Do Derivatives Matter?: Evidence From A Policy Experiment

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Abstract

We study the impact of derivatives on stock characteristics such as valuation, price efficiency, and liquidity. We resolve the endogeneity issue faced in the extant literature by using an order issued by the Indian market regulator that resulted in delisting of 51 stocks from the derivative segment. Using this policy experiment, we examine the conflicting hypothesis regarding the impact of derivatives on stock fundamentals. We find that excluded firms underperform the market by 4.07% during the event window. We identify decline in price efficiency and reduction in liquidity as channels through which the above phenomenon manifests. Contrary to the expectations of the regulators, volatility largely remains unchanged. We rule out regulatory targeting by employing several placebo and other robustness tests. We conclude that derivatives indeed add value by improving price efficiency and liquidity of a stock.

1 Introduction

Financial economists have recognised that a fuller understanding of the way an asset is priced requires a clear knowledge of the influence of derivative instruments, which use the asset under consideration as an underlying, on the fundamental characteristics of the asset (AN, Ang, Bali, and Cakici (2014), Johnson and So (2012), Easley, O'hara, and Srinivas (1998)). However, despite their first order importance and extensive research for over four decades, there is widespread disagreement regarding the influence exercised by derivatives on fundamental characteristics of an asset such as valuation, price efficiency, liquidity, volatility etc. A number of studies have found that derivatives have a positive impact on the underlying asset value by completing markets (Ross (1976)), enhancing informational efficiency of stock prices (Cao (1999), Easley, O'hara, and Srinivas (1998), Roll, Schwartz, and Subrahmanyam (2009), Naiker, Navissi, and Truong (2012), Blanco and Wehrheim (2015)), improving liquidity (Berkman, Eleswarapu, et al. (1998)) and reducing volatility (Damodaran and Lim (1991)). It has also been noted that derivatives alter the distribution of stock returns (Ni, Pearson, and Poteshman (2005)). On the other hand, some studies (Danielsen and Sorescu (2001), Ho and Liu (1997)) find that derivatives depress stock prices as they reduce short sale constraints. Some others have shown that derivatives do not have much of an impact. For example, Muravyev, Pearson, and Broussard (2013) show that option prices do not convey additional information. Vijh (1990) show that large option trades have no impact on stock prices and bid-ask spreads. Given the above conflicting findings Ni, Pearson, and Poteshman (2005) claim that "the literature relating to option introductions and expirations has not shown that equity option trading significantly impacts the prices of underlying stocks."

Such widespread disagreement regarding the impact of derivative securities stem from the lack of clear identification events to empirically examine the impact of derivatives. A major hurdle a researcher in this field faces is the problem of identification. Researchers have used derivative listing event (Conrad (1989), Kumar, Sarin, and Shastri (1998), Danielsen and Sorescu (2001)), the extent of derivative trading in a stock (Johnson and So (2012), Roll, Schwartz, and Subrahmanyam (2009, 2010), Admati and Pfleiderer (1988)) and lead lag relationship between the spot and the derivative market (Muravyev, Pearson, and Broussard (2013), Hu (2014)) for identification of the impact of derivatives on stock fundamentals. None of the above methods have been able to clearly identify the impact of derivatives, ruling out other endogenous explanations. Derivative listing has been shown to be endogenously decided by the exchange based on expected ex-post outcomes that the researchers seek to orthogonolize and study (Mayhew and Mihov (2004, 2005)).[1] Other two methods also face similar identification challenges. As these studies themselves point out, stocks with high options volume may be very different when compared to those with low option volume in many unobservable ways and the option volume may just reflect those differences in characteristics. Similar arguments can be made for lead lag strategy as well. Not surpassingly, therefore, the results of the extant studies on the impact of derivatives have significantly varied based on the asset class studied (Das, Kalimipalli, and Nayak (2014)), the time period of the study (Detemple and Jorion (1990)), the context of the study as reflected by the occurrence of major events (Cao (1999)), the nature of the derivative contract (Berkman, Eleswarapu, et al. (1998)) and many other observable and unobservable factors.

We overcome the above identification problem by examining a regulatory order issued by Securities Exchange Board of India[2] due to which 51 stocks were delisted from the derivative segment. On July 23, 2012, SEBI tightened the criteria for continuation of a stock in the derivative segment. Derivative listing criteria in India are based on thresholds, which depend on insider ownership and liquidity in the previous six months. The intent of the regulator was to allow derivative trading in stocks that are widely held and are highly liquid. The thresholds for continuation in the derivative segment were increased by SEBI. We believe

[1] Mayhew and Mihov (2004, 2005) show that the decision to list a stock in the options segment is endogenously determined by trading volume and volatility over the pre-listing period. In Mayhew and Mihov (2004) the control group consists of stocks that met the minimum criteria for listing in the options market but were not listed by the exchanges. More importantly, their logit model, which predicts listing based on ex-ante characteristics, also predicts ex-post outcomes attributed to derivative listing. Therefore it is difficult to deny the possibility that stocks may be listed in the options market based on expected real outcomes. Danielsen, Van Ness, and Warr (2007) show that derivative listing is accompanied by market-wide changes, which have an impact on stock characteristics. Thus the documented post listing impact of options could be an artifact of selection criteria for listing.

[2] The Indian market regulator

that the event was completely devoid of any endogenous factors because of the following reasons. First, old as well as new thresholds were based on historical as well as publicly available information whose impact, if any, is likely to have been priced in (Kaul, Mehrotra, and Morck (2000)). Second, in order to test if there is regulatory targeting as pointed out by (Karlan and Zinman (2009)), we plot the levels of the variables on which the exit decision is based for a period of 6 months before the SEBI order. In figure 1, we plot the values of the variables[3] on which exclusion decision is based for excluded stocks for the period of six months before exclusion. As can be seen, the measures for excluded stocks are relatively stable in the six months prior to exclusion. Further, there is no dramatic decrease in these measures just prior to SEBI changing the criteria for continued listing. Therefore, it is reasonable to conclude that the exclusion is a result of increase in threshold rather than any change in excluded stock characteristics. Third, it is well known that insider ownership tends to be sticky (Kaserer and Moldenhauer (2008)). Therefore, in order to rule out any residual concerns regarding regulatory targeting, we also study the price reaction of only those stocks that get excluded only because of failure to meet the revised insider ownership threshold.[4] Fourth, More importantly, unlike the situations considered by the extant literature (Mayhew and Mihov (2004, 2005)), the stock exchanges do not select the stocks to be listed or delisted. Compliance with SEBI regulations is mandatory for all stock exchanges. Therefore, endogenous selection by stock exchanges with an eye on future business opportunities is less of a concern in our setting.[5] Finally, we perform several placebo tests to establish the robustness of our results.

Using the above SEBI order, we first examine the impact of derivatives on stock returns in the short run. From the above discussion, three contradictory hypothesis emerge. First, Conrad (1989) and other show that derivatives add value positively. Under the above hypothesis, an exogenous derivative delisting is likely to lead to negative permanent price reaction. Second, Danielsen and Sorescu (2001) show that derivatives exert downward pressure

[3]The variables have been described in detail in 3

[4]In other words, when it comes to other criteria, these stocks are well above the required threshold

[5]In fact, news paper reports indicate that exchanges opposed such a move

on stock prices by easing short selling constraints. Under the above hypothesis, derivative delisting is likely to lead to a positive price reaction as short selling constraints increase post delisting. Finally, classical theories (Black and Scholes (1973)) consider derivatives as passive securities, in which case derivative delisting is unlikely to result in any significant price reaction.

We find that the stocks delisted from the derivative segment under-perform the broader market by 2.82% during our event window, which spans from 5 days before to 5 days after the event date.[6] As well, the negative returns are not recouped even after six months from the date of exclusion announcement. In order to understand the complete impact of derivatives, we create an event window by combining days both around announcement of exclusion as well as the actual exclusion. Using the expanded window, we find that the excluded stocks under perform the broader market by 4.07%. The negative and significant reactions to derivative exclusion clearly indicate that derivatives indeed add value to a stock. We then examine the impact on total trading turnover of a stock using the above event study framework. We find that, depending on the event window used, stock turnover declines by anywhere between 29.1% to 54.8% due to derivative exclusion.

Having established a link between derivatives and stock valuation, we then move on to establish the channel of influence. We start by investigating the link between derivatives and price efficiency. The extant literature has produced conflicting findings in this regard. While some important studies (Hu (2014), Easley, O'hara, and Srinivas (1998)) have shown that derivatives play an important role in price discovery, some others (Chan, Chung, and Fong (2002), Muravyev, Pearson, and Broussard (2013), Vijh (1990)) have denied such a possibility. Given the nature of the event, our setting allows us to cleanly measure the impact of derivatives on informational efficiency of the stock.

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

[6]The above result is robust to change in the event window

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 the ability of lagged market returns to explain stock returns of the excluded stocks increases by anywhere between 5.2% to 7.3%. We estimate the price efficiency regressions using the difference in difference framework and following Das, Kalimipalli, and Nayak (2014) we use, in separate tests, both pooled control sample as well matched control sample. In order to gauge the magnitude of change in price efficiency, we use the second measure (called D2) developed by Hou and Moskowitz (2005). This measure is simply the ratio between coefficients on lagged market returns upon the sum of coefficients on contemporaneous market returns and lagged returns. We find that the relative value of loadings on lagged market returns increase when compared to the loadings on the contemporaneous market returns. The economic magnitude of such increase ranges between 7.1% to 9.6%. From the above mentioned results, it is clear that price efficiency decreases post derivative desisting.

To further buttress our findings, we examine the number of analysts following the treatment and the control group firms before and after delisting. Roll, Schwartz, and Subrahmanyam (2009) show that stocks with higher options activity also attract higher analyst following, which in turn increases the informational efficiency of a stock. We find that the number of analysts following the treatment group firms significantly declines after delisting. The result holds even when we implement difference-in-difference specification using firms that continue to be listed as control group. Finally, we also find that that the earnings surprises significantly increase and the sensitivity of capital expenditure to stock value (Roll, Schwartz, and Subrahmanyam (2009)) significantly decrease for the excluded firms in the post delisting period. All the above results show that informational efficiency of the treatment group stock prices declines post delisting from the derivative segments. In other words, derivatives significantly contribute towards information production by inviting trades by informed outside investors.

The second channel that we examine is change in liquidity. Kumar, Sarin, and Shastri (1998) show that options help in enhancing the liquidity of a stock. It is also well known that arbitragers, noise traders and market makers operate both in spot as well as derivatives market to take advantage of any price discrepancies, to hedge positions or for reasons which at best can be termed as noise (Hu (2014)). Derivative delisting may drive away many such players who trade in both markets and thereby reduce liquidity in the cash market. We test for change in trading volume in the cash market for affected stocks. We find that the stock turnover in the spot market declines significantly post delisting. We test the impact of derivatives on liquidty using a battery of measures used in (Das, Kalimipalli, and Nayak (2014)). These measures range from simple daily volume to comprehensive measures such as Roll impact measure and Amihud's liquidity measure. All 8 measures of liquidity that we examine show a significant decline in liquidity in the post derivative delisting period. An overall permanent decrease in liquidity for the treatment group stocks results in lower valuation (Amihud and Mendelson (1986)). These results indicate that derivatives contribute significantly towards stock liquidity as well.

We then move on to test the impact of derivatives on stock volatility. As per classical theories, under full diversification idiosyncratic risks do not matter. However, recent studies have shown that due to under diversification idiosyncratic risks do matter for stock valuations (Fu (2009)). Using a difference in difference framework, we test the impact of derivatives on stock volatility. We use the measures used in Das, Kalimipalli, and Nayak (2014). We do not detect any change in volatility post delisting. However, skewness and kurtosis of returns show a significant increase.

Finally, we perform a number of tests to establish the robustness of all our results. First, we test for parallel trends (Bertrand, Duflo, and Mullainathan (2002)) and find them in all our difference-in -difference tests. Second, we conduct the following placebo tests to rule out alternative explanations. First, we conduct all our event studies and regression based tests using several false announcement and implementation dates. In these tests, we keep the exclusion criteria unaltered. We do not find any effects when we conduct tests based on false dates. If our results are driven by the fact that excluded firms had low outsider shareholding or low trading volume pre delisting and not because of delisting, one would expect to get results similar to our main results even in our placebo tests. Second, we also conduct a false limit test where we define our treatment group based on false limits without changing the event date. Here again, we do not find any difference between the treatment and the control group.

This paper contributes to the literature on the impact of derivatives by showing that derivatives positively impact stock valuation. The paper also contributes to the literature on informativeness of stock price by showing that price information efficiency is higher in the presence of derivatives than otherwise. Third, the paper also shows that derivatives indeed increase liquidity and hence contribute positively to stock value. Fourth, unlike existing inferences which are predominantly based on options, our inferences are not just limited to options but can be extended to futures as well. Indian derivative market comprises of both options as well as futures, with both categories trading actively. Finally, and most importantly, this paper exploits a regulatory event that is likely to be devoid of any endogenous information and to that extent produces clean identification, lack of which has been a major challenge for the extant literature in delineating the impact of derivatives.

The rest of the paper proceeds as follows: Section 2 provides the institutional background. Section 3 describes the event. Section 4 describes the data and summary statistics. Sections 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

[7]Source: http://www.bseindia.com/static/about/heritage.aspx?expandable=0

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 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

[8]Sensex comprises of 30 large companies in India from different sectors of the economy
[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

bigger than the underlying equity segment. As at the beginning of the year 2015, derivative transactions accounted for nearly 91% of all transaction volume in the stock exchanges.[14] 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 constraints. Given the short-sale constraints are severe in Indian spot markets (Berkman, Eleswarapu, et al. (1998)), derivatives are relatively more attractive compared to other markets. Roll, Schwartz, and Subrahmanyam (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 both options and futures are actively traded in India. Approximately 30% of derivative trading in India is in options and remaining in futures. This allows us to study the impact of both options as well as futures rather than options alone as is the case with the extant literature.

2.4 Regulation

The Securities and Exchange Board of India (SEBI), was formed on April 12, 1992 [15] 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 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. [16]

[14] Source: www.nseindia.com, www.bseindia.com

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

[16] Source: The Economic Times

3 The Event

Given that derivatives are complex instruments and come with high levels of leverage, regulators world over tend to be highly suspicious about them. In the U.S, the SEC took more than seven years to give permanent status to derivative instruments (Mayhew and Mihov (2004)). Initially, the options exchange was given only "experimental status". The SEC declared a "voluntary moratorium" on options trading in 1979 to study the impact of options trading and design appropriate regulatory mechanism. The SEC gave permanent status to options exchanges only in 1980.

SEBI has also been extremely cautious when it comes to derivatives. In fact, a forward trading facility known as the Badla (Berkman, Eleswarapu, et al. (1998)) was blamed by SEBI for "excessive speculation" and volatility in the 90s and was duly banned. Indian policy makers in general are apprehensive of derivative instruments and regularly call for imposition of restrictions on derivative trading, blaming derivative products for many negative consequences. For example, during periods of inflation, regulators conveniently ban forward trading in agricultural commodities[17] although there is no credible evidence to suggest that derivative products lead to higher commodity prices (Sahoo and Kumar (2009), Bose (2007)). Keeping up with the same spirit and tradition, SEBI, in 2012, came to a conclusion that it is desirable to restrict trading in derivatives in order to protect "market integrity".

3.1 The Criteria

On the 22nd of July 2012, SEBI issued guidelines tightening the qualification criteria for continued listing in the derivative segment. One of the criteria was dependent on the amount of outside ownership and other two were liquidity measures. Table 1 provides details about thresholds that prevailed before SEBI notification and the changed level.

a. Market Wide Position Limit(MWPL): This measure is based on floating stock of a

[17] Details about one such instance are given in www.legalserviceindia.com

TABLE 1: Old and New Criteria For Continued Listing In The Derivative Segment

We report the old and revised criteria for continued listing in the derivative segment. All figures are reported in INR millions.

Parameter	Earlier	Revised
MWPL	600	2,000
MQSOS	0.2	0.5
MMT	0	1,000

company. The market wide position limit is 20% of the number of shares held by non-promoters in the relevant underlying security.[18] As shown in row 1 of Table 1, the applicable limit of average MWPL over six months was increased from INR. 600 million to INR. 2,000 million.

b. Median Sigma Quarter Order Size (MSQOS): Order size required to move the bid ask mid-point by one fourth of the historical standard deviation of the stock returns. NSE calculates these numbers and puts out the figures in the public domain. As shown in row 2 of Table 1, the applicable limit of MSQOS in the last six months for continued listing was revised from INR 0.2 million to INR 0.5 million.

c. Minimum Monthly Turnover (MMT): SEBI introduced a new criterion pertaining to minimum average monthly derivative turnover, which was set at INR. 1,000 million. MMT is calculated based on prior three months turnover.

3.2 The Reasons For Exclusion

Stocks that failed to meet any one of the above criteria were excluded from the derivative segment. Stock exchanges were not given any discretion in this regard. However, contracts that existed as on July 22nd 2012 (July 2012, August 2012 and September 2012) continued to trade until expiry. Table 2 (below) reports the number of stocks that get excluded due to various reasons. Please note that 30 stocks got excluded solely because of breaching the extended MWPL threshold, which is dependent on the amount of insider ownership.

[18]Source: NSE

TABLE 2: Number Of Stocks Excluded Due To Various Reasons

We report the number of stocks that get excluded because of failure to meet one or more criteria for continued listing in the derivatives segment.

Reasons	Number of Stocks
Excluded due to MQSOS	5
Excluded due to MWPL	30
Excluded due to MMT	4
Excluded due to MQSOS/MWPL	2
Excluded due to MQSOS/MMT	8
Excluded due to MWPL/MMT	0
Excluded due to MQSOS/MWPL/MMT	1

3.3 Possibility of Regulatory Targetting

In order to test if there is regulatory targeting as pointed out by (Karlan and Zinman (2009)), we plot the levels of the variables on which the exit decision is based for a period of 6 months before the SEBI order. In figure 1, we plot all three variables for excluded stocks for the period of six months before exclusion. As can be seen, MWPL, MMT and MQSOS for excluded stocks are relatively stable in the six months prior to exclusion. Further, there is no dramatic decrease in these measures just prior to SEBI changing the criteria for continued listing. Therefore, it is reasonable to conclude that the exclusion is a result of increase in threshold (grey lines below) rather than any change in excluded stock characteristics.

Figure 1 about here

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;

a. National Stock Exchange(NSE): As noted in Section II, NSE is the largest stock exchange in India. We obtain all price and turnover information from NSE. We cross verify the numbers on a sample basis from multiple other sources. From NSE, we also obtain information pertaining to definition of technical terms such as MWPL (Market Wide Position Limit) and MQSOS (Median Quarter Sigma Order Size), which are typical to Indian markets.

b. Center For Monitoring Indian Economy (CMIE) Prowess: Prowess database, maintained by CMIE, has gained reputation as 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, Mullainathan, and Bertrand (2002), Gopalan, Nanda, and Seru (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. We note that the information on capital expenditure is available only in annual statements and not in quarterly filings. For the purposes of some tests where a unit of observation is a quarter, we calculate capital expenditure by calculating the difference between next fixed assets in a quarter and its immediately proceeding quarter. [19]

c. SEBI Web Site: We obtain all relevant SEBI circulares from their web site. From these circulares, we obtain information about derivative listing and delisting norms. We also learn about the effective dates of various regulations from this source.

d. Bloomberg: We obtain data regarding the number of analysts covering each stock from Bloomberg data base. We collect this data at a quarterly frequency.

4.2 Summary Statistics

We report summary statistics in Table 3(below).

Table 3 about here

[19] We ignore research and development expenditure as research and development expenditure forms a negligible portion of total expenditure incurred by Indian companies

Columns 2,3 and 4, report the numbers for the set of firms that were excluded from the derivative segment and columns 5,6 and 7, report summary statistics for firms that continued in the derivative segment. In column 8(9), we test for difference in mean (median). All values are given in millions of Rupees and the reported values are from latest available financial statements as on July 23rd, 2013. From the table, it is clear that firms that get excluded are systematically larger than continuing firms. For example, mean (median) values for assets for excluded firms is Rupees. 2853.88 (713.00) million whereas the same for firms that continued in the derivative segment is Rupees. 7441.35 (2860.00) million. Similar differences exist with respect to annual gross revenue and market capitalization. Both mean and median differences are statistically significant at 99% level of confidence. In the next three rows we report mean (median) values for exclusion criteria and also compare the mean (median) differences between excluded and continuing firms. Here again, continuing firms are systematically larger with respect to all three parameters. We next examine differences in valuation and profitability. There is no significant difference between the two groups with respect to price to book ratio. The mean (media) profit to sales ratio for the excluded stocks is 0.28(0.20) which is significantly lower than the mean (median) profit to sales ratio of 0.42(0.27) for the continuing firms. Finally, we compare the two group of stocks with respect to trading volume. Here, we find that the trading volume both in spot market as well as derivative market is higher for continuing firms when compared to excluded stocks.[20]

5 Empirical Strategy And Results

In this section, we describe our empirical strategy.

[20] We perform similar comparisons by including stocks that get excluded solely because of MWPL in our treatment group and obtain similar results

5.1 Impact on Valuation

As we note in the introduction, a number of articles (Conrad (1989), Damodaran and Lim (1991), Danielsen and Sorescu (2001) have tested if derivatives improve or worsen stock valuation. We also note that the identification strategy used in the above studies is seriously questioned by subsequent articles (Mayhew and Mihov (2004), Danielsen, Van Ness, and Warr (2007)), which show that the results of earlier studies were influenced by endogenous listing decision of the exchanges. We revisit the question using an exogenous regulatory action as a setting to study the impact of derivatives on stock valuation.

5.1.1 Market Model

We first estimate a market model to calculate the abnormal returns for the 51 stocks that were excluded from the derivative segment. We use CNX-200 [21] as a proxy for market. We calculate abnormal and cumulative abnormal returns for standard event windows used in the literature. T-statistics are computed following the procedure in Boehmer, Masumeci, and Poulsen (1991). T-statistics are adjusted to take into account cross-correlation due to event-date clustering using the methodology described in Kolari and Pynnönen (2010). We estimate the the results using both SEBI announcement day as well as the actual day of exclusion as the event dates.

If derivatives indeed affect value then we expect;

a. negative abnormal returns around the date of announcement;

b. no reversal of returns after the event;

c. negative abnormal returns after actual delisting due to price pressure and hence could be temporary.

On the other hand if derivatives are redundant, then we do not expect any abnormal returns around the event. Finally, if short selling constraints dominate, then we expect a

[21] A broad based index consisting of 200 stocks This is the most liquid Index in India. This represents 50 large stocks from diverse sectors

positive stock price reaction post delisting.

5.2 Market Reaction

The results regarding market reaction to exclusion of stocks from the derivative segment are presented in 2 and Tables 4A and 4B. We report daily averages for 5 days before and 5 days after the event date. We estimate a market model, with CNX-200 as the benchmark. In table 4A, we consider the SEBI notification date as the event day and in table 4B, we consider the actual exclusion date. Please note that SEBI issued the order on 22nd July, 2012 and following the SEBI order the stock exchanges published the list of excluded stocks on the 23rd July at 5 P.M. Also note that the updated data required for arriving at the list of excluded stocks was not available in the public domain on July 22nd, 2012 and hence the names of excluded stocks were revealed to the market participants only on the 23rd July and that too after market hours. Therefore, we consider July 24th, 2012 as the event date for our event study examining market reaction to the announcement. With respect to actual announcement, there is no such ambiguity. Derivative contracts in India expire on the last Thursday of a month and at any point of time, contracts are issued only upto subsequent 2 months. Therefore, as on 22nd July,[22] derivative contracts for the months of July, August and September were already live. Therefore, the derivative trading on excluded stocks effectively ended on last Thursday of September, 2012.

Table 4A and 4B about here

In table 4A, we report the event study results for SEBI announcement. The event time is measured as the number of trading days from the event date. N (in column 2) refers to number of treatment stocks. AR stands for abnormal return generated by the market model for a stock i as on day d. CAR is the cumulation of AR from day -5 to day d. Std CS test refers to t-statistics computed following the procedure in Boehmer, Masumeci, and Poulsen (1991). T-statistics are adjusted to take into account cross-correlation due to event-date

[22] SEBI notification date

clustering using the methodology described in Kolari and Pynnönen (2010). In column 3 (4), we report the mean (median) abnormal returns. In column 4 (5), we report the mean (median) cumulative abnormal returns. The cumulation starts from day -5. In column 5(6), we report appropriate p values for mean (median) cumulative abnormal returns.

From Panel A of the table, it is clear that stock reaction around the event is negative. Mean (Median) cumulative abnormal return during -5 to +5 day window that we consider is -2.82% (-2.34%). Both the above numbers are economically as well as statistically significant. We obtain similar results even when we use Nifty, which is the most widely tracked Indian Index comprising of fifty large stocks, as a market benchmark.

We next plot both abnormal and cumulative abnormal returns in figure 2. Here we cover a window spanning from 10 days before and 120 days after the event day. The idea is to see if the negative shock shown in Table 4A gets reversed quickly or does it persist for a longer time. A persistent negative shock strengthens our inference that derivatives indeed add value.

Figure 2 about here

In the above figure, green line represents cumulative abnormal returns. Notice that this line remains in the negative territory even after 120 days from the event date. Also notice a sharp negative slide after day 45. This is the day when all existing derivative contracts expire. From the above, we infer that negative abnormal returns caused by derivative exclusion do not reverse immediately after the event and hence the reaction that we have documented is unlikely to be an instance of price pressure. We conduct further tests to test if the price reaction is permanent.

In order to gauge the market reaction to derivative exclusion in its entirety, it is important to look at the market reaction to the actual delisting as well. This is because any residual uncertainty with regards to implementation gets resolved on that day. We re-estimate the event study after considering the actual day of derivative exclusion as the event day and report the results in Table 4B. The cumulative abnormal return during our preferred -5 to

+5 event window is statistically insignificant. However, there seems to be some temporary price pressure just before delisting as evidenced by the negative 1.89% cumulative abnormal return during the -5 to +0 window. Please note that the event day here corresponds to 45th day from the day of SEBI announcement. However, unlike the announcement effect, this reverses itself within next 3 days.

Table 4C about here

Finally, In table 4C, we combine the event studies reported in table 4A and table 4C and report the cumulative market reaction between -5 to +5 window after announcement and -5 to +1 window after actual exclusion. We restrict the post actual delisting period to just 1 day (instead of 5 days for announcement) after exclusion as information regarding exclusion was widely available. As can be seen in table 4C, the mean (median) cumulative abnormal reaction from -5 to 46 day window [23] is -4.07% (-5.02%), which is both statistically as well as economically significant.

The results presented in Table 4C unambiguously show that derivative delisting leads to negative price reaction for excluded stocks. Given the exogenous nature of the event and the sharp price reaction that we detect using a narrow window around the announcement and exclusion dates, it is reasonable to conclude that loss of value is indeed caused by derivative exclusion, or, in other words, derivatives add value to the stock. In the rest of the paper, we focus on establishing the robustness of the above result and also detecting the source of value added by derivative instruments.

5.2.1 Robustness Tests

As pointed out in the Introduction, we perform a number of robustness tests. Before dwelling into the specifics of the robustness tests, it is important to note the possible source of endogeneity. One possible concern could be that these results reflect a reaction to a pre existing trend in variables used for determining derivative delisting. For example; if stocks

[23] Please note that we consider a total of 17 days, which consists of 11 days (-5 to +5) around announcement and 6 days (-5 to 1) around the actual event

that have declining liquidity are more likely to get excluded, then it is possible that such stocks experience negative returns (Amihud and Mendelson (1986)) once the market learns about such a decline. In this case negative returns would ensue even without derivative delisting. A second related concern is related to regulatory targeting. Is it possible that regulators carefully chose the above limits based on some information not available publicly ?

We note the following in this regard. First, as we have pointed out in figure 1, the three exclusion criteria (MWPL, MQSOS and MMT) are based on publicly available historical information. The only new information is the revision in the criteria by SEBI. The revision is completely orthogonal to company fundamentals. As shown by (Kaul, Mehrotra, and Morck (2000)), any plausible price impact of historical information should have already played out. For example, say, TVS Motors has a MQSOS of INR .3 million for the six months ending July 23, 2012 and due to SEBI's notification, the stock gets excluded. Then, it is unlikely that MQSOS, which is public information, will move prices after the SEBI announcement. It is difficult to argue that impact of change in MWPL or MOSOS plays out after every six months.

Second, as noted in the introduction, the argument that the results are a reaction to a pre-existing trend in MWPL, MQSOS or MMT is likely to have merit only if there is a decreasing trend in those variables for the affected stocks and not for other stocks. Continuing with the TVS Motors example, say, in the last 10 days MWPL (or MQSOS or MMT) decreases and this decrease brings the average below the new threshold, then one may argue that the price impact post delisting may be an impact of this decrease, which almost coincides or might have influenced SEBI's decision to revise the listing criteria. On the other hand, if the above numbers are steady or increasing or do not show any differential change for the excluded stocks when compared to retained stocks, then it is difficult to make such arguments. In Figure 1, we show that the numbers remain stable during the estimation period.

Third, we perform separate price reaction tests for stocks that get excluded solely because of not meeting the revised MWPL hurdle. It is important to note that MWPL is based on proportion of outside ownership in a stock. This is unlikely to change in a span of six months unless there are some new issues or insider exits.[24] Therefore we expect MWPL to be sticky. Therefore, in order to further rule out regulatory targeting, we estimate the market model separately for stocks that were excluded solely due to lower MWPL. If stocks that get excluded solely due to lower MWPL also react negatively, it is further evidence that the event is indeed endogenous. It is difficult to make a case of regulatory targeting based on MWPL, which is sticky.

We show through Figure 1 presented in the Introduction that MWPL, which depends on proportion of insider ownership, remains almost flat during the estimation period. We also discuss in Section 3 that the possibility of regulatory targeting is lowest for stocks excluded solely for not meeting revised MWPL threshold. We point out in Table 2 that the 30 stocks get excluded for not fulfilling minimum MWPL requirement alone. We estimate the market model only for those stocks that get excluded the derivative segment due to breach of minimum MWPL requirement. We report the results for SEBI announcement date. Results are reported in Tables 5A, 5B and 5C .

Tables 5A, 5B and 5C about here

From the table, it is clear that stock reaction around the event is negative. Mean (Median) cumulative abnormal return during -5 to +5 day window that we consider is -3.7% (-4.05%). Both the above numbers are economically as well as statistically significant. The above result rules out the possibility of regulatory targeting. We cannot estimate the price reaction separately for stocks that get excluded for reasons other than MWPL as such stocks are very few in number.

In order to examine the long term reaction of stocks that get excluded because of MWPL, we plot the stock returns around event date in figure 3.

Figure 3 about here

The green line represents cumulative abnormal returns. It is clear from the figure that

[24] We perform a news search and do not find any such events for stocks getting excluded for lack of MWPL

negative abnormal returns tend to persist even after 120 days after the date of exclusion. Excluded stocks yield a cumulative abnormal negative return of nearly 11% during 120 days after the event day. This rules out price pressure driving our results. Given that there is very little chance of regulatory targeting, this result represents a cleaner measure of impact of derivatives on stock prices.

Fourth, if the new limit for exclusion is informative, then they are likely to remain so irrespective of SEBI action. We perform placebo tests to test this possibility. We estimate our market model by considering 200 randomly selected placebo dates as event dates and calculate the average CARs around such dates. It is important to note that our treatment group or the placebo excluded sample is likely to be different for different days as we select the sample by applying SEBI's exclusion criteria on each day. For example, on April 1 2011, which is a placebo event day, our sample includes those stocks that were a part of derivative segment as on April 1 but did not fulfill SEBI's revised criteria for continued listing as per norms declared on July 22nd. Here again, if reaching revised exclusion limits in itself is informative, then one can expect a negative stock price reaction even on the placebo dates. On the other hand, if our results are primarily driven by exclusion of treatment stocks form the derivatives segment, then no price reaction is likely on the placebo dates. We estimate the market model for placebo event dates by following the procedure described above. We calculate the average Abnormal Return and Cumulative Abnormal Return from all placebo event dates. For the sake of brevity, we do not report the above results. On an average, we do not find any significant stock movement around the placebo dates. We find that the average of all placebo tests indicate that, in general, having either MWPL or MQSOS within the range that lead to exclusion of 51 stocks in July 2012, does not convey any price sensitive information. If it did, negative reaction would have manifested even in the placebo tests.

Finally, the above falsification test does not address the concern that only during July 2012, due to some unobservable reasons or reasons known only to SEBI, stocks with lower levels of historical MWPL, MQSOS or MMT, under-perform the market. Therefore, the argument could go that the observed price reaction would have ensued regardless of SEBI action. In order to rule out such a possibility, we perform placebo tests using false limits. We create false limits for MWPL, MQSQS and MMT by keeping the event date unchanged(July 22nd 2012). A new false limit is created at an increment of INR. 10,000 for all three criteria. We estimate the market model by using all possible combination of false limits. The idea here is to test if lower MWPL, MQSOS, or MMT in the previous six months indeed translates to lower returns subsequently. If lower levels of MWPL, MQSOS, or MMT lead to lower future returns, then such a phenomenon is likely to manifest even at levels other than SEBI limits. On the other hand, if the results are driven by derivative delisting, then negative returns are likely to manifest only around exclusion limits. We perform the false limit test described above. As before, we calculate the average Abnormal Return and Cumulative Abnormal Return. In line with our main hypothesis that the results reported in this paper are driven by derivative exclusion and not by either regulatory targeting or due to lower trading volumes, we find no significant reaction around the event days when we use false limits. Therefore it cannot be said that our 51 excluded stocks lost value due to them having lower MWPL or MQSOS. For the sake of brevity, we do not report the above results.

5.3 Event Study Results For Turnover

We proceed to test the impact of the event on stock turnover. We perform the above event study using stock turnover before and after the event. We calculate abnormal volume as follows;

a. for any given trading day i, we first calculate the average trading volume over the 60 days immediately preceding day i.

b. The difference between the volume on day i and the average as calculated above represents our measure of abnormal volume.

We estimate the following regression equation;

$$Ab_{V}ol_{\text{ij}} = \alpha + \nu_i + \delta_j + \theta_{sj} + \beta_1 * \text{Treat} + \beta_2 * X_{ij} + \epsilon_{ijs} \tag{1}$$

This is a cross sectional regression with abnormal volume of a stock i during a window j being the dependent variable. The total sample includes retained as well as excluded stocks. Treat is a dummy that takes the value of one for excluded stocks and zero for other stocks. Xij refers to firm level control variables similar to ones used on equation (1).

Given the short selling constraints in the spot market, it is difficult to argue that all traders who were trading in derivatives seamlessly move to spot markets post exclusion of the stock from the derivative segment. We test if the trading volume in spot markets change delisting. We report the results of estimating equation (1) in table 6 below.

Table 6 about here

It is important to note that actual derivative trading continued for 45 days after the event date as existing contracts were kept active even after notification. Keeping this in mind, we devise our event windows. Each column in the table represents a event window. Column 2 covers an interval comprising of the event day and 3 days immediately after the event. We select this window because the July contract was due for expiry on 25th of July (3days from the event date of 22nd July). We expect a spike in volume immediately after announcement due to incremental trades aimed at closing existing open positions. We do find an immediate spike of 33.8% (column 2) in volume from the event date to the date of expiry. Please note that the next two months contract were kept open as they existed before the date of SEBI announcement. Therefore, we report, in columns 3 and 4, abnormal volumes for the excluded stocks for next two months separately. We do not find any statistically significant jump in volume in the next two months. Finally, in column 5, we look at volume reaction after 46th day, when all derivative contracts are eliminated. Here we find that during one month period following the 46th day, volumes in the spot market falls by a whopping 54.8%. In other words, volumes in the spot market falls by more than a half post derivative exclusion.

It is possible to argue that some of the fall is merely a reversal of the 33.8% increase (reported in column 2) seen immediately after the announcement by SEBI. In order to asses the overall impact of derivative exclusion on trading volume in the spot market, we report the abnormal volumes for the excluded stocks when compared to retained stocks for a period of 120 days from the date of exclusion. Here, again we find that volumes decline by 28.3% for the excluded stocks when compared to retained stocks. The number is comparable to the estimate made by Berkman, Eleswarapu, et al. (1998). Above results show that derivatives indeed improve liquidity in the spot market and hence add value to a stock.

5.4 The Channel

We then move on to examine the channels through which derivatives influence stock valuations. Specifically, we examine if derivatives

a. enhance price efficiency of stock prices by facilitating informed trading;

b. add to liquidity of stock

c. alter the volatility of stock returns

5.4.1 Price Efficiency- Speed of Information Assimilation

A number of scholarly studies have examined the impact of derivatives on price efficiency of a stock and found mixed results. A number of approaches and methods have been adopted in this regard. While some studies have developed elaborate theories (Easley, O'hara, and Srinivas (1998)) regarding the price efficiency impact of derivatives, others have used clever empirical designs such as examining lead lag relationships (Muravyev, Pearson, and Broussard (2013)) , comparing the association between stock market signals and capital expenditure for stocks with high derivative trading and those with low derivative trading (Roll, Schwartz, and Subrahmanyam (2010)), testing the reaction of derivative and spot markets to special events such as mergers (Cao (1999)), differentiating between spot market order flow driven by derivatives and others ((Hu (2014))) etc. Although the above mentioned studies use cleverly crafted instruments and perform a battery of robustness tests to rule out alternative explanations, lack of a truly exogenous shock to derivative trading in a stock makes them vulnerable to alternative explanations. Moreover, a clear divergence in results produced by the above mentioned studies further increases the need for a study that analyses the impact of derivatives on price efficiency in the context of an exogenous shock to the derivative trading.

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.

$$Y_{\mathrm{ij}} = \alpha + \nu_i + \beta_1 * \mathrm{Market} + \beta_2 * \mathrm{Lag1} + \beta_3 * \mathrm{Lag2} + \beta_4 * \mathrm{Lag3} + \beta_5 * \mathrm{Lag4} + \epsilon_{ijs} \tag{2}$$

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 fist 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-efficients 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.

If derivatives indeed contribute positively to price efficiency, then price efficiency is likely to decrease after derivative delisting. In other words, both our measures of price efficiency (or inefficiency) should increase after derivative delisting.

Using D1 and D2 as measures of price efficiency we conduct the following tests;

a. We first make a univariate comparison in a difference-in-difference sense using excluded stocks as treatment group and all other stocks that continue in the derivative segment as control group. Our measure of interest can be represented as follows:

$$\begin{aligned} \beta_1 &= (\overline{Y}_{\text{Treatment firms}} - \overline{Y}_{\text{Control Firms}})\big|_{\text{After Derivative Exclusion}} \\ &\quad - (\overline{Y}_{\text{Treatment firms}} - \overline{Y}_{\text{Control firms}})\big|_{\text{Before Derivative Exclusion}} \end{aligned} \tag{3}$$

b. We perform a difference in difference test using excluded stocks as treatment group and all other stocks that continue in the derivative segment as control group and test for change in price efficiency. Following (Das, Kalimipalli, and Nayak (2014)), we call this pooled controlled sample. We estimate the following regression equation;

$$Y_{\text{ij}} = \alpha + \nu_i + \delta_j + \theta_{sj} + \beta_1 * \text{Post} * \text{Treat} + \beta_2 * \text{Post} + \beta_3 * \text{Treat} + \beta_4 * X_{ij} + \epsilon_{ijs} \tag{4}$$

Each observation represents stock return for a week. We cover a period of two years before and two years after exclusion. We do not consider the period between SEBI announcement (July 22nd) and actual exclusion (September 25th). Treat refers to a dummy variable that takes the value of 1 for excluded stocks and zero for other stocks. Post refers to post derivative exclusion period.

c. We perform the same test as outlined above using a matched control group. We create the matched sample following the procedure outlined in (Das, Kalimipalli, and Nayak

(2014))

Table 7A and 7B about here

The results are reported in Tables 7A and 7B. Univariate results presented in table 7A clearly show a significant decline in price efficiency for the treatment stocks in the post period in a difference-in-difference sense. In multivariate tests presented in 7B, we report the results for difference in difference test and hence our focus is on the interaction between post and treatment. In columns 2 and 4, D1 is the dependent variable whereas in columns 3 and 5, D2 is the dependent variable. We use the pooled control sample in columns 2 and 3 and matched control sample in columns 4 and 5. The explanatory power of the lagged market returns, as reflected in change in D1, increases by anywhere between 5.2% to 7.3% in a difference in difference sense. Similarly, the economic magnitude of price efficiency, as measured by D2, changes by anywhere between 7.1% to 9.6%. Please note that the economic magnitude of increased price inefficiency matches with the negative price reaction documented in Table **??**.

Please note that in our reported results, we do not include either time or stock fixed effects due to the exogenous nature of the event and the difference and difference framework used. However, in untabulated results, we estimate the above difference-in-difference regression equation using both time and stock fixed effects. Inclusion of the above fixed effects do not change our results materially.

5.4.2 Price Efficiency- Number Of Analysts Following

Following (Damodaran and Lim (1991)), we also test if there is any change in the number of analysts following excluded stocks in the post delisting period when compared to pre delisting period. It has been recognised in the literature that analysts (Asquith, Mikhail, and Au (2005)) contribute towards both production of new information as well as interpretation of existing information. It has also been hypothesised that informed investors prefer derivatives for various reasons (Chakravarty, Gulen, and Mayhew (2004)). Given the above, we test if delisting results in reduced interest for the stock among analysts. Here again, we estimate a difference-in-difference regression similar to equation (2) above. The dependent variable is the number of analysts covering a stock i during a quarter j. All other terms remain same as in equation (2).

A negative and significant value for the difference-in-difference term would indicate that the analyst interest in the excluded stocks reduces post delisting. Such a result strengthens our view that derivatives lead to increased informed investor participation and hence their exclusion results in loss in informational efficiency. On the other hand, if derivatives have no such impact as (Vijh (1990)) shows, then we expect the difference-in-difference coefficient to be insignificant.

If a significant chunk of informed investors use only the derivatives route for exploiting the information at hand, then derivative exclusion is likely to see exit of such investors from excluded stocks. Consequently, analyst coverage on excluded stocks is likely to decrease. We test the above phenomenon by estimating regression equation (1) with number of analysts following a stock in a quarter as a dependent variable. The results of the above regression are reported in Table 8.

Table 8 about here

Each observation is at a firm quarter level. Our focus here is on the difference in difference term, which represents the change in difference between analyst coverage between excluded and retained firms in the post period when compared to pre period.

We find that the number of analysts covering the treatment firms drops significantly post the exclusion. We find that on average nearly four (column1) analysts stop covering the excluded firms because of derivative exclusion. The number drops to nearly 3 (columns 2), when we include other firm level controls. Given the above difference-in-difference result, we believe that a significant reduction in analyst coverage could have contributed to the reduced information production, which in turn could have influenced valuation of the affected stocks.

Please note that in our reported results, we do not include either time or stock fixed effects due to the exogenous nature of the event and the difference and difference framework used. However, in untabulated results, we estimate the above difference-in-difference regression equation using both time and stock fixed effects. Inclusion of the above fixed effects do not change our results materially.

5.4.3 Additional Measures of liquidity

We recognize that trading volumes alone fails to capture the complete impact of derivatives on liquidity. Therefore, following (Das, Kalimipalli, and Nayak (2014)), we use a battery of liquidity measures to test the impact of derivatives on stock liquidity. In total, we use 8 liquidity measures starting from total number of trades to Amihud measure of liquidity.

We start with univariate comparisons between the excluded stocks and all other continuing stocks using a difference-in-difference framework. Our univariate comparisons can be represented using equation 3. The results for univariate comparisons are reported in panel A to panel L of table 9A. We use the liquidity measures devised by Das, Kalimipalli, and Nayak (2014). The dependent variables, sequentially, are as follows: average daily trade (Panel A), average trade size (Panel:B), Amihid illiquidity measure for cash market, Amihid illiquidity measure for cash market and derivative segments (Panels C and D), average turnover in cash market derivative segments (Panels E and F), Roll impact measure (Panel G), total number of trades in a quarter(Panel H), total turnover in cash market and total turnover in cash and derivative segment(Panel I and J), Volume in cash markets and combined volume in cash and derivative segment (Panels K and L). Two years before SEBI notifications represents the "pre period" and two years after actual exclusion of stocks from derivative segment represents the "post" period.

The results clearly show a decline in liquidity. For example,In panel A of table 9A, we find that the average trade volume declines for the treatment group stocks in the post exclusion period whereas the same increases for the control group firms. We find similar results with respect to other measures of liquidity.

We then examine the impact on liquidity in a multi variate framework. We estimate regression equation (1) using each of the 8 measures as dependent variable in separate regressions. We estimate our results using both pooled controlled sample as well as matched controlled sample but report results only using the former. The results are reported in Table 9B.

Tables 9A and 9B about here

The table shows the impact of derivatives on liquidity. The sample consists of all stocks that were listed in the derivative segment before exclusion. Stocks that get excluded form the treatment group and those that continue to be listed in the derivative segment form the control group. Each observation represents a firm-quarter. We use the liquidity measures devised by Das, Kalimipalli, and Nayak (2014). The dependent variables, sequentially, are as follows: total number of trades in a quarter, average daily trades, total volume in cash market, total volume in cash and derivative segments, average trade size, total turnover in cash market, total turnover in cash and derivative segment, average daily turnover in cash market, average daily turnover in cash and derivative segment, Amihid illiquidity measure for cash market, Amihid illiquidity measure for cash market and derivative market and Roll impact measure. Two years before SEBI notifications represents the "pre period" and two years after actual exclusion of stocks from derivative segment represents the "post" period. The independent variable of interest is the interaction between treatment and post dummies. Other control variables include measures for firm size, firm profitability and liquidity. The levels of exclusion criteria (MQSOS, MWPL, Turnover) are also used as control variables.

All 8 measures are both economically as well as statistically significant. The results presented in the table clearly show deterioration in liquidity for the excluded stocks. The result remains robust to change in definition of liquidity.

5.4.4 Impact on Volatility:

Although traditional asset pricing theories do not assign any weight to idiosyncratic risks in determining expected returns, subsequent empirical research has shown that such risks do matter. Lack of sufficient diversification in investor portfolios leads to such a result (Fu (2009)). Given the above findings it is pertinent to ask if derivatives impact volatility of stock returns and thereby impact expected returns. In order to test the impact of derivatives on volatility, we estimate regression equation (6) with various measures of volatility as dependent variables. We follow (Das, Kalimipalli, and Nayak (2014)) in devising measures of volatility. The results are reported in Table 10.

Table 10 about here

The observations are organized at week-firm level. In column 1, we look at change in standard deviation in a difference in difference sense. As before, our main dependent variable of interest is the interaction between post delisting period and the treatment dummy. From the results presented in table, it is not possible to reject the hypothesis that the difference in standard deviation of returns between treatment and the control groups remains unchanged in post period when compared to the pre delisting period. We next look at standard deviation of returns (in column 2), absolute value of returns (in column 3), number of observations with returns lower than two standard deviation from the historical average(in column 4), number of observations with returns higher than two standard deviation from the historical average(in column 5), number of observations with returns higher than two standard deviation or lower than two standard deviations from the historical average(in column 6), standard deviation given return is below two standard deviation from historical average(in column 7), standard deviation given return is above two standard deviation from historical average(in column 8), absolute difference between a day's high and low price averaged at quarterly level (in column 8), skewness and kurtosis (in columns 9 and 10 respectively).

Please note that there is a marginal increase in standard deviation by about 4%. But it is significant only at 90% level and the significance vanishes when we employ fixed effects.[25] Most measures except standard deviation of negative returns are statistically insignificant indicating that volatility largely remains unaffected due to derivatives. The one measure- standard deviation of negative returns- which is marginally significant at 90% level of confidence shows a reduction in volatility of negative returns. This could be an immediate reaction to increased short selling constraints.

We next look at higher order moments. In column 9, we look at skewness and in column 10, we look at Kurtosis. As shown in the table, both the measures show a significant increase. Skewness increases by 20.5% and Kurtosis by 33.9%. Increase in skewness towards the right could be attributed to increase in short selling constraints. Increase in Kurtosis points out at the increased magnitude of extreme returns for excluded stocks in the post delisting period.

From the above results, it is reasonable to conclude that derivatives have little effect on the overall volatility of stock returns. However, they lead to increased skewness and kurtosis. Therefore, extreme returns become not only more likely but also more intense in post delisting period.

6 Conclusion

In this paper we revisit the question of whether derivatives are passive securities. Most studies in this area use derivatives listing or delisting as events to study the impact of derivatives on stock characteristics. However, with Mayhew and Mihov (2004) and Danielsen, Van Ness, and Warr (2007) showing that the decision of an exchange to list derivatives could be influenced by expected trends in fundamentals, a question mark has risen over the findings of the extant literature, which has used derivative listing as an event to study the impact of derivatives. Some studies have tried to overcome the same by considering stocks with

[25] Please note that in our reported results, we do not include either time or stock fixed effects due to the exogenous nature of the event and the difference and difference framework used. However, in untabulated results, we estimate the above difference-in-difference regression equation using both time and stock fixed effects. Inclusion of the above fixed effects do not change our results materially.

high derivative trading as the ones who are likely to have maximum impact of derivatives when compared to stock with low derivative trading. However, decision to trade derivatives on a stock might be influenced a number of endogenous factors. And finally and most importantly, there is no consensus regarding the possible impact of derivatives on stock characteristics. Some studies show positive impact Roll, Schwartz, and Subrahmanyam (2009), Conrad (1989), while some others show negative impact (Danielsen and Sorescu (2001) and some other showing no impact (Vijh (1990)).

We contribute to the literature by examining the impact of derivatives on stock fundamentals using a exogenous event. On July 22nd 2012, India's market regulator issued an order tightening the eligibility criteria for continuance in the derivative segment. These criteria were based on amount of outside ownership (MWPL) and trading volume (MQSOS) during the preceeding six months. The applicable limits with respect to both criteria were raised substantially. Thus the change in criteria was based on purely historical information.

Using the above natural experiment, we find that derivatives indeed add value. Derivative exclusion leads to 2.82% negative cumulative abnormal returns for the excluded stocks in the 5 days after exclusion. We then investigate the channels of such influence. We show that derivatives impact valuation by enhancing price efficacy as well as liquidity. Contrary to the expectations of the regulators, volatility largely remains unchanged.

We rule out regulatory targeting by performing a number of placebo tests. First, we show that there is no trend in the attributes used as benchmarks for exclusion. Especially there are no jumps for excluded stocks towards the end of the estimation period. Second, we perform several placebo tests to rule out alternative explanations. Third, we estimate our main result using only those stocks that get excluded because of a relatively sticky criteria of insider ownership. All our results taken together show that derivatives indeed add value to an underlying by improving liquidity and enhancing price efficiency.

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Figure 1: Trend In Exclusion Criteria

The three lines correspond to the three exclusion criteria described in 3. The grey lines represent the threshold limit for exclusion. The thick lines represent the average values for the stocks that get eventually excluded.

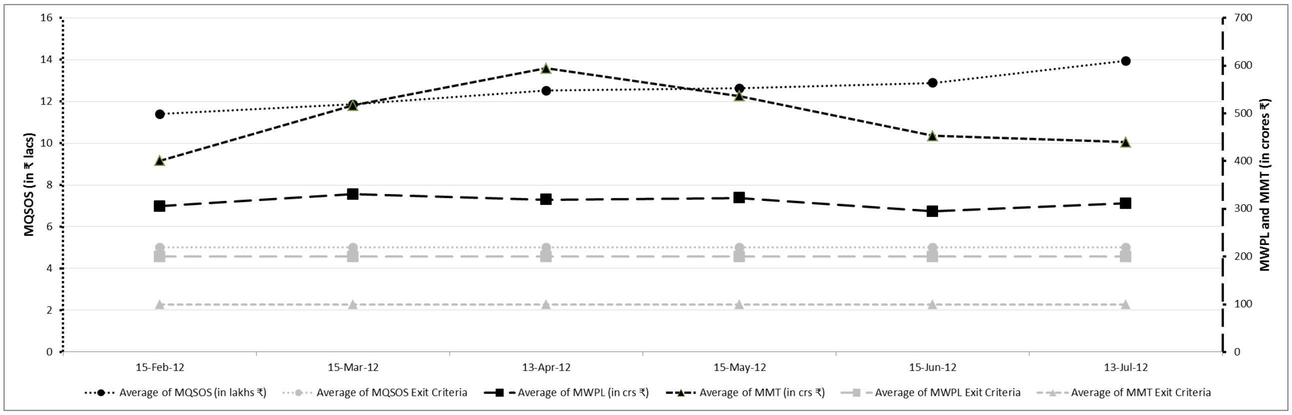

Figure 2: Market Reaction- All Excluded Stocks

This figure depicts the event study results for a period starting from 10 days before the SEBI announcement and ending on 120th day after the announcement. The green curve represents the Cumulative Abnormal Returns (CAR). The first blue vertical line denotes SEBI announcement date and the second vertical blue line denotes the actual exclusion day.

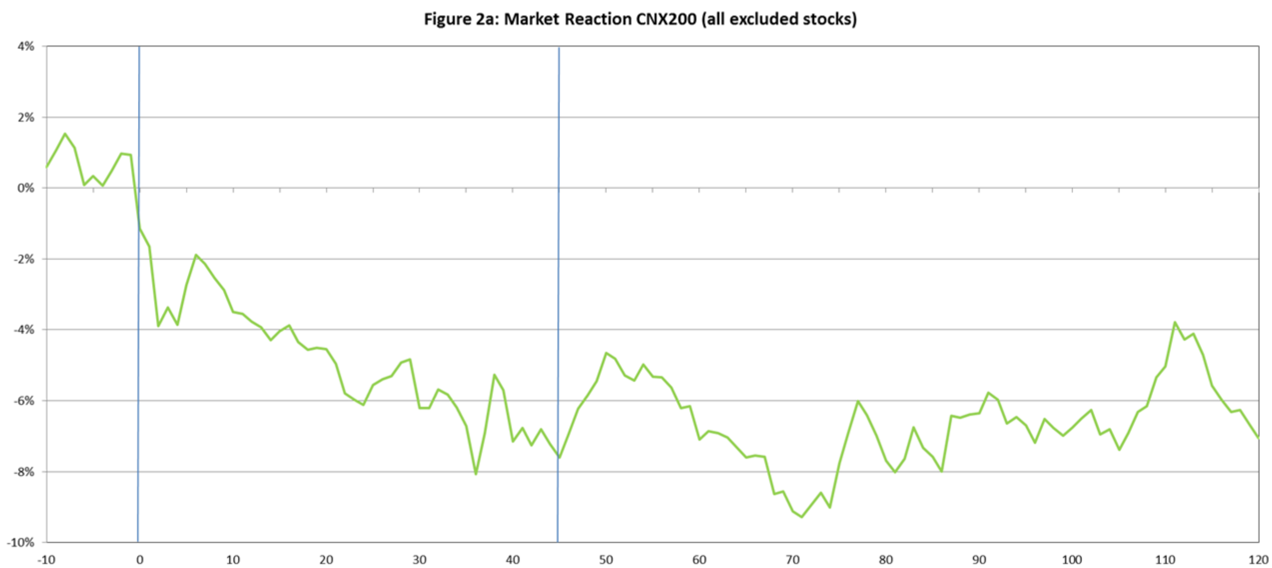

Figure 3: Market Reaction- Stocks Excluded Due to MWPL

This figure depicts the event study results for a period starting from 10 days before the SEBI announcement and ending on 120th day after the announcement. The event study is restrcited to stocks that got excluded solely due to failure to comply with MWPL requirement. The green curve represents the Cumulative Abnormal Returns (CAR). The first blue vertical line denotes SEBI announcement date and the second vertical blue line denotes the actual exclusion day.

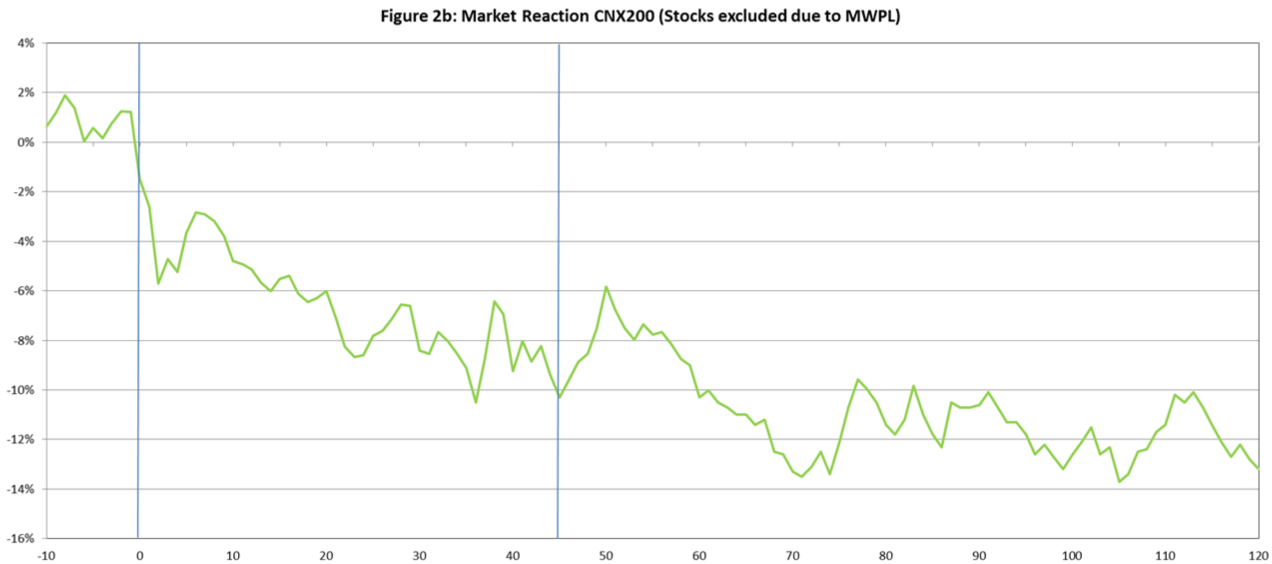

TABLE 3: SUMMARY STATISTICS- COMPARISON BETWEEN EXCLUDED AND RETAINED STOCKS.

We compare excluded firms and retained firms based on parameters such as sales, market capitalisation, earnings, turnover, market-wide position limit and median quarter sigma order size. We report mean, median, number of observations and standard deviation for all variables. MWPL, MQSOS and turnover are reported for the six month period immediately preceding delisting. Sales and EBIT are for financial year 2011-2012. Price to book ratio is calculated based on the last available financial statement. Reported market capitalisation is as on 21st July 2012. Turnover is calculated by dividing stock volume by floating market capitalisation. All figures (except for ratios) in Rupees Million. ***, **, * represents statistical significance at the 1%, 5% and 10% levels.

	Continuing Firms			Excluded Firms						
	N	Mean	Median	N	Mean	Median	Mean Diff	T-Stats	Median Diff	T-stats
Total Assets*	50	2853.9	713.0	154.0	7441.4	2860.0	-4587.5***	-3.2	-2147.0***	-4.5
Revenue*	50	64593.8	25233.4	154.0	214745.9	73741.0	-150152.1***	-3.4	-48507.5***	-5.0
Market Cap*	50	44561.7	21337.3	154.0	292856.2	117804.3	-248294.6***	-6.5	-96467***	-7.2
MMT*	50	4464.8	3237.3	154.0	26018.9	8959.5	-21554.1***	-4.8	-5722.2***	-6.2
MQSOS*	50	1.4	0.8	154.0	3.9	2.3	-2.5***	-5.5	-1.6***	-6.3
MWPL*	50	3114.3	1560.5	154.0	26261.4	10558.9	-23147.2***	-5.8	-8998.5***	-8.5
PB	47	2.8	1.3	153.0	3.0	1.9	-0.2	-0.2	-0.6	-1.5
Profit to Sales	50	0.3	0.2	154.0	0.4	0.3	-0.1***	-3.0	-0.08***	-2.7
Volume CM	50	79.4	49.9	154.0	407.5	187.0	-328.1***	-5.6	-137.08***	-6.3
Volume FnO	50	269.9	150.1	154.0	1679.3	578.7	-1409.4***	-4.7	-428.6***	-5.8

TABLE 4A: MARKET REACTION TO ANNOUNCEMENT.

The table shows the price reaction of all excluded stocks around the SEBI notification date an event-by-event basis. We consider the SEBI notification date as the event day. Event time is measured as the number of trading days from the event date. We cover a period of 5 days before and 5 days after the event. N (in column 2) refers to number of excluded stocks, for which we have data. AR stands for abnormal return generated by the market model for a stock i as on day d. CAR is the cumulation of AR from day -5 to day d. Columns 2 to 6 show CAR while columns 7 to 10 show AR. Std CS test refers to t-statistics computed following the procedure in Boehmer, Masumeci, and Poulsen (1991). T-statistics are adjusted to take into account cross-correlation due to event-date clustering using the methodology described in Kolari and Pynnönen (2010). ***, **, * represents statistical significance at the 1%, 5% and 10% levels.

		CAR				AR			
Event Day	N	Mean	Median	Std CS test	S R test	Mean	Median	Std CS test	SR test
-5	50	0.24%	0.22%	0.61	178.5*	0.24%	0.22%	0.46	178.5*
-4	50	-0.02%	-0.17%	-0.04	-51.50	-0.26%	-0.55%	-0.57	-228.5**
-3	50	0.39%	0.58%	0.56	122.50	0.41%	0.16%	0.94	215.5**
-2	50	0.89%	0.87%	1.04	205.5**	0.50%	0.16%	1.00	156.50
-1	50	0.85%	0.71%	0.75	138.50	-0.04%	-0.19%	-0.06	-79.50
0	50	-1.24%	-0.97%	-0.85	-221.5**	-2.09%	-1.96%	-2.46**	-492.5***
1	50	-1.74%	-1.60%	-0.90	-301.5***	-0.49%	-0.35%	-0.38	-162.50
2	50	-3.99%	-3.84%	-1.94*	-482.5***	-2.25%	-1.91%	-2.83***	-521.5***
3	50	-3.46%	-3.53%	-1.74*	-441.5***	0.53%	0.53%	0.42	238.5**
4	50	-3.95%	-4.46%	-1.84*	-446.5***	-0.49%	-0.78%	-0.72	-229.5**
5	50	-2.82%	-2.34%	-1.26	-352.5***	1.13%	1.00%	1.55	369.5***

TABLE 4B: MARKET REACTION TO EXCLUSION.

The table shows the price reaction of all excluded stocks around the actual exclusion of stocks from the derivative segment. The actual day of exclusion is the event day here. Event time is measured as the number of trading days from the event date. We cover a period of 5 days before and 5 days after the event. N (in column 2) refers to number of excluded stocks, for which we have data. AR stands for abnormal return generated by the market model for a stock i as on day d. CAR is the cumulation of AR from day -5 to day d. Columns 2 to 6 show CAR while columns 7 to 10 show AR. Std CS test refers to t-statistics computed following the procedure in Boehmer, Masumeci, and Poulsen (1991). T-statistics are adjusted to take into account cross-correlation due to event-date clustering using the methodology described in Kolari and Pynnönen (2010). ***, **, * represents statistical significance at the 1%, 5% and 10% levels.

		CAR				AR			
Event Day	N	Mean	Median	Std CS test	SR test	Mean	Median	Std CS test	SR test
-5	50	-1.45%	-1.19%	-1.92*	-410.5***	-1.45%	-1.19%	-1.8*	-410.5***
-4	50	-1.06%	-0.97%	-0.84	-242.5**	0.39%	0.34%	0.21	115.50
-3	50	-1.55%	-1.61%	-1.12	-316.5***	-0.49%	-0.70%	-0.71	-227.5**
-2	50	-1.11%	-1.44%	-0.77	-185.5*	0.44%	0.26%	0.67	128.50
-1	50	-1.51%	-1.75%	-0.88	-244.5**	-0.41%	-0.29%	-0.32	-87.50
0	50	-1.89%	-1.78%	-0.98	-258.5**	-0.38%	-0.31%	-0.30	-131.50
1	50	-1.25%	-0.68%	-0.68	-162.50	0.65%	0.58%	1.09	242.5**
2	50	-0.54%	-0.62%	-0.26	-53.50	0.71%	0.29%	0.87	133.50
3	50	-0.16%	-0.53%	-0.07	7.50	0.38%	0.06%	0.54	95.50
4	50	0.25%	0.05%	0.10	48.50	0.40%	-0.59%	0.27	-113.50
5	50	1.04%	0.47%	0.40	110.50	0.80%	0.50%	1.00	242.5**

TABLE 4C: MARKET REACTION COMBINED- ANNOUNCEMENT AND ACTUAL EXCLUSION.

In this table, we combine both announcement period as well as actual exclusion. We cumulate returns for 11 days around announcement and 7 days around actual exclusion. N (in column 2) refers to number of excluded stocks, for which we have data. AR stands for abnormal return generated by the market model for a stock i as on day d. CAR is the cumulation of AR from day -5 to day d. Columns 2 to 6 show CAR while columns 7 to 10 show AR. Std CS test refers to t-statistics computed following the procedure in Boehmer, Masumeci, and Poulsen (1991). T-statistics are adjusted to take into account cross-correlation due to event-date clustering using the methodology described in Kolari and Pynnönen (2010). ***, **, * represents statistical significance at the 1%, 5% and 10% levels.

		CAR				AR			
Event Day	N	Mean	Median	Std CS test	SR test	Mean	Median	Std CS test	SR test
-5	50	0.24%	0.22%	0.61	178.5*	0.24%	0.22%	0.46	178.5*
-4	50	-0.02%	-0.17%	-0.04	-51.50	-0.26%	-0.55%	-0.57	-228.5**
-3	50	0.39%	0.58%	0.56	122.50	0.41%	0.16%	0.94	215.5**
-2	50	0.89%	0.87%	1.04	205.5**	0.50%	0.16%	1.00	156.50
-1	50	0.85%	0.71%	0.75	138.50	-0.04%	-0.19%	-0.06	-79.50
0	50	-1.24%	-0.97%	-0.85	-221.5**	-2.09%	-1.96%	-2.46**	-492.5***
1	50	-1.74%	-1.60%	-0.90	-301.5***	-0.49%	-0.35%	-0.38	-162.50
2	50	-3.99%	-3.84%	-1.94*	-482.5***	-2.25%	-1.91%	-2.83***	-521.5***
3	50	-3.46%	-3.53%	-1.74*	-441.5***	0.53%	0.53%	0.42	238.5**
4	50	-3.95%	-4.46%	-1.84*	-446.5***	-0.49%	-0.78%	-0.72	-229.5**
5	50	-2.82%	-2.34%	-1.26	-352.5***	1.13%	1.00%	1.55	369.5***
40	50	-4.28%	-5.05%	-1.87*	-431.5***	-1.45%	-1.19%	-1.8*	-410.5***
41	50	-3.88%	-3.19%	-1.58	-375.5***	0.39%	0.34%	0.21	115.50
42	50	-4.37%	-3.33%	-1.75*	-386.5***	-0.49%	-0.70%	-0.71	-227.5**
43	50	-3.93%	-3.26%	-1.55	-364.5***	0.44%	0.26%	0.67	128.50
44	50	-4.34%	-4.61%	-1.83*	-373.5***	-0.41%	-0.29%	-0.32	-87.50
45	50	-4.71%	-5.12%	-1.91*	-383.5***	-0.38%	-0.31%	-0.30	-131.50
46	50	-4.07%	-5.02%	-1.78*	-365.5***	0.65%	0.58%	1.09	242.5**

TABLE 5A: MARKET REACTION TO ANNOUNCEMENT USING STOCKS EXCLUDED DUE TO MWPL.

The table shows the price reaction of stocks that were excluded solely because of their failure to fulfill minimum MWPL requirement, around the SEBI notification date an event-by-event basis. We consider the SEBI notification date as the event day. Event time is measured as the number of trading days from the event date. We cover a period of 5 days before and 5 days after the event. N (in column 2) refers to number of excluded stocks, for which we have data. AR stands for abnormal return generated by the market model for a stock i as on day d. Columns 2 to 6 show CAR while columns 7 to 10 show AR. CAR is the cumulation of AR from day -5 to day d. Std CS test refers to t-statistics computed following the procedure in Boehmer, Masumeci, and Poulsen (1991). T-statistics are adjusted to take into account cross-correlation due to event-date clustering using the methodology described in Kolari and Pynnönen (2010). ***, **, * represents statistical significance at the 1%, 5% and 10% levels.

		CAR				AR			
Event Day	N	Mean	Median	Std CS test	S R test	Mean	Median	Std CS test	SR test
-5	30	0.55%	0.66%	1.00	109.5**	0.55%	0.66%	0.97	109.5**
-4	30	0.15%	-0.04%	0.24	1.50	-0.40%	-0.66%	-0.95	-116.5**
-3	30	0.73%	0.85%	0.77	92.5*	0.58%	0.32%	0.92	111.5**
-2	30	1.23%	1.37%	0.99	99.5**	0.50%	-0.07%	0.68	24.50
-1	30	1.20%	1.05%	0.73	67.50	-0.03%	-0.17%	-0.05	-33.50
0	30	-1.51%	-1.93%	-0.71	-88.5*	-2.72%	-2.78%	-2.41**	-181.5***
1	30	-2.62%	-1.83%	-0.88	-148.5***	-1.10%	-2.64%	-0.58	-100.5**
2	30	-5.72%	-5.72%	-1.95*	-202.5***	-3.10%	-3.12%	-3.99***	-227.5***
3	30	-4.75%	-4.74%	-1.67	-194.5***	0.97%	0.67%	1.47	141.5***
4	30	-5.25%	-6.09%	-1.68	-179.5***	-0.50%	-0.87%	-0.52	-96.5**
5	30	-3.70%	-4.05%	-1.08	-152.5***	1.56%	1.25%	2.03*	180.5***

Table 5B: Market Reaction to Exclusion For Stocks Excluded Because of MWPL.

The table shows the price reaction of stocks that were excluded solely because of their failure to fulfill minimum MWPL requirement, around the actual exclusion of stocks from the derivative segment. The actual day of exclusion is the event day here. Event time is measured as the number of trading days from the event date. We cover a period of 5 days before and 5 days after the event. N (in column 2) refers to number of excluded stocks, for which we have data. AR stands for abnormal return generated by the market model for a stock i as on day d. CAR is the cumulation of AR from day -5 to day d. Columns 2 to 6 show CAR while columns 7 to 10 show AR. Std CS test refers to t-statistics computed following the procedure in Boehmer, Masumeci, and Poulsen (1991). T-statistics are adjusted to take into account cross-correlation due to event-date clustering using the methodology described in Kolari and Pynnönen (2010). ***, **, * represents statistical significance at the 1%, 5% and 10% levels.

		CAR				AR			
Event Day	N	Mean	Median	Std CS test	SR test	Mean	Median	Std CS test	SR test
-5	30	-2.28%	-2.18%	-2.62**	-210.5***	-2.28%	-2.18%	-2.65**	-210.5***
-4	30	-1.07%	-1.00%	-0.65	-94.5*	1.21%	1.03%	1.09	108.5**
-3	30	-1.89%	-2.79%	-0.94	-125.5***	-0.82%	-1.24%	-0.86	-101.5**
-2	30	-1.29%	-2.43%	-0.63	-73.50	0.60%	0.28%	0.67	57.50
-1	30	-2.43%	-2.01%	-1.02	-133.5***	-1.13%	-1.12%	-0.86	-108.5**
0	30	-3.33%	-2.82%	-1.34	-156.5***	-0.91%	-0.75%	-1.12	-128.5***
1	30	-2.68%	-2.06%	-1.10	-134.5***	0.65%	0.60%	1.04	105.5**
2	30	-1.92%	-1.52%	-0.73	-83.5*	0.76%	0.35%	0.93	87.5*
3	30	-1.58%	-1.87%	-0.51	-53.50	0.34%	0.06%	0.33	39.50
4	30	-0.59%	-0.97%	-0.16	-7.50	0.99%	-0.38%	0.58	0.50
5	30	1.12%	0.09%	0.30	39.50	1.71%	1.27%	2.05**	202.5***

TABLE 5C: Market Reaction Combined- Announcement And Actual Exclusion.

In this table, we combine both announcement period as well as actual exclusion. The sample is restricted to stocks that were excluded solely because of their failure to fulfill minimum MWPL requirement. We cumulate returns for 11 days around announcement and 7 days around actual exclusion. N (in column 2) refers to number of excluded stocks, for which we have data. AR stands for abnormal return generated by the market model for a stock i as on day d. CAR is the cumulation of AR from day -5 to day d. Columns 2 to 6 show CAR while columns 7 to 10 show AR. Std CS test refers to t-statistics computed following the procedure in Boehmer, Masumeci, and Poulsen (1991). T-statistics are adjusted to take into account cross-correlation due to event-date clustering using the methodology described in Kolari and Pynnönen (2010). ***, **, * represents statistical significance at the 1%, 5% and 10% levels.

		CAR				AR			
Event Day	N	Mean	Median	Std CS test	SR test	Mean	Median	Std CS test	SR test
-5	30	0.55%	0.66%	1.00	109.5**	0.55%	0.66%	0.97	109.5**
-4	30	0.15%	-0.04%	0.24	1.50	-0.40%	-0.66%	-0.95	-116.5**
-3	30	0.73%	0.85%	0.77	92.5*	0.58%	0.32%	0.92	111.5**
-2	30	1.23%	1.37%	0.99	99.5**	0.50%	-0.07%	0.68	24.50
-1	30	1.20%	1.05%	0.73	67.50	-0.03%	-0.17%	-0.05	-33.50
0	30	-1.51%	-1.93%	-0.71	-88.5*	-2.72%	-2.78%	-2.41**	-181.5***
1	30	-2.62%	-1.83%	-0.88	-148.5***	-1.10%	-2.64%	-0.58	-100.5**
2	30	-5.72%	-5.72%	-1.95*	-202.5***	-3.10%	-3.12%	-3.99***	-227.5***
3	30	-4.75%	-4.74%	-1.67	-194.5***	0.97%	0.67%	1.47	141.5***
4	30	-5.25%	-6.09%	-1.68	-179.5***	-0.50%	-0.87%	-0.52	-96.5**
5	30	-3.70%	-4.05%	-1.08	-152.5***	1.56%	1.25%	2.03*	180.5***
40	30	-5.97%	-6.70%	-1.84*	-185.5***	-2.28%	-2.18%	-2.65**	-210.5***
41	30	-4.76%	-5.00%	-1.38	-162.5***	1.21%	1.03%	1.09	108.5**
42	30	-5.58%	-5.79%	-1.57	-163.5***	-0.82%	-1.24%	-0.86	-101.5**
43	30	-4.99%	-4.73%	-1.41	-160.5***	0.60%	0.28%	0.67	57.50
44	30	-6.12%	-5.15%	-2.01*	-173.5***	-1.13%	-1.12%	-0.86	-108.5**
45	30	-7.03%	-6.46%	-2.36**	-190.5***	-0.91%	-0.75%	-1.12	-128.5***
46	30	-6.38%	-6.31%	-2.35**	-196.5***	0.65%	0.60%	1.04	105.5**

TABLE 6: Market Reaction- Event Study Based on Volume

This is a cross sectional regression with abnormal volume of a stock i during a window j being the dependent variable. The total sample includes retained as well as excluded stocks. Treat is a dummy that takes the value of one for excluded stocks and zero for other stocks. We include firm level control variables similar to the ones used before. We report different intervals (specified in top row) of time around the event day in different columns.

Interval	-1 to 10	0 to 3	4 to 27	28 to 46	47 to 64	1 to 120
VARIABLES	turnover	turnover	turnover	turnover	turnover	turnover
Treatment	-0.035	0.338*	-0.038	-0.041	-0.548***	-0.291***
	(0.078)	(0.192)	(0.099)	(0.218)	(0.174)	(0.104)
Firm Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	200	200	200	200	200	200
R-squared	0.020	0.069	0.016	0.029	0.096	0.056
Adj R-squared	-0.000111	0.0496	-0.00420	0.00916	0.0778	0.0370

TABLE 7A: PRICE EFFICIENCY -UNIVARIATE COMPARISONS

The table shows the impact of derivatives on price efficiency in a univariate framework. An observation represents a firm quarter. The sample consists of all stocks that were listed in the derivative segment before exclusion. Stocks that get excluded form the "treatment" group and those that continue to be listed in the derivative segment form the "control" group. The dependent variables, D1 and D2 are measures of price delay devised by (Hou and Moskowitz (2005)). Two years before SEBI notifications represents the "pre period" and two years after actual exclusion of stocks from derivative segment represents the "post" period. Standard errors are reported in parentheses. ***, **, * represents statistical significance at 1%, 5% and 10% levels.

	D1			D2		
Period	Treatment	Control	Diff (T-C)	Treatment	Control	Diff (T-C)
Pre	0.360	0.381	-0.021 (0.887)	0.566	0.58	-0.013 (0.878)
Post	0.503	0.428	0.075*** (-2.97)	0.665	0.612	0.053*** (-3.77)
Diff (Post-Pre)	0.144*** (6.373)	0.047*** (3.775)	0.096	0.099*** (7.801)	0.032*** (4.387)	0.066

TABLE 7B: PRICE EFFICIENCY

The table shows the impact of derivatives on price efficiency. An observation represents a firm quarter. In columns 2 and 3, the sample consists of all stocks that were listed in the derivative segment before exclusion. Stocks that get excluded form the "treatment" group and those that continue to be listed in the derivative segment form the "control" group. In columns 4 and 5, the control group consists of matched sample of firms. The dependent variables, D1 and D2 are measures of price delay devised by (Hou and Moskowitz (2005)). Two years before SEBI notifications represents the "pre period" and two years after actual exclusion of stocks from derivative segment represents the "post" period. The independent variable of interest is the interaction between treatment and post dummies. Other control variables include measures for firm size, firm profitability and liquidity. The levels of exclusion criteria (MQSOS, MWPL, Turnover) are also used as control variables. Errors are clustered at firm level and adjusted for heteroscedasticity. Standard errors are reported in parentheses. ***, **, * represents statistical significance at 1%, 5% and 10% levels.

VARIABLES	D1	D2	D1	D2
Treatment	0.008	0.003	-0.056*	-0.038*
	(0.022)	(0.014)	(0.033)	(0.020)
Post event	0.052***	0.037***	0.033	0.021
	(0.012)	(0.007)	(0.031)	(0.016)
Interaction	0.073***	0.052***	0.096**	0.071***
(Treat*Post)	(0.026)	(0.015)	(0.040)	(0.021)
Observations	3,146	3,146	1,011	1,011
Adj R-squared	0.0384	0.0406	0.0728	0.0811
Number of Companies	204	204	68	68
Control Vars	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No
Time FE	No	No	No	No

TABLE 8: Analyst Following Before And After Exclusion

The table shows the impact of derivative exclusion on analyst coverage of a stock. The total sample includes firms that are excluded from the derivative segment and those that continue to have derivatives traded on them even after the SEBI order. The dependent variable is the number of analysts following an firm i as at end of quarter j when compared to the same as at the end of quarter j-1. The independent variable after is a dummy variable that takes the value of 1 if quarter i lies in the post delisting period and zero otherwise. Treat is a dummy that takes the value of 1 if the stock i under consideration is an excluded stock and zero otherwise. The main independent variable of interest is the interaction between After and Treat dummies. We also include firm level controls for size(market cap), insider holding(MWPL) and liquidity (MQSOS). In column 1 we do not include any control variable. In column 2 we include other control variables. T-statistics are reported in parenthesis. ***, **, * represents statistical significance at the 1%, 5% and 10% levels.

VARIABLES	Analyst Reco.	Analyst Reco.
Treatment	-18.566***	-10.510***
	(1.875)	(1.911)
Post event	3.054***	3.320***
	(0.564)	(0.458)
Interaction	-4.132***	-2.675***
(Treat*Post)	(1.157)	(1.023)
Observations	3,160	3,076
Number of companies	0.0808	0.192
Adj R-squared	204	203
Control Vars	No	Yes
Firm FE	No	No
Time FE	No	No

TABLE 9A: Impact On Liquidity- Summary Evidence

The table shows the impact of derivatives Liquidity. The sample consists of all stocks that were listed in the derivative segment before exclusion. Stocks that get excluded form the "treatment" group and those that continue to be listed in the derivative segment form the "control" group. Each observation represents a firm-quarter. We use the liquidity measures devised by Das, Kalimipalli, and Nayak (2014). The dependent variables, sequentially, are as follows: average daily trade (Panel A), average trade size (Panel:B), Amihid illiquidity measure for cash market, Amihid illiquidity measure for cash market and derivative segments (Panels C and D), average turnover in cash market derivative segments (Panels E and F), Roll impact measure (Panel G), total number of trades in a quarter(Panel H), total turnover in cash market and total turnover in cash and derivative segment(Panel I and J), Volume in cash markets and combined volume in cash and derivative segment (Panels K and L). Two years before SEBI notifications represents the "pre period" and two years after actual exclusion of stocks from derivative segment represents the "post" period. The independent variable of interest is the interaction between treatment and post dummies. Other control variables include measures for firm size, firm profitability and liquidity. The levels of exclusion criteria (MQSOS, MWPL, Turnover) are also used as control variables. Errors are clustered at firm level and adjusted for heteroscedasticity. Standard errors are reported in parentheses. ***, **, * represents statistical significance at 1%, 5% and 10% levels.

Panel A: Avg Daily Trade			
	Treatment	Control	Diff (T-C)
Pre	11381.01	23318.50	-11937.497*** (4.105)
Post	6724.93	28241.91	-21516.987*** (6.947)
Diff (Post-Pre)	-4656.076*** (-4.768)	4923.414*** (5.411)	-9579.49

Panel B: Avg Trade Size			
	Treatment	Control	Diff (T-C)
Pre	15370.66	21081.10	-5710.44*** (3.552)
Post	12549.78	19966.04	-7416.26*** (4.881)
Diff (Post-Pre)	-2820.88*** (-4.919)	-1115.06*** (-2.613)	-1705.82

Panel C: Amihud Illiquidity Spot Market			
	Treatment	Control	Diff (T-C)
Pre	24192.90	91842.74	-67649.84 (0.465)
Post	91892.10	875273.79	-783381.69 (0.516)
Diff (Post-Pre)	67699.20*** (4.231)	783431.05 (1.003)	-715732

Panel D: Amihud Illiquidity Spot and Derivatives			
	Treatment	Control	Diff (T-C)
Pre	9471.26	3655.38	5815.885*** (-7.12)
Post	91891.34	35407.93	56483.416 (-1.123)
Diff (Post-Pre)	82420.08*** (5.013)	31752.55 (1.131)	50667.53

Panel E:Avg Turnover (CM))			
	Treatment	Control	Diff (T-C)
Pre	0.541	0.297	0.244*** (-3.526)
Post	0.265	0.354	-0.089 (1.303)
Diff (Post-Pre)	-0.276*** (-4.171)	0.057** (2.319)	-0.333

Panel F: Avg Turnover Spot and Futues)			
	Treatment	Control	Diff (T-C)
Pre	1.363	1.138	0.225 (-0.585)
Post	0.265	1.527	-1.262*** (3.026)
Diff (Post-Pre)	-1.098*** (-5.602)	0.389*** (3.487)	**-1.487**

Panel G: Roll Impact Factor			
	Treatment	Control	Diff (T-C)
Pre	11444.92	1952.32	9492.60** (-2.494)
Post	13730.60	2947.45	10783.15*** (-4.304)
Diff (Post-Pre)	2285.685 (0.316)	995.132 (1.166)	1290.55

Panel H: Total Trades			
	Treatment	Control	Diff (T-C)
Pre	713694.1	1462290	-748595.437*** (4.109)
Post	416059	1749781	-1333722.228*** (6.94)
Diff (Post-Pre)	-297635.165*** (-4.860)	287491.625*** (5.068)	-585127

Panel I: Turnover Spot Markets			
	Treatment	Control	Diff (T-C)
Pre	45.947	22.681	23.266*** (-4.255)
Post	24.857	26.667	-1.809 (0.343)
Diff (Post-Pre)	-21.09*** (-3.780)	3.986** (2.034)	-25.076

Panel J: Turnover Spot and Futures Markets			
	Treatment	Control	Diff (T-C)
Pre	112.439	90.825	21.613 (-0.606)
Post	24.905	114.474	-89.568*** (2.901)
Diff (Post-Pre)	-87.533*** (-5.916)	23.648*** (2.668)	-111.182

Panel K: Total Volume Spot

	Treatment	Control	Diff (T-C)
Pre	10925.33	37489.51	-26564.17*** (3.644)
Post	5571.37	42165.40	-36594.04*** (5.372)
Diff (Post-Pre)	-5353.97*** (-4.369)	4675.90** (2.481)	-10029.86

Panel L: Total Volume Spot And Derivative

	Treatment	Control	Diff (T-C)
Pre	26970.20	119996.86	-93026.67*** (3.528)
Post	5621.49	176213.14	-170591.648*** (4.998)
Diff (Post-Pre)	-21348.711*** (-7.125)	56216.271*** (5.955)	-77564.98

TABLE 9B: Impact on Liquidity-Regression Based Tests

The table shows the impact of derivatives Liquidity. The sample consists of all stocks that were listed in the derivative segment before exclusion. Stocks that get excluded form the "treatment" group and those that continue to be listed in the derivative segment form the "control" group. Each observation represents a firm-quarter. We use the liquidity measures devised by Das, Kalimipalli, and Nayak (2014). The dependent variables, sequentially, are as follows: total number of trades in a quarter, average daily trades, total volume in cash market, total volume in cash and derivative segments, average trade size, turnover in cash market, turnover in cash and derivative segment, average turnover in cash market, average turnover in cash and derivative segment, Amihid illiquidity measure for cash market, Amihid illiquidity measure for cash market and derivative market and Rollimpact measure. Two years before SEBI notifications represents the "pre period" and two years after actual exclusion of stocks from derivative segment represents the "post" period. The independent variable of interest is the interaction between treatment and post dummies. Other control variables include measures for firm size, firm profitability and liquidity. The levels of exclusion criteria (MQSOS, MWPL, Turnover) are also used as control variables. Errors are clustered at firm level and adjusted for heteroscedasticity. Standard errors are reported in parentheses. ***, **, * represents statistical significance at 1%, 5% and 10% levels.

VARIABLES	Total Trades	Avg Daily Trade	Total Volume (CM)	Total Volume (CM, F&O)	Avg Trade Size	Turnover (CM)	Turnover (CM, F&O)	Avg Turnover (CM)	Avg Turnover (CM, F&O)	Amihud Illiquidity (CM)	Amihud Illiquidity (CM,F&O)	Roll Impact
Treatment	-0.081	-0.083	0.107	0.127	0.239***	0.123	0.139	0.082	0.091	-0.296**	-0.268**	0.391*
	(0.128)	(0.128)	(0.132)	(0.109)	(0.069)	(0.133)	(0.110)	(0.140)	(0.114)	(0.135)	(0.109)	(0.236)
Post event	0.121***	0.137***	0.052	0.176***	-0.057***	0.047	0.172***	0.064**	0.179***	-0.092***	-0.205***	-0.211***
	(0.031)	(0.030)	(0.032)	(0.045)	(0.016)	(0.032)	(0.046)	(0.033)	(0.048)	(0.030)	(0.046)	(0.058)
Interaction	-0.352***	-0.355***	-0.438***	-1.422***	-0.063*	-0.435***	-1.421***	-0.515***	-1.478***	0.450***	1.430***	1.228***
(Treat*Post)	(0.079)	(0.079)	(0.089)	(0.110)	(0.034)	(0.087)	(0.109)	(0.085)	(0.108)	(0.076)	(0.103)	(0.148)
Observations	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	3,161	1,380
Adj R-squared	0.236	0.236	0.365	0.493	0.408	0.179	0.351	0.231	0.374	0.511	0.567	0.278
Number of Companies	204	204	204	204	204	204	204	204	204	204	204	204
Control Vars	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No	No	No	No	No	No	No	No	No
Time FE	No	No	No	No	No	No	No	No	No	No	No	No

TABLE 10: Impact on Volatility

The table shows the impact of derivatives Liquidity. The sample consists of all stocks that were listed in the derivative segment before exclusion. Stocks that get excluded form the "treatment" group and those that continue to be listed in the derivative segment form the "control" group. Each observation represents a firm-quarter. We use the liquidity measures devised by Das, Kalimipalli, and Nayak (2014). The dependent variables, sequentially, absolute value of returns (in column 2), number of observations with returns lower than two standard deviation from the historical average(in column 3), number of observations with returns higher than two standard deviation from the historical average(in column 4), number of observations with returns higher than two standard deviation or lower than two standard deviations from the historical average(in column 5), standard deviation given return is below two standard deviation from historical average(in column 6), standard deviation given return in below two standard deviation from historical average(in column 7), absolute difference between a day's high and low price averaged at quarterly level (in column 8), skewness and kurtosis (in columns 9 and 10 respectively). Two years before SEBI notifications represents the "pre period" and two years after actual exclusion of stocks from derivative segment represents the "post" period. The independent variable of interest is the interaction between treatment and post dummies. Other control variables include measures for firm size, firm profitability and liquidity. The levels of exclusion criteria (MQSOS, MWPL, Turnover) are also used as control variables. Errors are clustered at firm level and adjusted for heteroscedasticity. Standard errors are reported in parentheses. ***, **, * represents statistical significance at 1%, 5% and 10% levels.

VARIABLES	Std Dev	—Return—	Down	Up	Up or Down	Down Risk	Up Risk	High-Low	Skewness	Kurtosis
Treatment	-0.004**	-0.181***	0.008	-0.004	0.003	-0.000	0.001	-0.263***	0.068	0.055
	(0.002)	(0.051)	(0.005)	(0.003)	(0.004)	(0.000)	(0.004)	(0.095)	(0.048)	(0.105)
Post event	0.001	-0.003	-0.002	0.008***	0.006*	-0.000	0.001*	-0.086***	0.079***	0.262***
	(0.001)	(0.018)	(0.004)	(0.002)	(0.003)	(0.000)	(0.001)	(0.031)	(0.030)	(0.068)
Interaction	0.004*	0.046	-0.013**	0.009**	-0.005	0.000	0.004	0.054	0.205***	0.339**
(Treat*Post)	(0.002)	(0.048)	(0.005)	(0.004)	(0.004)	(0.000)	(0.007)	(0.078)	(0.066)	(0.167)
Observations	3,146	3,146	3,146	3,146	3,146	3,141	275	3,146	3,146	3,146
Adj R-squared	0.0589	0.0842	0.0183	0.0269	0.00485	0.0861	0.00630	0.105	0.0169	0.0135
Number of Companies	204	204	204	204	204	204	161	204	204	204
Control Vars	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No	No	No	No	No	No	No
Time FE	No	No	No	No	No	No	No	No	No	No