SEBI rule, exchanges identified 9 stocks to be split by half. As mentioned in section 2, derivative contracts expire on last Thursday of every month. April 2010 contract would be already operational on March 31^{st}, 2010. Therefore, the revision is effected to immediately after the expiry of the April contract. The April contract expires on last Thursday of April i.e 29^{th} of April. Therefore the lot size revision is effected to with effect from 30^{th} of April. In column 5 and 6, we present data relating lot size splits which are done because of corporate actions. Finally in column 7, we present the number of stocks where there were no change in lot size. These are stocks that do not cross the nearest threshold during one month immediately proceeding revision. These are 1011 in number.

4 Data and Summary Statistics

In this section, we briefly describe our data sources and relevant summary statistics.

4.1 Data

We obtain most of our data from following four sources;

1. *National Stock Exchange*: As noted in Section 2, NSE is the largest stock exchange in India. More than 85% of the derivative trading in India is executed at the NSE. We obtain all price and turnover information from NSE. We cross verify the numbers on a sample basis from multiple other sources. NSE also provides information about the list of stocks that were eligible for trading in the derivative segment at any point of time. The stocks that undergo lot size change are separately identified. We use the above information to identify our treatment and control groups. Finally, from the NSE,we also obtain data regarding the trading volume executed by different category

of traders at stock-day level in the derivative segment. Traders are categorized into five categories, namely retail, domestic institutional, foreign institutional, corporate and proprietary. We consider the last four categories as institutional traders.

2. *Center For Monitoring Indian Economy (CMIE) Prowess*: Prowess database, maintained by CMIE, has gained reputation as the Indian compustat. The data base provides detailed accounting and financial information for more than 25,000 large and medium companies in India. A number of prominent research articles (Khanna and Palepu (2000), Mehta et al. (2002), Gopalan et al. (2007), Vig (2013)) use the same database. We obtain company-level financial information from Prowess. In particular, we collect data relating to sales, capital expenditure, earnings after interest and tax (EBIT), gross value of assets and cash flows.

3. *SEBI Web Site* : We obtain all relevant SEBI circulares from their web site. From these circulares, we collect information pertaining to lot size rules and changes in them. We also learn about the effective dates of various regulations from this source.

4.2 Summary Statistics

In Table 3, we present data pertaining to key financial variables of our sample firms. We also compare the stocks that undergo a split in lot size and those that remain unchanged in terms of levels of key financial variables. Note that the number of observation here refers to number of firms and not firm events as in table 2. The list of financial variables that we examine is comprehensive and includes sales, assets, profit before depreciation and taxes, profit as a proportion of assets, price to book ratio and shares outstanding. We report the mean, median and standard deviation for the above variables. Columns 1 to 4 cover those stocks that underwent a lot size split and columns 5 to 8 cover those stocks that did not undergo a lot size split. In column 9(10), we present the results of test of difference in mean (median) between the two group of stocks. It is crucial to note that the set of stocks that underwent treatment and those that missed the same do not differ substantially in terms of any of the above observable parameters. The test for difference in mean (median) in each of the row yields a statistically insignificant result. Based on the above result, it is reasonable to state that the treatment and control group stocks seem to share similar observable characteristics.

5 Empirical Strategy and Results

In the first part of our empirical analysis, we test the impact of the entry of small investors into equity derivative markets. As explained in section 3, the lot size determination of equity derivatives in India is based on rules specified by SEBI. Whether the lot size of a derivative contract on stock increases, decreases or remains unchanged depends on the average stock price during the months of September and March crossing or not crossing the pre specified thresholds. As discussed in the introduction and in section 3, the setting lends itself nicely to a regression discontinuity test.

We use the method designed by Calonico et al. (2014). This method recognises the fact that the routinely employed polynomial estimators are extremely sensitive to the specific bandwidths employed. Calonico et al. (2014) show that both conventional and regression discontinuity(RD) tests as well as recently developed nonparametric local polynomial estimators make bandwidth choices that lead to "bias in the distributional approximation of the estimator." They first bias-correct the RD estimator by re-centering the t-statistics. This leads to their bias-corrected estimators. They also recognise that such approximation may lead to "low quality distributional approximation." They devise a novel method to calculate standard errors which accounts for the additional variability introduced by the previous step. They call these robust standard errors. We estimate both bias corrected as well robust RD estimators. We also report conventional RD coefficients.

We first calculate the cumulative abnormal return around the event date for each stock in the sample. We use the standard market model to estimate abnormal returns. We use India's most tracked Nifty Fifty index as a proxy for the market. For the purpose of RD test we use two event windows- 0 to 3 days and 0 to 5 days- zero being the event day.

We use the cumulative abnormal returns as the dependent variable in RD test. The gross contract value of each derivative contract is the running variable with Rupees 400,000 being the cut-off. Note that SEBI has designed threshold limits in such a way that lot size of any stock whose gross contract value per lot crosses Rupees 400,000 from below is split into half. For example; Assume that stock A and B get quoted at Rupees 195 and 395 respectively on February 28*th*, 2011. As per rules described in 3, the lot size of stock A and B in the derivative segment is likely to be 2000 and 1000 respectively. Suppose the average daily closing price of stock A(B) for the month of March 2011 works out to be 205(405). Then the lot size will be reduced to 1000 for A and 500 for B. This is because both the stocks cross threshold limits of 200 and 400 from below. Note that in both cases the nominal thresholds of 200 and 400 (also 800 and 1600 in other cases) actually represent gross contract value of Rupees 400,000. In effect, lot size split is effected to if the average gross contract value of a lot crosses Rupees 400,000 from below. As noted in section 3 and shown in Table 2, the change is effected on the first derivative settlement date following the announcement date. In the case mentioned above, the lot size change is announced on March 31*st* and come into force on day following the last Thursday of April i.e April 29*th*.

5.1 Impact on the Proportion of Retail Trading

It is crucial to first verify that the relative trading by retail traders indeed increased as a result of derivative lot size split. Our thesis is that the minimum lot size requirement acts like a hurdle for retail investors and hence, relaxation of lot size requirement leads to entry of retail investors. As discussed in section 2, the institutional investors are less likely to be impacted by reduction in lot size. Given that the changes are made to the lot size requirement in the derivative market, we examine the impact of the event on the proportion of retail trading over total trading in value terms.

We use the regression discontinuity design described in section above to examine the impact of the event on retail trading. The proportion of retail trading over total trading in value terms is the dependent variable. We organize the data at stock-day level. We first regress the dependent variable on firm and day fixed effects. The residual from the above regression is used as the dependent variable in our regression discontinuity tests. The average value of a single lot in the derivative segment measured over the month of March or September as the case may be is the running variable. The value of 400,000- level beyond which a stock is split- is used as the running variable. In effect, we compare stocks that barely cross the specified threshold and hence undergo treatment and those that barely miss the threshold. In separate tests, and 15 trading days before and after the actual implementation. Note that the split announced at the end of September (March) is implemented from November(May) series. We have trader category level trading data for the years 2010 and 2011 only.

The results are reported in Table 4. In column 1(2),we consider a period of 10 (15) trading days before and after event. In row 1, we present conventional estimates, in row 2, bias corrected estimates and in row 3, robust estimates. As shown in the table, the proportion of retail trading is higher by nearly 2.6 percentage points for treated stocks when compared to control stocks. Given that the average retail trading is nearly 40%, this represents an increase of more than 6% in the proportion of retail trade. These results support our thesis that the number of traders indeed increases after the split.

5.2 Impact Of Lot Size Split On Value

5.2.1 Reaction In The Futures Market

Using the empirical strategy described above we examine the impact of stock split on value both in derivative as well as spot markets. Note that we have multiple events per firm and in total 141 firm events which are carried on at eight different periods. Therefore, in order to control for time invariant firm characteristics and the time trend, we first regress the dependent variable, which is cumulative abnormal return in this case, on firm fixed effects and event period fixed effects and obtain the residuals. We use the residuals so obtained as the dependent variable in our main RD specification. The above procedure takes care of the possibility of other covariates jumping along with running variable precisely at the cut-off

(Lee and Lemieuxa (2010)).

The results are reported in Table 4. In columns 1, we calculate CAR over a period of 0 to 3 days around the event and in columns 2, we calculate CAR over 0 to 5 days. In row 1, we report results based on conventional RD. In row 2, the standard errors are bias corrected. Finally, in row three the standard errors are bias corrected as well robust (Calonico et al. (2014)). We draw all our inferences based on specification used in row 3 i.e RD with bias corrected and robust standard errors.

Note that stocks that are immediately on the right of the cut-off get treated (split). If entry of small investors leads to overall negative consequences for the stock, then we expect the treatment stocks to react more negatively when compared to the comparable stocks that barely miss the cut-off. If on the other hand, the entry of small investors adds value, we expect to find an opposite result. Our results clearly show that the stocks which are on the immediate right of the cut-off yield a higher positive CAR when compared to stocks that are on the immediate left. Using a 3 (5) day CAR, we find that stocks that barely cross the threshold outperform those that barely miss the threshold by 2.8% (3.3%). We depict the RD results pictorially in figure 1. Given that stocks on both sides are comparable and that we have accounted for firm specific and event specific characteristics, it is reasonable to infer from the above results that entry of small investors indeed adds value to the derivative market.

5.2.2 Reaction In The Spot Market

We now examine the impact of the event on spot prices. Note that the split is limited to lot size in the derivative markets and no change is made in the spot markets. However, spot market activity may increase because of several reasons. The new entrants to derivatives markets may engage in hedging or speculative trading strategies that involve taking simultaneous but opposite positions in spot and derivative markets.[16] Second, market makers in the

[16]For example: A strategy known as protective put involves buying a stock in the spot market and buying a put option the stock

derivative markets may take positions in the spot market in order to hedge their positions (Hu (2014). This can lead to increased activity in the spot segment as a consequence of increased derivative activity. Finally, any one sided move in the derivatives markets may attract arbitragers into the spot market and hence lead to increased trading activity. We therefore test if the event leads to positive valuations even in the spot markets.

We use the same empirical specification as in section 5.2.1. The results are reported in Table 5. The arrangement of rows and columns in the table exactly mimics the arrangement in Table 4. We find that the stocks that barely cross the threshold from below outperform stocks that barely fail to cross the threshold by 2.3%. The results clearly show that the impact of entry of small investors spills over to the spot markets and impacts the spot market valuation of the firm positively.

5.3 Announcement Day Reaction

As described in section 3, the announcement of change in derivative lot size is done on either 31^{st} March or 30^{th} September. However, the change comes into effect on the next day of the immediately following settlement date. The results presented in sections 5.2.1 and section 5.2.2 measure the abnormal return around the actual day of implementation. The idea here is that the actual entry of small investors can happen only after implementation. However, given that the announcement of the event is made in advance, it is possible that other investors anticipate the positive reaction and hence move the prices immediately after announcement. On the other hand if the effect is caused by the actual entry of small investors, there is unlikely to be any reaction on announcement.

In order to test the above proposition, we first measure cumulative abnormal returns around the announcement date and estimate the RD specification described in section 5.2.1. We report the results in Table 6. In columns 1 and 2, we use derivative market prices and in columns 3 and 4, we use spot prices. The event window used is 0 to 3 (o to 5) days in columns 1 and 3(2 and 4). As shown in the table, we do not detect any discontinuity near the cut-off. Therefore, the spike in valuation pointed out in section 5.2.1 happens only as a result of actual entry of small investors.

5.4 Lot Size Increases

As described in section 3, the SEBI rule also mandates an increase in lot size if the gross contract value crosses the threshold limit of Rupees 400,000 from above. If the increase in lot size is implemented the same way as decreases, then such events are expected to lead to results that are opposite in direction when compared to the results reported in Tables 4 and 5. However, as discussed in section 3, the actual implementation of increase in lot size makes identification very difficult. The increase in lot size is effected to for derivative contracts starting from 3 months after the announcement date. For example: if as per rules a stock qualifies for lot size consolidation say from 500 to 1000 on 31st March, the actual consolidation applies to all contracts starting from July. This creates a situations where immediately after the announcement the near month and mid month contracts- May and June contracts in this case- continue to trade with lower lot size whereas the lot size for the far month contract-July in this case-is increased.[17] Therefore, it is very difficult to ascertain when exactly do small investors exit. It is unlikely that such traders wait till end of June and exit suddenly. They may exit gradually starting from March. In such a situation a sharp identification becomes difficult.

Nevertheless, we perform our RD tests using CAR near the actual date of exclusion. The results are reported in Table 7. The arrangement of the table mimics the arrangement of table 6. As shown in the table, we do not detect any significant jump near the cut-off. It is likely that small investors exit gradually making sharp identification extremely difficult. Therefore, we draw our inferences based on cases were the lot sizes were reduced.

[17] Note that July contract becomes operational on the day following the last Thursday of April

5.5 Placebo Test

We perform placebo tests in order to rule out the possibility of omitted variables impacting our results. We perform false limit test where we use limits other than the actual thresholds and estimate the RD specification. The results are reported in Table 9. We do not find any significant reaction when we use false limits. Similarly, we perform false event tests where we use months other than March and September as review months. Here again, we do not find any significant results. These findings further strengthen our proposition that the positive reactions documented in Tables 4 and 5 are indeed caused by the entry of small investors.

5.6 Impact of Small Investor Entry On Market Fundamentals

In the second part of the paper we examine the impact of entry of small investors on fundamental characteristics of markets such as price efficiency, liquidity and volatility.

5.6.1 Price Efficiency

If small investors behave like noise traders and engage in positive feedback trading (De Long et al. (1990b)), then price efficiency is likely to deteriorate as a result of entry of small investors. If, on the other hand, entry of more investors leads to accumulation of more information as in Merton (1987), then such entry is likely to lead to improvement in informativeness of prices and hence enhance efficiency.

To test price efficiency, we use the methods developed by Hou and Moskowitz (2005) and used in Saffi and Sigurdsson (2010). The first of the two measures, called the D1 is based on the idea that increased price efficiency is likely to lead to a faster incorporation of market wide news into stock prices. The above hypothesis is formally tested using the difference in the explanatory power of the contemporaneous and lagged market returns in explaining current stock returns. Formally, we estimate the following regression equation to calculate D1.

$$Y_{\mathrm{ij}} = \alpha + \nu_i + \beta_1 * \mathrm{Market} + \beta_2 * \mathrm{Lag1} + \beta_3 * \mathrm{Lag2} + \beta_4 * \mathrm{Lag3} + \beta_5 * \mathrm{Lag4} + \epsilon_{ijs} \tag{1}$$

Following Hou and Moskowitz (2005), we regress the current week stock returns, which is the dependent variable in the above equation, on the market as well its four lags. We use daily lags for the purpose of above equation. We first calculate the R squared of the above equation. We next re-estimate the above equation by constraining the co-efficient of lagged values to zero and calculate the R squared of the constrained regression. The difference in R squared is our first measure, D1, of price efficiency for a stock. The second measure, called the D2, is also derived from the above regression equation. Here again, following Hou and Moskowitz (2005), we calculate the ratio between sum of co-efficient on the lagged market returns and the co-efficient on the market. While the first measure D1, focusses on the relative explanatory power of current and lagged market returns, the second one, D2, focuses on the difference in economic magnitude of the influence of current and lagged market returns.

Note that unlike market reaction, change in price efficiency is unlikely to happen instantly and hence a sharp discontinuity around the event date is unlikely manifest. Therefore, we perform a difference in difference test with stocks that undergo a split forming the treatment group and stocks that do not see any change forming the control group. We estimate the following regression equation;

$$Y_{\mathrm{ij}} = \alpha + \nu_i + \delta_j + \theta_{sj} + \beta_1 * \mathrm{Post} * \mathrm{Treat} + \beta_2 * \mathrm{Post} + \beta_3 * \mathrm{Treat} + \beta_4 * X_{ij} + \epsilon_{ijs} \tag{2}$$

Each observation represents stock return for a day. We cover a period of three months before and three months after every lot size change. Treat refers to a dummy variable that takes the value of 1 for treated stocks and zero for other stocks. Post is a dummy variable that takes the value of 1 for days after the change in lot size and zero otherwise.

The results are reported in Table 10. In all specifications, we include firm level and event level fixed effects. We also include firm level controls representing size and profitability. Our focus is on the interaction between post and treatment. Please note lower the economic magnitude of the coefficient, higher is the price efficiency. We use futures (spot) prices to calculate abnormal returns in columns 1 and 2 (3 and 4). In columns 1 and 3, D1 is the dependent variable whereas in columns 2 and 4, D2 is the dependent variable. The sign of the interaction term in all four columns is negative and the term is statistically significant in three of the four columns. The measure named D2-which represents the economic magnitude of the change-shows that after the split in lot size price efficiency increases by about 5.8%(5.9%) in derivative (spot) markets. The results show that participation of small investors leads to increased price efficiency.

5.6.2 Liquidity

We next proceed to test the impact of entry of small investors on liquidity. Findings in Amihud et al. (1999), Hauser and Lauterbach (2003) suggests that entry of small investors is likely to increase liquidity in spot markets. However Stiglitz (1989) argue that entry of noise traders may end up hurting liquidly. As described in the Introduction, due to unique characteristics of derivative markets, it is not possible to fully extrapolate the findings in spot markets to derivatives.

We use two measures of liquidity- total turnover and amihud illiquidity measure. We estimate regression equation 2 with various measures of liquidity as the dependent variable in each specification. The results are reported in Table 11. In columns 1 and 2 (3 and 4), we present the results for derivative (spot) markets and in column 5 we combine volumes in both derivative and spot markets. As before, our focus is on the interaction between treatment and post dummies. The results show that total turnover increases and Amihud illiquidity factor decreases significantly in derivatives markets. This shows a clear improvement in liquidity in the derivative segment. However results in the spot market are not very strong. While

Amihud measure shows an increase in liquidity, the total turnover measure is statistically insignificant. In sum, the results presented in Table 10 point out towards increase in liquidity post the entry of small investors.

5.6.3 Volatility

As discussed in the Introduction, it is the belief of regulators that the entry of small investors leads to increased volatility. SEBI, while imposing restrictions on trading in derivatives, clearly stated that the purpose of these restrictions is to protect market integrity and reduce volatility. Given that the derivative instruments are complicated by nature, such apprehensions may be even higher for derivative instruments. We test whether volatility indeed increases post the entry of small investors. We use standard deviation, skewness and kurtosis of daily returns as dependent variables in different regression equations and estimate specifications similar to equation 2.

The results are reported in Table 12. In column 1,2 and 3 we use prices from derivative markets whereas in columns 4,5 and 6, we use spot prices. In derivative markets skewness and kurtosis measures do not see any change in the post event period as shown by the interaction term. However, standard deviation increases by barely statistically significant but economically insignificant 0.2%. In spot markets, we do not see significant change in any of the three volatility measures that we employ. From the above results, it is reasonable to conclude that volatility does not change significantly post the entry of small investors.

5.6.4 Link Between Increased Retail Participation and Change in Market Participation

The results presented so far show that the increase in retail participation in the derivative segment leads to increase in share holder value, price efficiency and liquidity. Volatility does not change by much. We now attempt to link the change in stock fundamentals and retail participation. Specifically, we ask if the results presented in this paper are stronger for stocks with higher retail participation after the lot size change. We limit the sample to firms that experience stock split and consider only the post split period. We alternatively use various measures of stock fundamentals used in this paper as dependent variables and the interaction between post period dummy and the average proportion of retail participation in a stock-quarter as the main independent variable of interest.

The results are reported in Table 13. The coefficient corresponding to the interaction term indicates that price efficiency and liquidity is higher in treatment stocks with higher retail participation in the post split period. The various measures of liquidity do not seem to vary with the extent of retail participation. This provides a suggestive evidence in support of our claim that increased retail participation is related to change in stock fundamentals such as valuation, price efficiency and liquidity.

6 Conclusion

Financial derivatives, even after the recent financial crisis, occupy a dominant position in global financial markets. The gross value of outstanding derivative contracts crossed USD 630 trillion as at the end of 2015.[18] Increased use of financial derivatives is often considered as one of the factors that worked as a catalyst during the recent financial crisis (Foster and Magdoff (2009)). This has led to a deluge of regulatory actions and pronouncements with respect to financial derivatives in the recent past. Apart from many structural issues relating to derivatives, regulators all over the world are also concerned about the consequences of participation of unsophisticated small investors in the derivatives markets. These concerns are not limited to paternalistic views about protecting small investors from losses but also extend to market stability and efficiency. Therefore, the issue of small investor participation in derivative market has attained immense regulatory attention. Surprisingly however, financial economists have not focussed much on this topic. This papers seeks to fill this gap by examining the consequences of entry of small investors into equity derivative markets.

[18] Source: https://www.sec.gov/news/statement/protecting-investors-through-proactive-regulation-derivatives.html

We use rule based determination of derivative lot sizes in India as an economic setting. The rule based determination of lot sizes allows us to employ regression discontinuity design using arbitrarily defined threshold limits. Comparing stocks whose lot sizes get reduced due to the operation of the rule with those that barely miss the treatment, we find that small investor participation leads to increased valuations both in spot as well as derivative markets. We then investigate the source of such increase. We find that both liquidly and price efficiency improve after the entry of small investors into the derivative segment. Contrary to the expectations of the regulators, volatility does not increase post the entry of small investors.

Note that we do not focus on the impact of derivative trading on the wealth of small investors. It is quite possible that they may consistently lose money in derivative market either because of lack of sophistication or any other reason. Our focus is on the impact of entry of small investors on the market fundamentals such as valuation which in turn reflects cost of capital, price efficiency, liquidity and volatility. Our findings clearly suggest that entry of small investors do not lead to adverse effect on any of the above and to the extent regulatory concerns regrading impact on market fundamentals may be overstated. It is worthwhile to investigate if small investors indeed lose money trading in derivatives.

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TABLE 2: SUMMARY OF EVENTS

*This table presents an overview of all events during March-2010 to March-2014 when either the lot size of the future contract was decreased or kept unchanged.

Announcement Date	**Total contracts**	**Lot Size Decrease by a Factor of 0.5**	**Effective Date**	**Lot Size Decrease by Other Factor**	**Effective Date**	**No Change in Lot Size**
31-Mar-2010	189	9	30-Apr-2010	113	25-Jun-2010	7
30-Sep-2010	197	29	29-Oct-2010	7	31-Dec-2010	151
31-Mar-2011	222	4	29-Apr-2011	5	1-Jul-2011	140
30-Sep-2011	222	13	28-Oct-2011	4	30-Dec-2011	155
31-Mar-2012	211	25	27-Apr-2012	5	29-Jun-2012	152
30-Sep-2012	148	10	26-Oct-2012			110
28-Mar-2013	141	14	26-Apr-2013	2	28-Jun-2013	114
30-Sep-2013	130	8	1-Nov-2013	1	27-Dec-2013	83
31-Mar-2014	136	29	25-Apr-2014	5	27-Jun-2014	99
Total Events		141		142		1011
No of Unique Firms		253				

TABLE 3: FIRM CHARACTERISTICS

*This table presents characteristics of firms for which future contract lot size was decreased (column 1 to 4) as well as firms for which there was no change in the lot size (column 5 to 8). We report the number of observations, mean, standard deviation, and median values of all variables as on the annoucement date. In columns 9 and 10, we report the results of mean and median comparison tests. Number of observation varies due to unavailability of data. Sales, Assets, PBITDA and market capitalization are reported in millions of rupees while shares outstanding is in millions.

	Lot Size Decrease				No change in Lot Size				Mean Comparison Test	Median Comparison Test
Variable	N	Mean	Median	Std. Dev.	N	Mean	Median	Std. Dev.	p-value	p-value
Sales	69	190,000.00	47,611.50	610,000.00	292	240,000.00	64,910.20	560,000.00	0.608	0.296
Assets	84	620,000.00	120,000.00	1,100,000.00	340	600,000.00	170,000.00	1,300,000.00	0.898	0.196
Market Capitalization	84	340,000.00	110,000.00	640,000.00	339	390,000.00	170,000.00	590,000.00	0.503	0.306
PBDITA	84	55,978.21	13,784.80	86,740.26	340	64,382.37	23,668.55	100,000.00	0.446	0.180
PAT/Assets	84	0.07	0.04	0.09	340	0.07	0.05	0.08	0.748	0.715
PB	84	4.31	2.56	5.25	339	3.59	2.19	4.59	0.251	0.884
Shares Outstanding	84	830.00	390.00	1,200.00	340	1,000.00	390.00	1,600.00	0.207	0.903

TABLE 4: IMPACT OF LOT SIZE DECREASE ON THE PROPORTION OF RETAIL TRADE

*The table below shows the impact of lot size decrease on the proportion of retail trade using Regression Discontinuity Design. The ratio between value of retail trade and total trade at stock-day level, named as retail proportion, is the dependent variable. In the first stage, we regress the retail proportion on firm fixed effects and day fixed effects and use residuals obtained from this regression for Regression Discontinuity Framework using 400,000 as the cut-off value of the minimum lot size.

	10 Days Window	**15 Days Window**
	Proportion Of Retail Trading	
Traded Value		
Method:		
Conventional	0.021**	0.014*
	[1.994]	[1.659]
Bias-corrected	0.026**	0.018**
	[2.408]	[2.120]
Robust	0.026**	0.018*
	[2.150]	[1.938]
First Stage Variables:		
Firm fixed effects	Yes	Yes
Day fixed effects	Yes	Yes
Number of observations	3,926	6,502

TABLE 5: IMPACT OF LOT SIZE DECREASE ON FUTURE PRICES

*The table below shows the impact of lot size decrease on future prices around the implementation date of new future contracts using Regression Discontinuity Design. CAR is the cumulation of abnormal returns generated by the market model. In the first stage, we regress CAR on firm fixed effects and event fixed effects and use residuals obtained from this regression for Regression Discontinuity Framework using 4 lakhs as the cut-off value of the minimum lot size.

	CAR(0, +3)	**CAR(0, +5)**
Lot turnover coefficient		
Method:		
Conventional	0.025**	0.028**
	[2.467]	[2.109]
Bias-corrected	0.028***	0.033**
	[2.705]	[2.460]
Robust	0.028**	0.033**
	[2.335]	[2.178]
First Stage Variables:		
Firm fixed effects	Yes	Yes
Event fixed effects	Yes	Yes
Number of observations	497	497

TABLE 6: IMPACT OF LOT SIZE DECREASE ON SPOT PRICES

*The table below shows the impact of lot size decrease on spot prices around the implementation date of new future contracts using Regression Discontinuity Design. CAR is the cumulation of abnormal returns generated by the market model. In the first stage, we regress CAR on firm fixed effects and event fixed effects and use residuals obtained from this regression for Regression Discontinuity Framework using 400,000 as the cut-off value of the minimum lot size.

	CAR(0, +3)	**CAR(0, +5)**
Lot turnover coefficient		
Method:		
Conventional	0.023**	0.020
	[2.513]	[1.516]
Bias-corrected	0.024***	0.025*
	[2.680]	[1.832]
Robust	0.024***	0.025
	[2.306]	[1.626]
First Stage Variables:		
Firm fixed effects	Yes	Yes
Event fixed effects	Yes	Yes
Number of observations	518	518

TABLE 7: IMPACT OF LOT SIZE DECREASE ANNOUNCEMENT ON FUTURE AND SPOT PRICES

*The table below shows the impact of lot size decrease announcement on future (column 1 and 2) and spot (column 3 and 4) prices using Regression Discontinuity Design. CAR is the cumulation of abnormal returns generated by the market model. In the first stage, we regress CAR on firm fixed effects and event fixed effects and use residuals obtained from this regression for Regression Discontinuity Framework using 400,000 as the upper cut-off value of the minimum lot size.

	Future		**Spot**	
	CAR(0, +3)	**CAR(0, +5)**	**CAR(0, +3)**	**CAR(0, +5)**
Lot turnover coefficient				
Method:				
Conventional	-0.01	-0.009	-0.008	-0.01
	[-1.144]	[-1.141]	[-0.839]	[-1.028]
Bias-corrected	-0.012*	-0.011	-0.01	-0.012
	[-1.718]	[-1.289]	[-1.062]	[-1.225]
Robust	-0.012	-0.011	-0.01	-0.012
	[-1.481]	[-1.119]	[-0.888]	[-1.031]
First Stage Variables:				
Firm fixed effects	Yes	Yes	Yes	Yes
Event fixed effects	Yes	Yes	Yes	Yes
Number of observations	337	337	385	385

TABLE 8: IMPACT OF LOT SIZE INCREASE ON FUTURE AND SPOT PRICES

*The table below shows the impact of lot size increase on future (column 1) and spot (column 2) prices around the implementation date of new future contracts using Regression Discontinuity Design. CAR is the cumulation of abnormal returns generated by the market model. In the first stage, we regress CAR on firm fixed effects and event fixed effects and use residuals obtained from this regression for Regression Discontinuity Framework using 200,000 as the lower cut-off value of the minimum lot size.

	Future		**Spot**	
	CAR(0, +3)	**CAR(0, +5)**	**CAR(0, +3)**	**CAR(0, +5)**
Lot turnover coefficient				
Method:				
Conventional	-0.006	-0.004	-0.003	-0.007
	[-0.748]	[-0.446]	[-0.395]	[-0.804]
Bias-corrected	-0.007	-0.003	-0.003	-0.008
	[-0.881]	[-0.318]	[-0.439]	[-0.9481]
Robust	-0.007	-0.003	-0.003	-0.008
	[-0.734]	[-0.263]	[-0.361]	[-0.789]
First Stage Variables:				
Firm fixed effects	Yes	Yes	Yes	Yes
Event fixed effects	Yes	Yes	Yes	Yes
Number of observations	742	742	763	763

TABLE 9: Placebo Tests

*The table below shows the impact of lot size decrease on future (column 1 and 2) and spot (column 3 and 4) prices around the implementation date of new future contracts using Regression Discontinuity Design using false limits of 300,000 (Panel A) and 500,000 (Panel B). CAR is the cumulation of abnormal returns generated by the market model. In the first stage, we regress CAR on firm fixed effects and event fixed effects and use residuals obtained from this regression for Regression Discontinuity Framework.

7(A): Placebo test with 300,000 as the cut-off

	Future		**Spot**	
	CAR(0, +3)	**CAR(0, +5)**	**CAR(0, +3)**	**CAR(0, +5)**
Lot turnover coefficient				
Method:				
Conventional	0.001	-0.004	0.008	0.005
	[0.183]	[-0.354]	[1.261]	[0.536]
Bias-corrected	0.000	-0.006	0.010	0.007
	[0.235]	[-0.522]	[1.525]	[0.655]
Robust	0.000**	-0.006	0.010	0.007
	[0.020]	[-0.447]	[1.298]	[0.552]
First Stage Variables:				
Firm fixed effects	Yes	Yes	Yes	Yes
Event fixed effects	Yes	Yes	Yes	Yes
Number of observations	929	929	968	968

7(B): Placebo test with 500,000 as the cut-off

	Future		**Spot**	
	CAR(0, +3)	**CAR(0, +5)**	**CAR(0, +3)**	**CAR(0, +5)**
Lot turnover coefficient				
Method:				
Conventional	-0.009	-0.009	-0.010	-0.016
	[-0.407]	[-0.483]	[-0.554]	[-0.830]
Bias-corrected	-0.004	-0.007	-0.008	-0.017
	[-0.175]	[-0.394]	[-0.430]	[-0.926]
Robust	-0.004	-0.007	-0.008	-0.017
	[-0.149]	[-0.326]	[-0.364]	[-0.76]
First Stage Variables:				
Firm fixed effects	Yes	Yes	Yes	Yes
Event fixed effects	Yes	Yes	Yes	Yes
Number of observations	170	170	179	179

TABLE 10: Impact of Lot Size Decrease on Price Efficiency

*The table below shows future (column 1 and 2) and spot price (column3 and 4) efficiency around the implementation date of new future contracts when lot size of the contract is decreased using difference-in-differences framework. Firms for which the lot size was decreased form the "treatment" group and those for which there was no change in the lot size form the "control" group. The dependent variables, D1 and D2 are measures of price delay. We calculate D1 and D2 measures using one quarter of daily data before the announcement date for the "pre" period and after the implementation date for the "post" period. Control variable includes market capitalization and price-to-book ratio. Standard errors are clustered at the firm level and adjusted for heteroscedasticity. t-stats are reported in parentheses. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

	Future		**Spot**	
	(1)	**(2)**	**(3)**	**(4)**
VARIABLES	**D1**	**D2**	**D1**	**D2**
Treatment	0.029	0.035*	0.006	0.047***
	[1.473]	[1.752]	[0.407]	[2.831]
Post	0.003	0.019***	-0.012***	-0.001
	[0.509]	[2.667]	[-3.097]	[-0.207]
Treatment * Post	-0.044*	-0.058**	-0.006	-0.059***
	[-1.845]	[-2.347]	[-0.402]	[-2.773]
Constant	-0.018	0.072	-0.171	-0.799*
	[-0.043]	[0.140]	[-0.704]	[-1.876]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Event FE	Yes	Yes	Yes	Yes
Clustering of SE	Firm	Firm	Firm	Firm
Observations	1,976	1,976	1,977	1,977
Adjusted R-squared	0.121	0.307	0.103	0.307

TABLE 11: Impact of Lot Size Decrease on Liquidity

*The table below shows future (column 1 and 2) and spot (column 3 and 4) price liquidity around the implementation date of new future contracts when lot size of the contract is decreased using difference-in-differences framework. Firms for which the lot size was decreased form the "treatment" group and those for which there was no change in the lot size form the "control" group. We calculate dependent variables average turnover and Amihud's illiquidity measures using one quarter of daily data before the announcement date for the "pre" period and after the implementation date for the "post" period. Control variable includes market capitalization and price-to-book ratio. Standard errors are clustered at the firm level and adjusted for heteroscedasticity. t-stats are reported in parentheses. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

	Future		**Spot**	
	(1)	**(2)**	**(3)**	**(4)**
VARIABLES	**Average Turnover**	**Amihud's Measure**	**Average Turnover**	**Amihud's Measure**
Treatment	-544,502.352**	0.040	94.238*	-0.000*
	[-2.519]	[0.016]	[1.840]	[-1.782]
Post	-355,790.897***	9.735***	-31.439***	0.000***
	[-3.224]	[4.426]	[-3.214]	[3.523]
Treatment * Post	799,651.112**	-8.662**	-4.640	-0.000
	[2.352]	[-2.527]	[-0.112]	[-0.373]
Constant	763,626.183	632.028***	-5,454.084**	0.002***
	[0.059]	[4.921]	[-2.179]	[2.540]
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Event FE	Yes	Yes	Yes	Yes
Clustering of SE	Firm	Firm	Firm	Firm
Observations	1,974	1,973	1,976	1,976
Adjusted R-squared	0.533	0.423	0.874	0.401

TABLE 12: Impact of Lot Size Decrease on Price Volatility

*The table below shows future (column 1, 2, and 3) and spot price (column 4, 5, and 6) volatility around the implementation date of new future contracts when lot size of the contract is decreased using difference-in-differences framework. Firms for which the lot size was decreased form the "treatment" group and those for which there was no change in the lot size form the "control" group. The dependent variables standard deviation, skewness and kurtosis are measures of price volatility. We calculate these measures using one quarter of daily data before the announcement date for the "pre" period and after the implementation date for the "post" period. Control variable includes market capitalization and price-to-book ratio. Standard errors are clustered at the firm level and adjusted for heteroscedasticity. t-stats are reported in parentheses. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

		Future			**Spot**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
VARIABLES	**Std Dev**	**Skweness**	**Kurtosis**	**Std Dev**	**Skweness**	**Kurtosis**
Treatment	-0.000	0.139	1.008	0.000	0.195*	0.588
	[-0.379]	[0.870]	[1.048]	[0.304]	[1.959]	[1.010]
Post	0.001*	-0.368***	0.747***	-0.000	-0.090***	0.252*
	[1.731]	[-6.192]	[2.656]	[-0.956]	[-2.647]	[1.870]
Treatment * Post	0.002*	-0.239	-1.388	0.001	-0.141	-0.084
	[1.788]	[-1.127]	[-1.328]	[1.615]	[-0.955]	[-0.108]
Constant	0.140***	-4.912	39.677**	0.110***	-3.863	8.251
	[5.405]	[-1.278]	[2.259]	[5.724]	[-1.369]	[0.633]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Event FE	Yes	Yes	Yes	Yes	Yes	Yes
Clustering of SE	Firm	Firm	Firm	Firm	Firm	Firm
Observations	1,974	1,976	1,976	1,976	1,977	1,977
Adjusted R-squared	0.446	0.074	0.183	0.514	0.042	0.120

TABLE 13: Link Between Retail Participation, Price Efficiency, Liquidity and Volatility

*The table below shows the link between increased retail participation and change in price efficiency, liquidity and volatility. The data are organized at a firm event level. The measures of price efficiency, liquidity and volatility used before are the dependent variables. We calculate these measures using one quarter of daily data before the announcement date for the "pre" period and after the implementation date for the "post" period. The data are restricted to firms for which the lot size was decreased. Control variable includes market capitalization and price-to-book ratio. Standard errors are clustered at the firm level and adjusted for heteroscedasticity. t-stats are reported in parentheses. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

	1	**2**	**3**	**4**	**5**	**6**	**7**
	Price Efficiency		**Liquidity**			**Volatility**	
	D1	**D2**	**Average Turnover**	**Amihud's Measure**	**Std Dev**	**Skweness**	**Kurtosis**
Post	0.176	0.252	1029253.3	17.910*	0.01	0.811	7.567
	[1.319]	[1.121]	[0.559]	[1.948]	[1.429]	[0.287]	[0.480]
Retail Participation	0.085	-1.600***	-2.931e+07***	-162.847***	-0.080***	-24.763***	-179.209***
	[0.619]	[-7.244]	[-19.178]	[-16.610]	[-10.830]	[-9.000]	[-11.638]
Post * Retail Participation	-0.470*	-0.778*	-1330187	-35.711*	-0.013	-2.88	-19.059
	[-1.701]	[-1.760]	[-0.435]	[-1.821]	[-0.906]	[-0.523]	[-0.619]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Event FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	110	110	110	110	110	110	110
Adjusted R-squared	-0.028	0.299	0.631	0.139	0.407	-0.171	0.055

Figure 1: Regression Discontinuity Plot

Figure 2: *
The horizontal axis represents lot turnover and the vertical axis represents cumulative abnormal returns accumulated from Day 0 to Day 3.

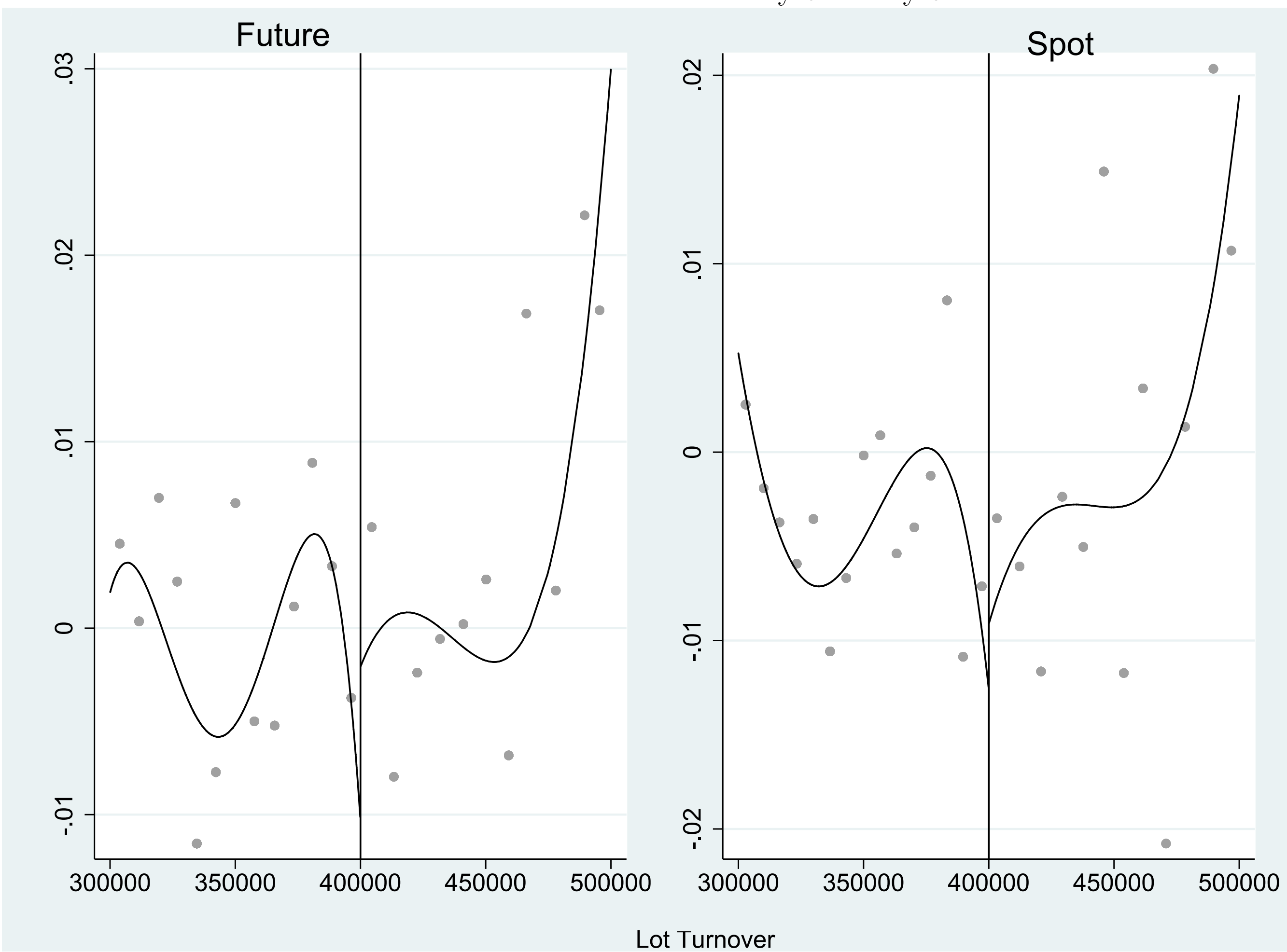

Figure 3: Regression Discontinuity Plot Without Outliers
The horizontal axis represents lot turnover and the vertical axis represents cumulative abnormal returns accumulated from Day 0 to Day 3.