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Article

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Asia and the Global Economy (AGE)

Provided in Cooperation with:

Asia Economic Community Foundation, Incheon

Suggested Citation: Chakraborty, Indrani; Kattuman, Paul A. (2023) : The impact of mergers and acquisitions on performance of firms: A pre- and post-TRIPS analysis of India's pharmaceutical industry, Asia and the Global Economy (AGE), ISSN 2667-1115, Elsevier, Amsterdam, Vol. 3, Iss. 2, pp. 1-17,
<https://doi.org/10.1016/j.aglobe.2023.100059>

This Version is available at:

<https://hdl.handle.net/10419/340954>

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The impact of mergers and acquisitions on performance of firms: A pre- and post-TRIPS analysis of India's pharmaceutical industry

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ARTICLE INFO

JEL:

C21

C23

G34

L25

L52

L65

Keywords:

Mergers and acquisitions

Pharmaceutical industry

TRIPS

Difference-in-differences

Propensity score matching

India

ABSTRACT

This study analyses the impact of mergers and acquisitions on performance of Indian pharmaceutical firms following the implementation of TRIPS in 1995. In order to identify adequately the effect of mergers, we investigate the impact on firm performance of the merged vis-a-vis the non-merged firms in the post-TRIPS period using difference-in-differences and propensity score matching approaches. Our results suggest that firm performance improved in merged firms, following the mergers. We argue that our finding represents the incidence of "positioning" merger (Gorton et al., 2009). Moreover, transfer of technologies and capabilities helped to improve firm performance in merged firms. Our findings have significant policy implications for Asian countries.

1. Introduction

The Indian pharmaceutical industry is one of the leading industries in India, having grown and transformed rapidly over the past four decades. From sales turnover of about US \$ 3 million in 1947, the industry reported a figure of about US \$5.5 billion in 2004 with an annual growth rate of about 17% (Von and Mazumder, 2013). India is the third largest pharmaceutical producer worldwide in terms of volume, ranks among the top 14 in value (GOI, Annual Report, 2020-21) and has 20–22% share of the global generic production (Aggarwal, 2004; Report of Unimarckpharma, 2022). This success is the result of India's ability to perform R&D and develop generic drugs between the Patent Act of 1970 until the mid-90 s, when the patent protection system was relatively weak. The Patent Act of 1970, which replaced product patents with

process patents, played an instrumental role in developing indigenous R&D. It helped Indian drug producers acquire expertise in 'reverse engineering', which helped them produce less expensive drugs and export to the world market (Greene, 2007)¹.

However, the implementation of the Agreement on Trade-Related Intellectual Property Rights (TRIPS) by the World Trade Organization (WTO) in 1995, brought challenges to the Indian pharmaceutical industry. In March 2005, when the amendment of the Patent Act of 1970 to comply with the TRIPS Agreement was completed, product patents were introduced for drugs, foods and chemical products with a validity of twenty years (Chaudhuri, 2005)^{2,3}. The new patent law banned Indian drug producers from manufacturing and selling reverse-engineered drugs which had been patented by foreign drug producers. This resulted in loss of sales for many Indian leading pharmaceutical producers. These

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¹ For the history of the development of Indian Pharmaceutical industry see Chaudhuri, 2005; Horner, 2014; Racherla, 2019 among others,

² TRIPs was implemented in three successions. The first version of it was implemented in 1995 in which the "mailbox" system was established, where patent applications could be filed between January 1, 1995 and 2005. On January 1, 2000, a second amendment was introduced. Its key issues redefined patentable subject matter, extended the term of patent protection to 20 years and amended the compulsory licensing system. A third amendment of patent law was made on January 1, 2005 to introduce product patent regime in areas including pharmaceuticals that were covered earlier by process patents only.

³ For a detailed discussion on the amendment of patent laws in India following TRIPs see Dhar and Gopakumar (2006).

companies began increasing their exports of generic drugs to the U.S. and Europe, and entered into R&D agreements, mergers and acquisitions and other alliances with foreign pharmaceutical firms. Due to these ventures, India's pharmaceutical exports increased from \$1.9 million in 1999 to \$5.2 billion in 2005 which was around 40% of the industry turnover in India (Greene, 2007).

From the above, we observe that there has been a gradual shift in public policy from the regime of control and process patents to a regime of decontrol and product patents. It is expected that such changes in policy will have far-reaching effects on the Indian pharmaceutical industry.

As mentioned, one such change is to do with business strategies of Indian firms, which changed after the amendment of the patent laws in January 2005. Firms entered into more merger and acquisition (M&A) deals. This is considered to be the most important strategy for gaining competitive advantage for Indian pharmaceutical firms.

Mergers and acquisitions (M&A) have become an important aspect of corporate restructuring both in developed and developing countries. A significant literature exploring post-merger performance and consequences has evolved. Economic theory leads to several motives of mergers, including economies of scale and scope, acquisition of specific assets, resolving agency cost problem, the market for corporate control, synergy effect, economies of vertical integration, market power and empire building (Danzon et al., 2007; Jensen and Meckling, 1976; Motta, 2004; Tirole, 1988; Amihud and Lev, 1981; Ravenscraft and Scherer, 1987; Williamson, 1968).

However, there is no consensus on whether M&A create value or improve firm performance. Both the positive effect (Healey et al., 1992; Gugler et al., 2003; Iwaki, 2007; Ramakrishnan, 2008) and negative effect (Yeh and Hoshino, 2002; Vanitha and Selvan, 2007; Bhaumik and Selarka, 2008) of M&A on profitability of firms are reported in the existing literature. In light of the inconclusive empirical results and the absence of a comprehensive theory that explicitly conceptualizes a clear and precise relationship between mergers and acquisitions and firm performance, we examine this relationship in the context of the Indian pharmaceutical industry. Our objective is to examine whether or not firm performance in the Indian pharmaceutical industry improved due to M&A following TRIPS. TRIPS can be considered an exogenous shock which generates an opportunity to examine the causal impact of M&A on firm performance following the implementation of TRIPS in March 2005. Our study period is from 2000–2015.

Some studies have analysed the impact of M&A on firm performance (Vanitha and Selvam, 2007; Bhaumik and Selarka, 2008; Pawaskar, 2001) in India, as discussed in the next section. We use a different methodology which obtains causal estimates by comparing the pre and post-TRIPS, merged and non-merged firms' performances in the pharmaceutical industry. To be more specific, we use the difference-in-differences (DID) methodology considering mergers and acquisitions as the treatment following TRIPS. This is new in the Indian context. Use of DID allows us identify the causal effect. The problem of non-random sample selection remains, and to avoid this we combine DID with propensity score matching (PSM). PSM and DID have been widely used in the literature estimating the impact of M&A on several different aspects of firm performance in the context of developed economies (Girma and Gorg, 2007; Arnold and Javorick, 2009; Guadalupe et al., 2012; Bandick et al., 2014 among others). However, there is no such study in the Indian context. In addition, in applying DID to estimate the impact of M&A on firm performance, we also consider the role of TRIPS which is a policy intervention. We use DID to evaluate the impact of this policy intervention on firm performance. Our treatment

group consists of those firms which have been acquired due to M&A policy and our control group consists of those firms which have not been merged following TRIPS in 2005⁴.

Our findings, based on matched difference-in-differences estimates, indicate that mergers following TRIPS in 2005 increased the profitability of merged firms in the Indian pharmaceutical industry. Several dimensions of firm performance improved after TRIPS with these effects increasing over time. The post-TRIPS degree of improvement varied from one dimension of firm performance to another and ranged between 1% and 50%.

The paper is organised as follows: Section 2 presents the review of related literature. Section 3 sets out the PSM and DID methodologies used to estimate the impact of M&A. Section 4 considers data and descriptive statistics. Section 5 discusses the empirical findings. Section 6 presents a discussion. Section 7 concludes.

2. Review of related literature

We have already stated in the earlier section that there is no consensus among studies on whether M&A improves firm performance. We will discuss both strands of literature in detail in this section. There are various arguments in the literature for the positive effects of M&A on firm performance (Mueller, 1980; Scherer, 1990; Ravenscraft and Scherer, 1987; Cosh et al., 1998). According to the theoretical literature, firms in the post-merger period should enjoy higher profitability due to the synergy effect. The value of the firm after the merger should increase compared to its pre-merger value as it enjoys economies of scale and scope and of vertical integration. Profitability also increases as the customer base increases in the post-merger period due to expansion into more markets. Moreover, it was argued that profitability increases in the post-merger period because the merged firms replace the inefficient managers and inferior assets by efficient managers and superior assets respectively in the market for corporate control.

Healey et al. (1992) examined the post-merger performance of the 50 biggest acquisitions of US companies that took place between 1979 and 1984. Their findings show that operating performance increased in the post-merger period compared to the pre-merger period. Gugler et al. (2003) analysed the impact of M&A on corporate performance and observed a decline in sales and profitability in the post-merger period in countries such as New Zealand, Canada, Australia, USA, UK and some European countries, with the only exception being Japan, where it increased. Ramaswamy and Waagelein (2003), using a sample of 162 U. S. acquiring firms, observed that post-merger operating performance improved among firms which announced mergers prior to 1983, those which acquired firms in dissimilar industries and those which acquired smaller relative-size firms. Iwaki (2007), in her study on Japan, observed an increase in return on assets (ROA) in the post-merger period, indicating sharing of information in the pre-merger period between the directors of the subsidiary and the parent company. Ramakrishnan (2008) studied 87 merged companies between 1996 and 2001 in India and found an improvement in efficiency in the post-merger period. He argued that companies opt for mergers mainly due to operating synergy.

There are also some studies which have observed that firm performance decreases due to mergers. This strand of literature argues that profitability decreases due to mergers because managers pursue corporate growth at the cost of some current profits (Marris, 1964). Yeh and Hoshino (2002) find a decline in the profitability in the post-merger period, when the acquisitions took place within the same Keiretsu groups of Japan. This suggests that the merger was done not to increase

⁴ This study considers only domestic mergers. It does not consider cross-border mergers, in which case the differences in tax rates between home and host countries might affect the financial measures of performance. Therefore, this problem does not arise in our study.

profitability or exploit innovation capacities of the firm but to bail out a financially distressed affiliate. Using a sample of 36 Australian acquisitions that occurred between 1986 and 1991, [Sharma and Ho \(2002\)](#) found no improvement in post-acquisition operating performance. Based on 17 manufacturing firms over the period 2000–2002 in India, [Vanitha and Selvam \(2007\)](#) studied the post-merger performance. They observed no significant change in the performance of the merged firms following the merger. [Bhaumik and Selarka \(2008\)](#) analysed the effect of M&A on ownership and performance in some Indian firms covering the period 1995–2001. They observed that performance of firms deteriorated in the post-merger period. [Pawaskar \(2001\)](#) estimates the effect of mergers considering 36 firms over the period 1992–1995 in India, by comparing pre- and post-merger operating performance, and find no increase in post-merger profit. Therefore, the effect of M&A on performance of firms is a contested issue, which can be studied further.

In a theoretical study, also supported by empirical evidence, it has been argued that due to regime shift, “defensive” mergers can decrease firm value whereas “positioning” mergers can create firm value ([Gorton et al., 2009](#)). In a defensive merger a firm acquires another firm to avoid being acquired itself, so that the managers of the acquirer retain the control of the firm. As the firm becomes larger through acquisition, it is less likely that it will be acquired by its rivals. This merger motive is self-reinforcing and hence leads to a merger wave. Under this defensive merger, if a firm does not acquire another firm, it would become vulnerable as a target firm and would be acquired by some other firms. Hence this leads to an “eat or be eaten” scenario which results in an unprofitable, wealth-destructing acquisition. On the other hand, in a positioning merger, a large firm is an attractive takeover target by becoming larger. In those industries which have a dominant firm, such a positioning merger is likely. In a positioning merger, if the managers are interested in increasing the firm value, they would engage in acquisitions in order to position their firm as a more attractive target for acquisition by the largest dominant firm, which in turn would create firm value. In this scenario, merger waves occur only if managers care sufficiently about maximizing firm value. The above arguments are applicable in our study if we consider TRIPS as a regime shift. Hence post-TRIPS performance of merged firms may improve or decline, depending on the nature of merger followed in the Indian pharmaceutical industry.

It is further argued that in merged firms, management, organization and technology will be better than non-merged firms ([Karpaty, 2007](#)). As merged firms would have better management and technology, they will be able to spend more money on R&D and hence innovations will be higher in these firms, relative to the non-merged firms. Therefore, we argue that if innovations are more in merged firms after TRIPS, profitability of these firms will be higher due to the advantage of having a 20-year patent term. Although TRIPS are applicable to both the merged and non-merged firms in the similar manner, non-merged firms, having relatively less expenses on R&D, would not be able to take the advantage of patent with fewer innovations and hence would be relatively less profitable.

There are many studies in the context of the Indian pharmaceutical industry, which have investigated the impact of patent policy changes. In the product patent regime of post-2005, an increase in the number of product patent filing by Indian pharmaceutical companies has been observed ([Chadha, 2006](#); [Chadha, 2009](#); [Banerji and Suri, 2019](#)). It has been observed that the majority of the applications for patent were related to new and improved processes for products than for novel products by Indian pharmaceutical companies. Studies show that the incentive to innovate increased in pharmaceutical firms following TRIPS which resulted in an increase in spending on research activities, and majority budget was being spent on reverse engineering to expand Abbreviated New Drug Application (ANDA) filing ([Suri and Banerji, 2019](#); [Chaudhuri, 2007](#); [Kiran and Mishra, 2011](#); [Mahajan, 2011](#) and [Dutta and Sharma, 2009](#)). [Chaudhuri \(2007\)](#) observes that Indian pharmaceutical companies started to increase their rate of Drug Master

Filing (DMF) following TRIPS, which led to an increase in their participation in the advanced markets, particularly the US. [Gupta \(2007\)](#) observes that ANDA filing with USFDA also started to increase in post-TRIPS period. [Dhar and Gopakumar \(2006\)](#) show that R&D spending of some leading firms like Ranbaxy and Dr. Reddy's have increased largely in the post-TRIPS period, which resulted in a significant increase in their R&D intensities. [Horner \(2014\)](#) also observes that during post-TRIPS period, there is a positive impact of patent policy changes on R&D expenditure which has been reflected in the increase in R&D expenditures to sales ratio of 37 major Indian pharmaceutical companies from 1.39% in 1992–93 to 7% in 2007–08. [Jagadeesh and Sasidharan \(2014\)](#), analysing 424 Indian pharmaceutical firms over the period 1994–2010, conclude that the TRIPS regime had a significant positive impact on R&D. [Kale and Little \(2007\)](#) show that, due to TRIPS, Indian pharmaceutical firms became innovators from imitators. TRIPS triggered their movement towards innovative R&D. However, it has been argued that the imitative R&D created basic capabilities that helped the movement towards innovative R&D in post-TRIPS period become much easier. [Aggarwal and Garg \(2019\)](#) analysed the accounting performance of 68 Indian firms pre- and post-merger over the period 2007–2008 to 2011–2012. They found that profitability of the acquiring firms significantly increased in 5 years after merger. [Dixit \(2020\)](#) examines the return on assets (ROA) of acquirers and control firms for three years in each pre- and post-acquisition period and compares them using the difference-in-difference method for the period 1989–2012. He observes that the operating performance of acquirers does not change after acquisition. [Rani et al. \(2015\)](#) compare performance of the acquiring firms before and after M&A based on sample of 305 M&A during the period of January 2003 to December 2008. They observe that the profitability of the acquiring companies involved in M&A improved significantly. [Kumar and Bansal \(2008\)](#) found that, the financial performance has improved in the post-merger period in more than 60% of cases of the total mergers.

Further, there are some studies which show that in merged firms, product capability, patents and brand reputation of the target firms would be acquired following acquisitions ([Bianconi and Tan, 2019](#); [Kallunki et al., 2009](#); [Sevilir and Tian, 2012](#)). These transfer of technologies and capabilities, consequently, would result in higher growth of profitability of merged firms ([Bianconi and Tan, 2019](#); [Ranft and Lord, 2002](#)).

From the above discussion we develop the following hypotheses:

Hypothesis 1. Firm performance in merged firms improved after TRIPS in the Indian pharmaceutical industry.

Hypothesis 2. Firm performance in merged firms decreased in post-TRIPS period in the Indian pharmaceutical industry.

In the following section we discuss the methodology.

3. Methodology

We apply two different techniques, viz., difference-in-differences (DID) estimation method and a propensity score matching (PSM) technique in this study. DID helps us to deal with endogeneity resulting from the time-invariant unobserved effects. One of the crucial assumptions of DID is the parallel trend assumption, which states that in the pre-treatment trends in the outcome variable for the treatment group and the control group would have followed parallel trends over time. In order to address this assumption and to select a more suitable control sample we apply a propensity score matching methodology that matches each treated firm with some control firms. This approach should strengthen the parallel trends assumption, allowing us to control for time-variant pre-treatment observables. The validity of the PSM also depends on another assumption viz. conditional independence (CIA). CIA holds, if the treatment is independent of the outcome, conditional on the observed covariates used in the PSM. This assumption is not testable but its validity is justified if we assume that we have included all the relevant variables in PSM.

Let us first explain the DID methodology briefly. Let $MERGE_{it} \in \{0,1\}$ be an indicator of whether firm i is merged at time period t , and let Y_{it+s}^1 be firm performance at time $t+s$, $s>0$, following TRIPS in 2005. Also denote Y_{it+s}^0 as the firm performance of the firm, which is not merged. The causal effect of merger for firm i at time period $t+s$ is then defined as:

$$Y_{it+s}^1 - Y_{it+s}^0 \quad (1)$$

The problem of causal inference is that the quantity Y_{it+s}^0 is unobservable for firms that have been merged (i.e. for which we observe Y_{it+s}^1). Following Heckman et. al. (1985) and Dehejia and Wahba (2002), we define the average effect of the merger on merged firms as:

$$E\{Y_{it+s}^1 - Y_{it+s}^0 | MERGE_{it} = 1\} = E\{Y_{it+s}^1 | MERGE_{it} = 1\} - E\{Y_{it+s}^0 | MERGE_{it} = 1\} \quad (2)$$

where causal inference relies on the construction of the counterfactual for the last term in Eq. (2), which is the outcome the merged firms would have experienced had they not been merged. This is estimated by the average firm performance of the non-merged firms, $E\{Y_{it+s}^0 | MERGE_{it}=0\}$.

One important point in the accurate construction of the counterfactual is the selection of a valid control group. The approach we take is the propensity score matching technique (Rosenbaum and Rubin, 1983). The purpose of matching is to pair each merged firm with a non-merged firm on the basis of some observable variables in such a way that the non-merged firms' performance can be studied to generate the counterfactual for the merged firms.

PSM involves estimating a probit/logit model for MERGE as the dependent variable on regressor variables X which may affect the likelihood of being assigned into T/C groups. We can then obtain the propensity of observations to be assigned into the T group.

$$p = Pr(MERGE = 1 | X) = E(MERGE | X) \quad (4)$$

This predicted probability of receiving treatment conditional on (pre-treatment) characteristics X is called the propensity score. In practical terms, for each treated entity i , we seek to find a match j among control entities, that is similar in pre-treatment characteristics. We can then match observations from treated and control groups based on their propensity scores and estimate ATE by comparing the mean outcomes between T and matched C group observations.

$$ATET = E(Y_1 | p, MERGE = 1) - E(Y_0 | p, MERGE = 0) \quad (5)$$

We can compare the mean outcomes of T and C observations that are matched on propensity scores. With each treated observation i matched with j control observations, and their outcomes Y_0 weighed by w :

$$ATET = 1/n \sum_i i \in \{D=1\} | Y_1, i - \sum_j w(i,j) Y_0, j | \quad (6)$$

In summary, matching treatment and control entities on a single index, the estimate of the probability of treatment, can yield consistent estimates of ATE, if this "propensity score" summarises all the relevant information contained in the covariates X , such that matching on this index is equivalent to matching on all covariates. The Propensity Score Theorem holds that for any given value of the propensity score, the distribution of X is the same for T group entities and C group entities.

In the PSM, we match merged firms (treated) with non-merged firms (controls). Specifically, we adopt the nearest-neighbor matching method, that is, we are selecting the non-merged firms with a predicted probability of being treated that is closest to that of the merged firms. For each treated firm, we match one nearest neighbor, allowing a given non-merged firm to be matched to one merged firm.

The explanatory variables chosen in our study are: firm age (AGE), firm size (SIZE), leverage (LEV), log of assets (LASSET), R&D intensity (R&D), square of age (SQAGE), square of size (SQSIZE), and lagged value of firm performance. The last variable is chosen to take care of the

selectivity bias which may result due to positive or negative selection. As performance, we are using the four alternative variables: Tobin's q (TOBINQ), return on assets (ROA), operating cash flow returns on assets (OCFRA), and cash flow returns from sales (CFRS). The pre-TRIPS value of the explanatory variables, considering 2000–2004 values of these variables, are used. The probit model of M&A is as follows:

$$p_i = Pr(D_i = 1 | X_i) = \Phi(X_i \beta + \varepsilon_i) \quad (7)$$

Where D_i is a binary variable representing treatment status: $D = 1$ if firm i is merged, and $D = 0$ if non-merged. X_i is a vector of observable characteristics in the pre-TRIPS years i.e. before acquisitions and Φ is a standard normal cumulative distribution function. Then we calculate the predicted probability of being merged (propensity score) and we create a sample where for each merged firm (i.e. treated) there is one purely non-merged firm (matched counterfactual) having a very similar ex-ante probability of being merged.

Finally, we compare merged and non-merged firms using DID methodology. We consider 2005–2015 as the post-TRIPS years i.e. post-treatment time period. We use unbalanced panel data to help control for unobserved heterogeneity across firms. Our DID methodology uses the following equation:

$$\begin{aligned} Performance_{it} = & \alpha + \beta DMERGE_{it} + \delta POST_t + \mu DMERGE_{it} * POST_t \\ & + \gamma_1 AGE_{it} + \gamma_2 SIZE_{it} + \gamma_3 LEV_{it} + \gamma_4 LASSET_{it} + \gamma_5 RD_{it} \\ & + \gamma_6 SQAGE + \gamma_7 SQSIZE_{it} + \theta_i + \lambda_t + \eta_{it} \end{aligned} \quad (8)$$

where i represents the firm and t represents time.

$DMERGE=1$ for merged firms after TRIPS in 2005

$=0$, otherwise

$POST=1$ for $t \geq 2005$

$=0$, otherwise

The interaction term between $DMERGE$ and $POST$ represents the treatment effect, i.e. the effects of mergers on firm performance due to TRIPS.

Finally, we have verified the "common support" assumption, which is the overlap between values of the explanatory variables for the comparison groups (treated and controls), confirming our assumption that the large sample from which controls are selected would ensure it⁵.

The propensity score matching method will provide a reliable and robust method for estimating the merger effect if, conditional on the propensity score, the potential outcomes Y^1 and Y^0 are independent of the incidence of the merger. Under the assumption of independence conditional on observables, the pre-merger variables should be balanced between the merged and non-merged firms. Lack of balance points to a possible misspecification of the propensity score estimation. Hence, it is important to verify that this balancing condition is satisfied by the data (Rosenbaum and Rubin, 1983; Dahejia and Wahaba, 2002). The balancing test performed in this paper examines the standardized bias (or standardized difference) for all variables in X (that is the vector of covariates used in the propensity score matching). For example, the standardized bias for the variable $SIZE$ is defined as the difference in means between the merged firms (Group A) and the appropriately matched comparison group of non-merged firms (Group B) scaled by the average variances of the $SIZE$ variable in groups A and B. Based on N merged firm, this is given as follows:

⁵ We have used STATA routine "psmatch2" to implement the matching and to verify the common support assumption.

$$\text{Standardized Bias}(\text{SIZE}) = \left(100 / N \sum_{i \in A} \left(\text{SIZE}_i - \sum_{j \in B} f(p_i, p_j) \text{SIZE}_j \right) \right) / \sqrt{(\text{Var}_{i \in A}(\text{SIZE}) + \text{Var}_{j \in B}(\text{SIZE})) / 2}$$

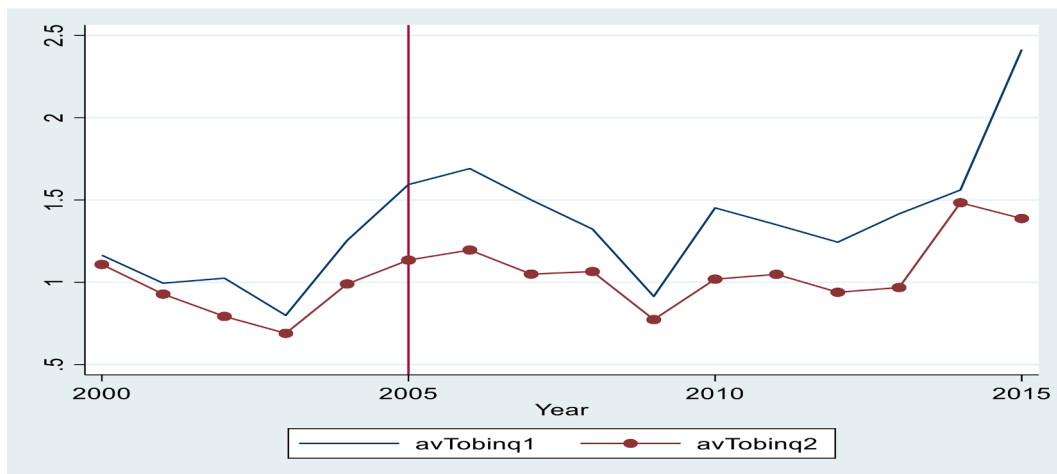
Note that the lower the standardized bias, the more balanced or similar the treatment and control groups will be in terms of the variable under consideration. Although there is no formal criterion as to how large a standardized bias should be for it to be considered serious, following [Rosenbaum and Rubin \(1985\)](#) and [Girma and Gorg \(2007\)](#), we assume that a value of 20 is large.

4. Data and descriptive statistics

The data for the present analysis are obtained from PROWESS, a

database provided by the center for Monitoring Indian Economy (CMIE) for the period 2000–2015. TRIPS was implemented in March 2005. Hence, we take four pre-TRIPS years and ten post-TRIPS years to analyze the treatment effect on firm performance in the Indian pharmaceutical industry. Our full sample includes 203 firms, of which 64 firms merged after TRIPS in 2005 and 139 firms are non-merged. We are using unbalanced panel data here. [Fig. 1](#) presents the trends in merged (treatment) and non-merged (control) firms over the study period for the four indicators of firm performance viz. TOBINQ, ROA, OCFRA and CFRS respectively. From these figures it appears that the common trend

A. TOBIN's Q



B. ROA

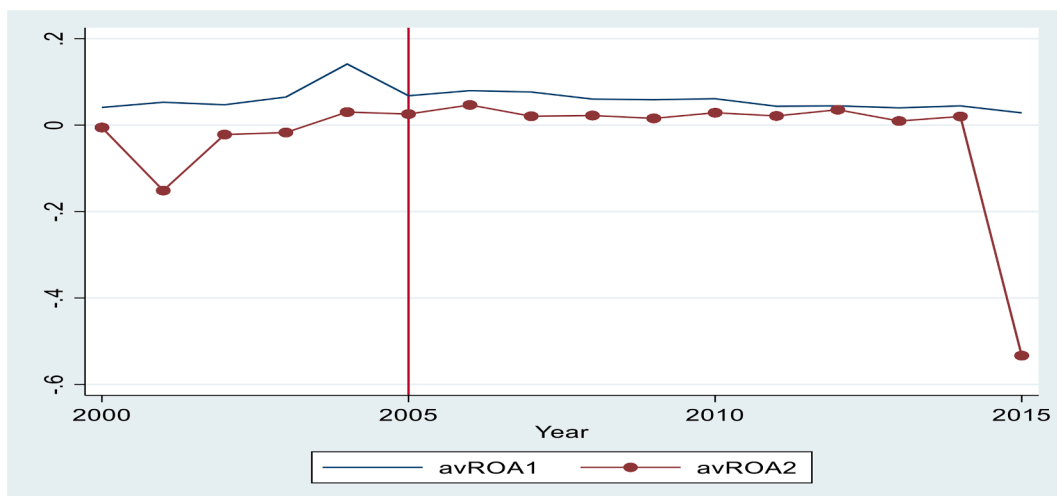
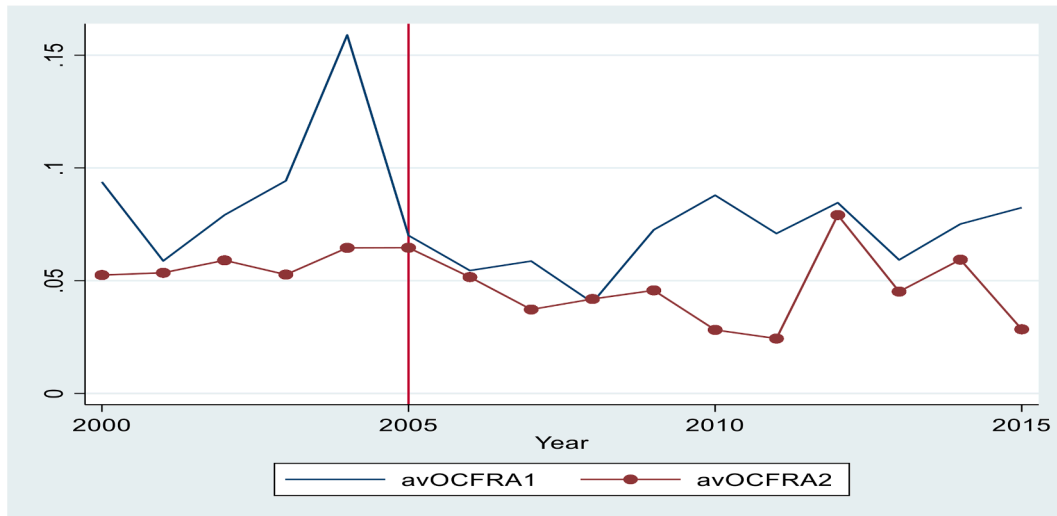


Fig. 1. Trends of firm performance indicators for treatment and control groups.

C. OCFRA



D. CFRS

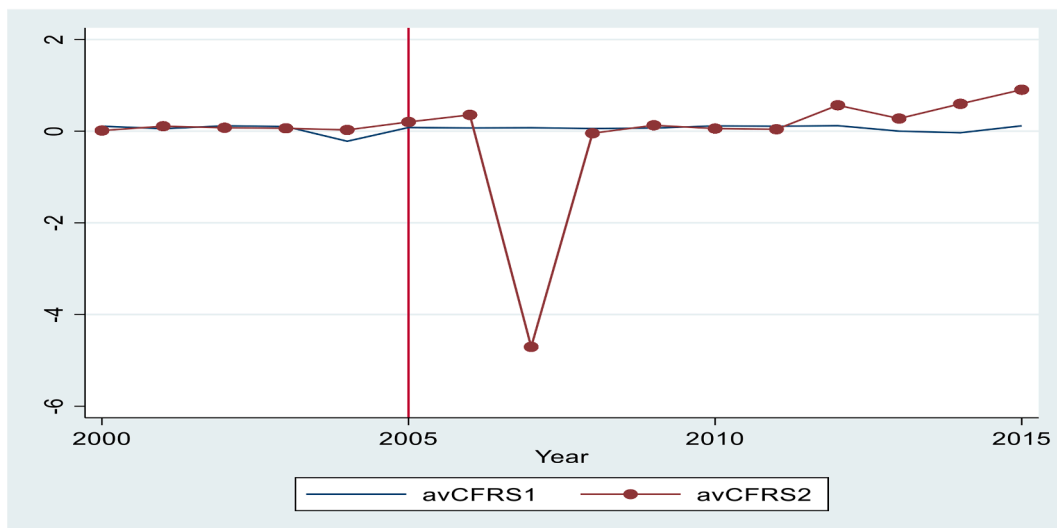


Fig. 1. (continued).

Table 1
Summary statistics for merged firms.

Variables	2000–2004				2005–2015			
	Mean	Std. Dev	Min.	Max.	Mean	Std. Dev.	Min.	Max.
AGE	19.884	13.717	1	68	27.884	13.992	6	79
SIZE	6.619	1.862	−0.693	9.772	7.948	1.710	2.862	11.522
LEV	0.336	0.304	0	3.259	0.328	0.213	0	1.649
LASSET	2.977	0.691	1.526	4.431	3.622	0.769	1.675	5.590
R&D	87.044	219.389	0.1	1910.5	663.802	1502.481	0	11,230
TOBINQ	1.019	1.144	0	6.771	1.492	1.291	0	9.974
ROA	0.077	0.252	−0.651	3.281	0.055	0.119	−0.746	0.958
OCFRA	0.099	0.274	−0.340	3.671	0.068	0.096	−0.346	0.722
CFRS	0.008	1.578	−21.311	4.322	0.070	0.441	−7.867	2.365

assumption is supported by these indicators of firm performance, except OCFRA, as the trends for treatment and control groups follow almost parallel trends before 2005 - the year of implementation of TRIPS.

A summary table on the description of the variables is provided in the

appendix. Table 1 reports the descriptive statistics for the variables for the years 2000–2004 and 2005–2015 for firms that merged after 2005. Similar statistics for non-merged firms are reported in Table 2. From Table 1, we observe that the average firm performance was higher in

Table 2
Summary statistics for non-merged firms.

Variables	2000–2004				2005–2015			
	Mean	Std. Dev	Min.	Max.	Mean	Std. Dev.	Min.	Max.
AGE	19.040	13.979	1	80	27.040	14.257	6	91
SIZE	5.330	1.996	–2.302	10.568	6.163	2.167	–2.302	11.535
LEV	0.405	0.464	0	3.739	0.388	0.781	0	12.226
LASSET	2.455	0.704	0.176	4.567	2.764	0.854	0.342	5.227
R&D	46.922	219.527	0.1	2380.5	253.730	866.320	0	7140.4
TOBINQ	0.850	0.985	0	11.588	1.091	2.067	0	53.985
ROA	–0.042	0.765	–15.8	1.495	–0.021	1.409	–46.14	1.863
OCFRA	0.057	0.146	–0.359	1.666	0.045	0.142	–0.952	1.738
CFRS	0.068	0.466	–2.206	8.333	–0.159	14.902	–448	99

Table 3
Correlation matrix.

	TOBINQ	ROA	OCFRA	CFRS	AGE	SIZE	LEV	LASSET	R&D	VIF
TOBINQ	1.00									1.41
ROA	0.287	1.00								2.45
OCFRA	0.215	0.410	1.00							1.36
CFRS	0.041	0.142	0.346	1.00						1.29
AGE	0.247	0.273	0.193	0.044	1.00					1.36
SIZE	0.427	0.379	0.166	0.203	0.347	1.00				6.12
LEV	–0.243	–0.614	–0.298	–0.035	–0.415	–0.217	1.00			1.45
LASSET	0.442	0.227	0.069	0.087	0.272	0.936	–0.100	1.00		5.16
R&D	0.350	0.098	0.032	0.025	0.085	0.493	–0.1*20	0.525	1.00	1.66

Table 4
Probit estimates: determinants of mergers.

	Model 1	Model 2	Model 3	Model 4
Const.	–3.164 (1.440)**	–3.541 (1.422)*	–3.620 (1.419)*	–3.765 (1.451)*
AGE	–0.021 (0.018)	–0.016 (0.018)	–0.017 (0.018)	–0.015 (0.018)
SIZE	0.514 (0.377)	0.564 (0.376)	0.583 (0.372)	0.606 (0.379)
LEV	–0.255 (0.334)	–0.157 (0.347)	–0.203 (0.325)	–0.232 (0.332)
LASSET	0.454 (0.383)	0.519 (0.382)	0.510 (0.382)	0.505 (0.385)
R&D	–0.0001 (0.0004)	–0.0002 (0.0004)	–0.0002 (0.0004)	–0.0002 (0.0004)
SQAGE	0.00004 (0.0002)	–0.00004 (0.0002)	–0.00003 (0.0002)	–0.00005 (0.0002)
SQSIZE	–0.024 (0.032)	–0.033 (0.031)	–0.033 (0.031)	–0.034 (0.032)
LTOBINQ	–0.103 (0.061)***			
LROA		0.542 (0.809)		
LOCFRA			0.737 (0.711)	
LCFRS				0.533 (0.546)
Log Likelihood	–201.917	–203.131	–202.822	–199.991
No. of Obs.	331	331	331	329
Pseudo R ²	0.11	0.10	0.10	0.11

Note: * represents significant at 1% level, ** represents significant at 5% level and *** represents significant at 10% level.

post-TRIPS period for TOBINQ and CFRS but not for ROA and OCFRA for merged firms. Mean values of AGE, SIZE, LASSET and R&D were higher in the post-TRIPS period compared to the pre-TRIPS period in merged firms. Whereas from Table 2, we observe that, in non-merged firms, average value of TOBINQ only was higher in the post-TRIPS periods compared to the pre-TRIPS period. Average values of AGE, SIZE, LASSET and R&D were higher in post-TRIPS period compared to pre-TRIPS period in non-merged firms too.

Table 3 presents the correlations between the variables for all firms. All the correlation coefficients are very low, except those between LEV and ROA (–0.614) and between LASSET and SIZE (0.936). However, none of the correlations among the independent variables raise multicollinearity concerns as the variance inflation factors (VIF) are all less than 10 (Nachane, 2006).

5. Empirical findings

5.1. Propensity score matching (PSM)

Using propensity score matching, first we estimate the probability of

being acquired using a probit model, by considering the values of the explanatory variables in pre-TRIPS period. Table 4 presents the results of probit model in eqn. (1). The estimations in Table 4 are used for both the “cherry picking” hypothesis or positive selection bias and for finding the determinants of being acquired, following TRIPS. The dependent variable DMERGE takes the value 1 if the firm is acquired after 2005 and 0 when it is not acquired. Explanatory variables thought to influence the probability of being merged are age and size of the firms, R&D expenditures and so on. We also use square of age and size as explanatory variables to capture nonlinear effects (Girma and Gorg, 2003, 2004; Karpatty, 2007). The age variable is important, because a younger firm may be acquired more easily than an older firm. Again, a larger sized firm has economies of scale, and hence, it may be profitable to acquire such a firm, which may help to increase future profitability. Similar arguments are applicable in the case of a firm with higher R&D expenditures. If a firm has more debt, then debt obligation after merger will be higher. Thus, a firm with high leverage has low probability of being acquired as it represents lower financial soundness. Similarly, we have considered log of total assets (LASSET) as one of the explanatory variables, which represents a firm having more assets, and thereby a higher probability of being acquired. Lagged value of firm

Table 5
Comparisons between full sample, treated firms and controls.

Variables	Full sample			Propensity Score matching sample			
	Mean Treated	Control	Difference in means	Mean Treated	Control	% Bias	Difference in means
AGE	19.884	19.040	0.844	27.766	26.163	9.2	1.603*
SIZE	6.619	5.330	1.289*	8.172	6.829	18.8	1.343*
LEV	0.336	0.405	-0.069	0.318	0.344	-10.2	-0.026
LASSET	2.977	2.455	0.522*	3.702	3.560	19.9	0.142*
R&D	87.044	46.922	40.122*	305.14	248.1	19.7	57.04*
LTOBINQ	1.129	1.039	0.09	1.505	1.242	17.1	0.263*
LROA	0.045	-0.120	0.165*	0.069	0.058	9.9	0.011*
LOCFRA	0.080	0.051	0.029*	0.075	0.058	13.6	0.017*
LCFRS	0.092	0.198	-0.106	0.038	0.084	-6.0	-0.046

Note: * represents significant at 1% level.

performance, represented by LTOBINQ, LROA and so on are included to examine the “cherry picking” hypothesis, which argues that if the past performance of a firm is better, then the probability of being acquired would be higher, as it would help improve the future performance of merged firms.

In Model (1), the lagged value of Tobin’s q (LTOBINQ) is negatively significant at 10% level, indicating that negative selectivity bias is operating with respect to Tobin’s q. Hence, there is no support of “cherry picking” hypothesis in the case of the Indian pharmaceutical industry. However, other explanatory variables are not statistically significant,

Table 6
Placebo tests for common trend assumption.

Variables	TOBINQ	ROA	OCFRA	CFRS
First Regression: Moving Mergers to 2001				
Constant	-1.844 (2.721)	-0.037 (0.209)	-0.589 (0.021)	-0.529 (0.534)
DMERGE* Placebo1	-0.435 (0.159)**	-0.014 (0.012)	-0.035 (0.021)	-0.043 (0.031)
AGE	0.121 (0.052)**	0.003 (0.004)	0.002 (0.007)	0.008 (0.010)
SIZE	0.589 (0.667)	0.050 (0.051)	0.184 (0.091)**	0.111 (0.131)
LEV	0.560 (0.382)	-0.180 (0.029)*	0.017 (0.052)	-0.061 (0.075)
LASSET	-0.287 (0.469)	-0.109 (0.036)*	-0.110 (0.064)***	-0.001 (0.092)
R&D	0.0002 (0.0003)	0.00001 (0.00002)	0.00005 (0.00004)	0.00005 (0.00006)
SQAGE	-0.002 (0.0007)*	-0.00007 (0.00005)	-0.00006 (0.00009)	-0.0002 (0.0001)
SQSIZE	-0.025 (0.049)	0.0009 (0.003)	-0.005 (0.006)	-0.0004 (0.009)
No. of Obs.	359	359	359	359
Second Regression: Moving Mergers to 2002				
Constant	-0.517 (2.729)	0.089 (0.208)	-0.498 (0.372)	-0.417 (0.532)
DMERGE* Placebo2	-0.195 (0.135)	-0.013 (0.010)	-0.004 (0.018)	-0.007 (0.026)
AGE	0.077 (0.049)	0.002 (0.003)	-0.001 (0.007)	0.004 (0.009)
SIZE	0.543 (0.673)	0.049 (0.051)	0.180 (0.091)**	0.106 (0.131)
LEV	0.663 (0.384)***	-0.176 (0.029)*	0.024 (0.052)	-0.052 (0.075)
LASSET	-0.414 (0.498)	-0.120 (0.037)*	-0.109 (0.067)***	-0.002 (0.095)
R&D	0.0002 (0.0003)	-0.00002 (0.00002)	0.00005 (0.00004)	0.00005 (0.00006)
SQAGE	-0.002 (0.0007)*	-0.00006 (0.00005)	-0.00005 (0.00009)	-0.0002 (0.0001)
SQSIZE	-0.022 (0.050)	0.001 (0.003)	-0.005 (0.007)	-0.004 (0.009)
No. of Obs.	359	359	359	359
Third Regression: Moving Mergers to 2003				
Constant	-1.411 (2.694)	0.070 (0.208)	-0.503 (0.372)	-0.430 (0.532)
DMERGE* Placebo3	-0.392 (0.131)*	0.0001 (0.010)	0.001 (0.018)	-0.002 (0.025)
AGE	0.089 (0.049)***	0.002 (0.003)	-0.002 (0.007)	0.004 (0.009)
SIZE	0.539 (0.664)	0.048 (0.052)	0.180 (0.092)*	0.106 (0.131)
LEV	0.680 (0.379)***	-0.178 (0.029)*	0.023 (0.052)	-0.053 (0.075)
LASSET	-0.137 (0.468)	-0.107 (0.036)*	-0.105 (0.064)***	0.005 (0.092)
R&D	0.0002 (0.0003)	0.00002 (0.00002)	0.00005 (0.00004)	0.00005 (0.00006)
SQAGE	-0.002 (0.0007)*	-0.00006 (0.00005)	-0.00005 (0.00009)	-0.0002 (0.0001)
SQSIZE	-0.025 (0.049)*	0.00009 (0.003)	-0.005 (0.007)	-0.004 (0.009)
No. of Obs.	359	359	359	359
Fourth Regression: Moving Mergers to 2004				
Constant	1.588 (2.701)	0.082 (0.212)	-0.477 (0.379)	-0.329 (0.542)
DMERGE* Placebo4	0.622 (0.146)*	0.003 (0.011)	0.007 (0.020)	0.025 (0.029)
AGE	0.010 (0.050)	0.001 (0.004)	-0.002 (0.007)	0.001 (0.010)
SIZE	0.472 (0.653)	0.048 (0.051)	0.179 (0.092)**	0.103 (0.131)
LEV	0.736 (0.374)**	-0.177 (0.029)*	0.025 (0.052)	-0.049 (0.075)
LASSET	-0.537 (0.465)	-0.109 (0.036)*	-0.108 (0.065)***	-0.008 (0.093)
R&D	0.0001 (0.0003)	0.00002 (0.00002)	0.00005 (0.00005)	0.00005 (0.00006)
SQAGE	-0.001 (0.0007)	-0.00006 (0.00005)	-0.00005 (0.00009)	-0.0001 (0.0001)
SQSIZE	-0.021 (0.048)	0.0009 (0.004)	-0.006 (0.007)	-0.004 (0.009)
No. of Obs.	359	359	359	359

Note: * represents significant at 1% level, ** represents significant at 5% level and *** represents significant at 10% level.

Table 7
Difference-in -differences: Merged versus non-merged firms.

Variables	TOBINQ	ROA	OCFRA	CFRS
Constant	1.389 (0.705)**	0.244 (0.060)*	0.0002 (0.068)*	−9.098 (0.524)*
DMERGE*POST	0.503 (0.101)*	0.018 (0.008)**	−0.010 (0.009)	0.232 (0.075)*
AGE	0.013 (0.015)	−0.005 (0.001)*	−0.004 (0.001)	−0.027 (0.011)*
SIZE	0.155 (0.168)	0.028 (0.014)**	0.052 (0.016) *	2.555 (0.125)*
LEV	−0.224 (0.178)	−0.241 (0.015)*	−0.067 (0.017)*	0.043 (0.132)
LASSET	−0.695 (0.197)*	−0.088 (0.017)*	−0.071 (0.019)*	−0.047 (0.146)
R&D	0.00005 (0.00004)	−4.80e-06 (3.72e-06)	−5.28e-06 (4.21e-06)	0.0002 (0.00003)*
SQAGE	−0.00007 (0.0001)	−3.84e-06 (0.00001)	−0.00001 (0.00002)	0.0004 (0.0001)*
SQSIZE	0.013 (0.012)	0.002 (0.001)***	−0.0004 (0.001)	−0.163 (0.009)*
Firm FE	Yes	Yes	Yes	Yes
Obs.	1200	1200	1200	1200

Note: * represents significant at 1% level, ** represents significant at 5% level and *** represents significant at 10% level.

implying that these variables have no role to play in the decision to acquire.

PSM provides a robust and reliable control sample for estimating the effects of mergers on firm performance if the pre-TRIPS variables are balanced between the merged and non-merged firms. The balancing property implies that the control group produced by PSM has a distribution of explanatory variables very similar to that of the treatment group. Table 5 shows the mean values of the treatment group and the control group both in the full sample and in the post-PSM sample. We also report the results of a simple t-test on the mean value differences of the performance variables of the two groups of firms.

Table 5 shows the mean values of treated firms and controls both in the full sample and in the post-PSM sample and the results of a simple t-test on the mean value differences of the performance variables of the two groups of firms. It appears that, before matching, R&D is significantly larger for treated firms than for the control group while the leverage was lower. After matching, the difference in means is not significantly reduced, which indicates that the difference in covariate means of treated firms and controls is significant. However, the

Table 8
Dynamic Development on Firm Performance: DID on Matched Firms.

Variables	TOBINQ	ROA	OCFRA	CFRS
Constant	1.061 (0.682)	0.247 (0.061)*	0.009 (0.068)	−9.101 (0.525)*
DMERGE*Y2006	0.663 (0.148)*	0.019 (0.013)	−0.016 (0.014)	0.135 (0.114)
DMERGE*Y2007	0.435 (0.150)*	0.028 (0.013)**	−0.015 (0.015)	0.132 (0.115)
DMERGE*Y2008	0.183 (0.154)	0.015 (0.013)	−0.017 (0.015)	0.197 (0.118)***
DMERGE*Y2009	−0.260 (0.155)	0.025 (0.013)***	0.003 (0.015)	0.210 (0.119)***
DMERGE*Y2010	0.327 (0.158)**	0.017 (0.014)	0.018 (0.015)	0.285 (0.121)*
DMERGE*Y2011	0.258 (0.163)	0.015 (0.015)**	0.018 (0.016)	0.366 (0.125)*
DMERGE*Y2012	0.116 (0.166)	0.033 (0.015)**	0.037 (0.016)**	0.470 (0.128)*
DMERGE*Y2013	0.308 (0.170)**	0.006 (0.015)	0.006 (0.017)	0.334 (0.131)*
DMERGE*Y2014	0.467 (0.177)*	0.025 (0.015)	0.021 (0.017)	0.290 (0.136)*
DMERGE*Y2015	1.557 (0.185)*	0.018 (0.016)	0.040 (0.018)**	0.470 (0.142)*
AGE	0.002 (0.015)	−0.005 (0.001)*	−0.002 (0.001)	−0.035 (0.011)*
SIZE	0.176 (0.164)	0.029 (0.014)**	0.060 (0.016)*	2.607 (0.126)*
LEV	−0.227 (0.171)	−0.241 (0.015)*	−0.068 (0.017)*	0.042 (0.132)
LASSET	−0.444 (0.193)**	−0.089 (0.017)*	−0.066 (0.019)*	−0.014 (0.148)
R&D	−1.30e-06 (0.00004)	−4.61e-06 (3.77e-06)	−6.42e-06 (4.24e-06)	0.0002 (0.00003)*
SQAGE	−0.0001 (0.0001)	−3.14e-06 (0.00001)	−9.14e-06 (0.00001)	0.0004 (0.0001)*
SQSIZE	0.009 (0.012)	0.002 (0.001)***	−0.001 (0.001)	−0.168 (0.009)*
Firm FE	Yes	Yes	Yes	Yes
Obs.	1200	1200	1200	1200

Note: * represents significant at 1% level, ** represents significant at 5% level and *** represents significant at 10% level.

balancing property is confirmed by the size of the standardized bias (less than 20%) as suggested by Rosenbaum and Rubin (1985) and Girma and Gorg (2007).

In the appendix, we present the comparative picture of the kernel density estimation of the distribution of the explanatory variables pre- and post-matching.

5.2. Difference-in-differences (DID)

Before implementing a difference-in-difference estimation as a robustness check, we test the DID common trend assumption using pre-treatment period i.e. pre-TRIPS period (2000–2004). The test is carried out by estimating two placebo experiments that artificially move the TRIPS year from 2005 to 2000 (the first one), to 2001 (the second one), and so on till the year 2004. The estimated equation is as follows:

$$Performance_{it} = \alpha + \beta DMERGE * placebo1 + controlvariables + firmFE + u_{it} \quad (9)$$

Where DMERGE=1 for firms merged after 2005 and 0, otherwise Placebo1=1 for $t = 2001$ and 0, otherwise, in the first placebo test Placebo 2 = 1 for $t = 2002$ and 0, otherwise, in the second placebo test

And so on for the other years till 2004.

The results are reported in Table 6 and show that the β coefficients in Eq.(9) are negative but not significant in most of the cases except Tobin's q in the case of the first placebo test. Similar observations emerge from all other placebo tests. Therefore, if TRIPS was implemented in the years before 2005, it would not help to improve firm performance for merged firms. The findings also exclude the existence of an ex-ante divergent trend of future treated firms compared to the matched controls. Thus, our findings support the common trend assumption for DID estimation.

We now consider DID estimation of Eq. (8) for different measures of firm performance. The results are reported in Table 7.

The results show that the coefficient of DID is positively significant for the variables TOBINQ, ROA, CFRS, but not OCFRA, controlling for the effects of other covariates. Thus, firm performance of the pharmaceutical industry improved due to mergers after TRIPS, with respect to majority of the indicators of performance. Since we found no evidence of “cherry picking” in Table 4, this finding indicates that any remaining

Table 9
Mean pre-merger performance of target and acquirer firms in the Indian pharmaceutical Industry.

Company name	Merger date	Mean values			
		ROA	TOBINQ	OCFRA	CFRS
Merger 1					
Ranbaxy Laboratories Ltd. [Target]	March 25, 2015	0.047471	2.645345	0.053105	0.06072
Sun Pharmaceutical Inds. Ltd. [Acquirer]		0.136185	5.318399	0.113238	0.202407
Merger 2					
Elder Pharmaceuticals Ltd.[Target]	December 13, 2013	0.0467	0.891091	0.031764	0.087318
Torrent Pharmaceuticals Ltd. [Acquirer]		0.113957	1.544814	0.41381	0.177566
Merger 3					
Burroughs Wellcome (India) Ltd. [Target]	January 1, 2005	0.092828	2.164982	0.055655	0.077044
Glaxosmithkline Pharmaceuticals Ltd. [Acquirer]		0.097813	3.211588	0.083243	0.062255
Merger 4					
Tonira Pharma Ltd. [Target]	April 1, 2011	0.025738	0.715845	0.086793	0.095174
Ipca Laboratories Ltd. [Acquirer]		0.10071	1.357414	0.10175	0.095448

improvement in firm performance should be explained by ex post differences in observables or unobservables. The findings suggest that firm performance improved between 1% and 50%, for the majority of the indicators.

Next, we consider the dynamic development of firm performance in merged firms following TRIPS up until ten years ex-post mergers using a matched sample of firms. The results are reported in Table 8. Table 8 is based on the following equation:

$$\begin{aligned}
 Performance_{it} = & \alpha + \beta_1 DMERGE_i * Y2006 + \beta_2 DMERGE_i * Y2007 \\
 & + \beta_3 DMERGE_i * Y2008 + \beta_4 DMERGE_i * Y2009 \\
 & + \beta_5 DMERGE_i * Y20010 + \beta_6 DMERGE_i * Y20011 \\
 & + \beta_7 DMERGE_i * Y20012 + \beta_8 DMERGE_i * Y20013 \\
 & + \beta_9 DMERGE_i * Y20014 + \beta_{10} DMERGE_i * Y20015 \\
 & + firmFE + yearFE + u_{it}
 \end{aligned} \quad (10)$$

Where DMERGE=1 for firms merged after 2005 and 0, otherwise
 Y2006=1 for $t = 2006$ and 0, otherwise
 Y2007=1 for $t = 2007$ and 0, otherwise and so on.

The results reveal that the time lag in improvement in firm performance is between one to ten-year ex-post mergers following TRIPS. The effect of a merger is highest for the variable TOBINQ and the least for

OCFRA. We observe that the effect of mergers on firm performance increases over time. However, post-merger effects on firm performance are not significant in some of the years' post-TRIPS for some of the indicators of firm performance. It indicates that the effects on firm performance of mergers following TRIPS are sensitive to the choice of the measure of firm performance in the case of the Indian pharmaceutical industry.

Thus, our findings support our Hypothesis 1. As our findings show that firm performance or profitability of merged firms increased in post-TRIPS periods, following the merger of firms in the pharmaceutical industry, it represents the incidence of "positioning" merger, as argued by Gorton et al. (2009). According to Gorton et al. (2009), in a positioning merger, if the managers are more interested about the firm value, the firm would engage in acquisitions in order to position their firm as a more attractive target for acquisition by the largest dominant firm, which in turn would create firm value. Thus, one can argue that the merger scenario of the Indian pharmaceutical industry followed this path, where the managers are more concerned about maximizing firm value and hence, present themselves as the target firms to be acquired by some other dominant firms in the industry. The outcome that firm performance improved after TRIPS in merged firms is likely because in merged firms, management, organization and technology are better than non-merged firms, as argued earlier. Moreover, the expenditures on innovative R&D would increase in merged firms compared to non-merged firms as the financing constraints of merged firms would be lower relative to non-merged firms. As a consequence, merged firms would be able to take advantage of patenting activities after TRIPS for 20-year patent terms, which would help to improve profitability further. Further, as earlier studies show, the product capability, patents and

Table 10
Number of patents in pharmaceutical industry in India.

Year	No. of Patent
2000	27
2001	52
2002	74
2003	134
2004	219
2005	180
2006	327
2007	278
2008	296
2009	269
2010	295
2011	241
2012	340
2013	379
2014	336
2015	370
2016	551
2017	732

Source: Banerji and Suri (2019) and Indiastat.com.

Note: Data after 2017 is not reported in Indiastat.com.

Table A.1
Variable description.

Variable definition	Symbols used	Measurement of the variables
Tobin's q	TOBINQ	Ratio of sum total of market value of equity and book value of debt to total assets
Return on assets	ROA	Ratio of net profit to total asset
Operating cash flow returns on assets	OCFRA	Ratio of operating cash flow to total asset
Cash flow returns from sales	CFRS	Ratio of operating cash flow to total sales
Age of the firm	AGE	Number of years since the incorporation of the firm
Size of the firm	SIZE	Natural log of sales
Leverage	LEV	Ratio of total debt to total asset
Log of asset	LASSET	Log of total asset
Research and Development expenses	R&D	Total R&D expenses

brand reputation of target firms would be acquired in a merger, and hence, profitability of the merged firm would be higher. Further, the operating strategy of merged firms would be higher relative to non-merged firms and hence, it would also help to improve the firm

performance in the Indian pharmaceutical industry. Thus, our finding supports similar observations from the studies by [Bianconi and Tan, 2019](#); [Ranft and Lord, 2002](#) and [Sevilir and Tian, 2012](#).

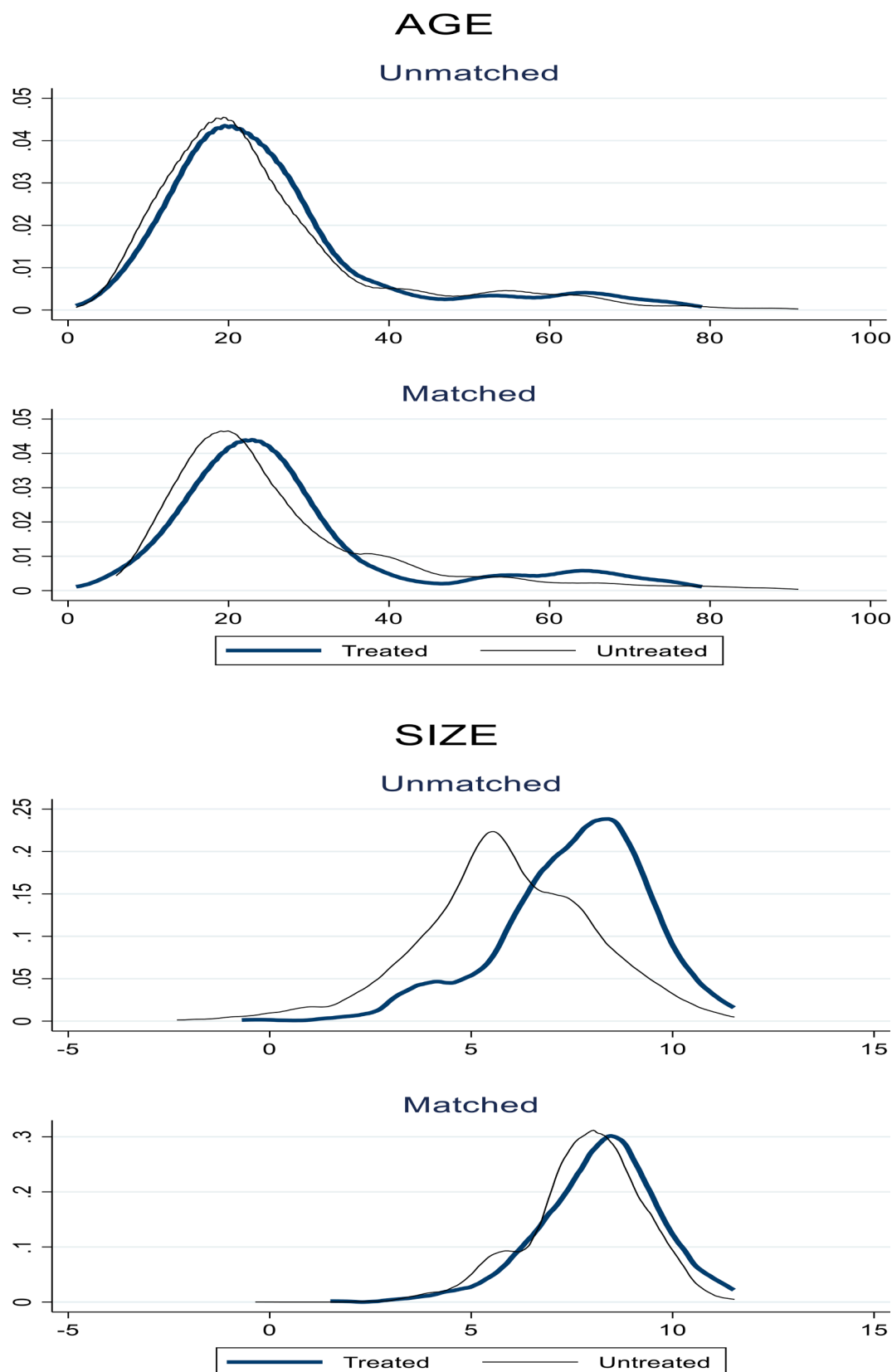


Fig. A1. Kernel density estimates of the distribution of explanatory variables-pre and post-matching.

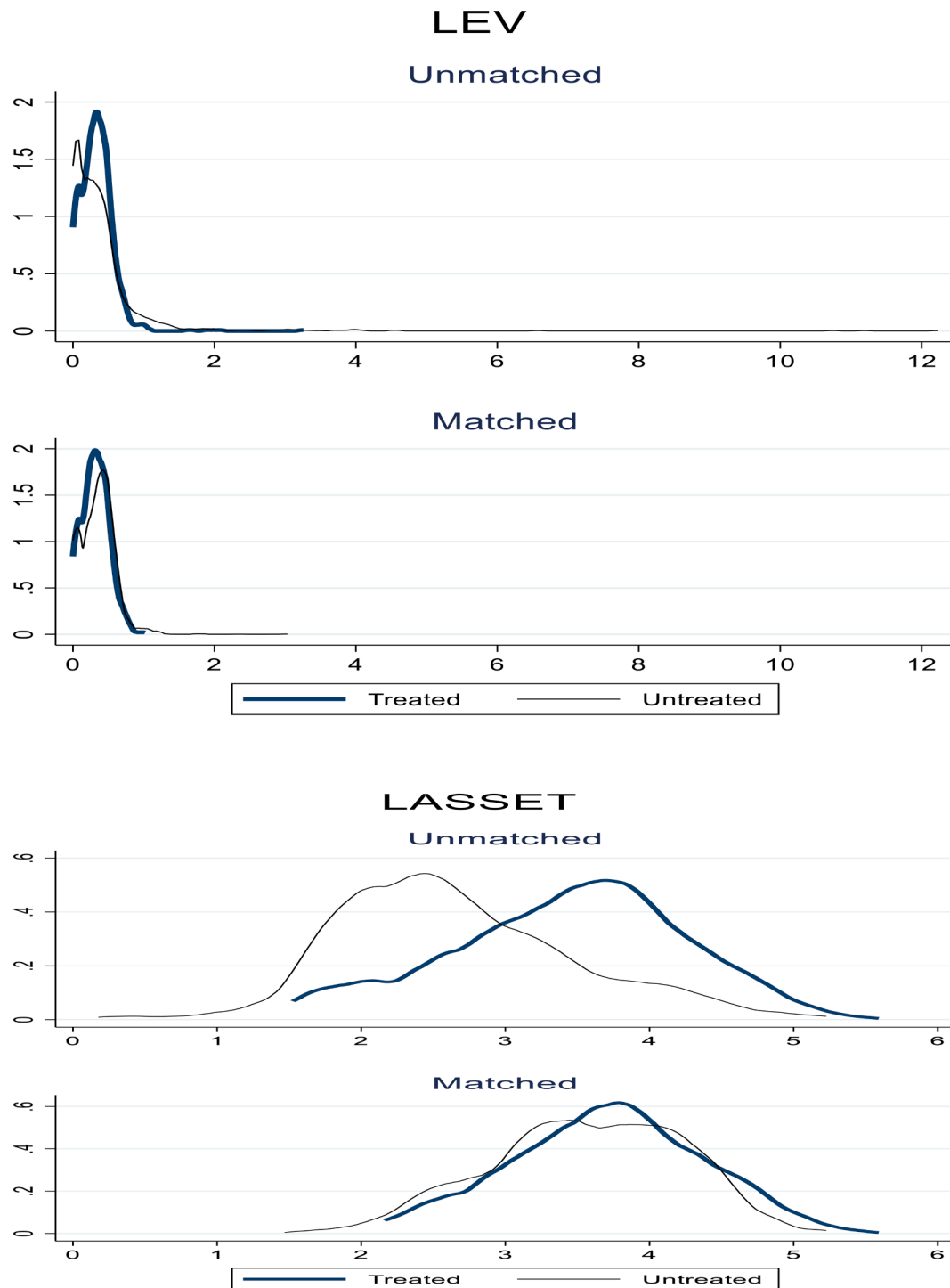


Fig. A1. (continued).

6. Discussion

Our findings show that firm performance measured by Tobin's q , ROA and CFRS improved in merged firms in post-TRIPS period but not for OCFRA. OCFRA represents operating cash flow to total assets. Hence, after-merger increase in operating cash flow relative to total assets did not improve. Thus, the increase in total assets was much higher than the increase in operating cash flow in merged firms after TRIPS. We get support for this evidence if we look at the mean value for OCFRA during the pre- and post-merger periods for merged firms from Table 1. On the other hand, operating cash flow to sales (CFRS) improved because sales

did not increase much relative to operating cash flow in post-TRIPS period in merged firms (See Table 1). On the other hand, in case of ROA, net profit increased more relative to total assets in merged firms in post-TRIPS period (see Table 1). Similarly, for Tobin's q , sum total of equity and debt increased more relative to total assets in merged firms during post-TRIPS period (see Table 1). Our finding for CFRS corroborates those of Ravenscraft and Scherer (1987).

If firm performance improves due to mergers, one argument is that they provide opportunities for economies of scale and scope, synergy or product market power. One implication that follows from this argument is that mergers by firms that have overlapping businesses will experience

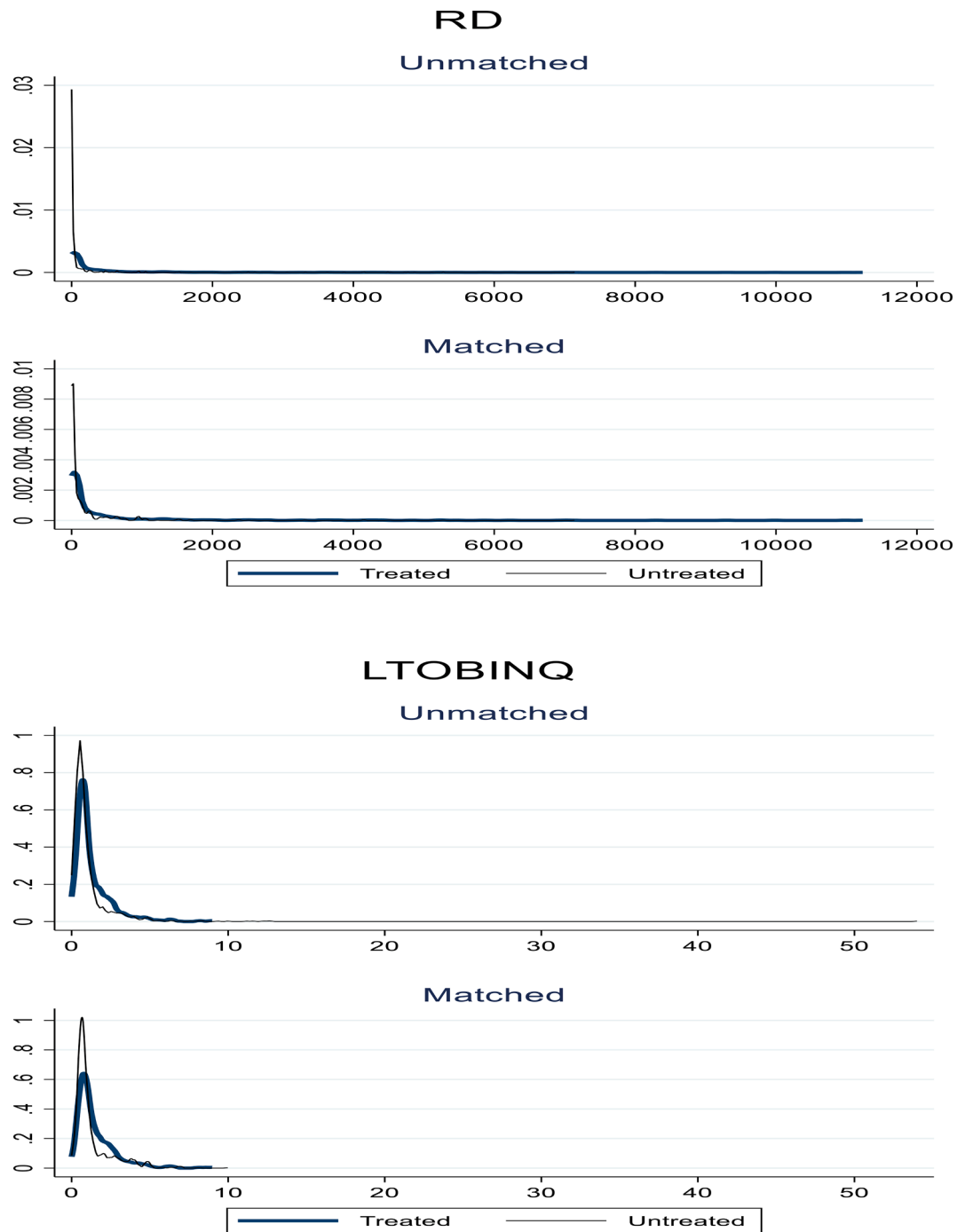


Fig. A1. (continued).

improvement in firm performance. Earlier studies observe that, in case of medium or low business overlap between the target and acquiring firms, firm performance does not improve (Healey et al., 1992). As we are focussing on the pharmaceutical industry only, business overlap is very high and hence, it leads to improvement in firm performance in post-TRIPS period in merged firms. Improvement in merged firms in post-TRIPS period, also do not come at the expense of long-term performance, because mean R&D expenditures in merged firms increased much more during the post-merger period compared to the pre-merger period (see Table 1).

Moreover, we find that in target firms, debt is higher than equity (i.e., they are high-leveraged firms) (see Table 1). Thus, after acquisition, the debt burden of acquired firms increased, limiting the management's

freedom to use future cash flows, and hence reducing the possibility of misuse of free cash flows. In other words, this phenomenon would resolve the agency problem of managers, who are prone to invest free cash flow in negative net present value projects (Jensen, 1986).

Some scholars suggest that if it is observed that acquirers performed better than the targets during the pre-acquisition period, then it suggests that targets were experiencing financial distress (Clark and Ofek, 1994). In Table 9 below, we report the mean performance indicators of various measures of firm performance used in this study for some targets and acquirer firms, where merger took place after 2005. It shows that the targets' performance indicators were significantly worse than the acquirers' in the pre-acquisition period in most of the cases and hence it supports the argument of Clark and Ofek (1994) that targets were in

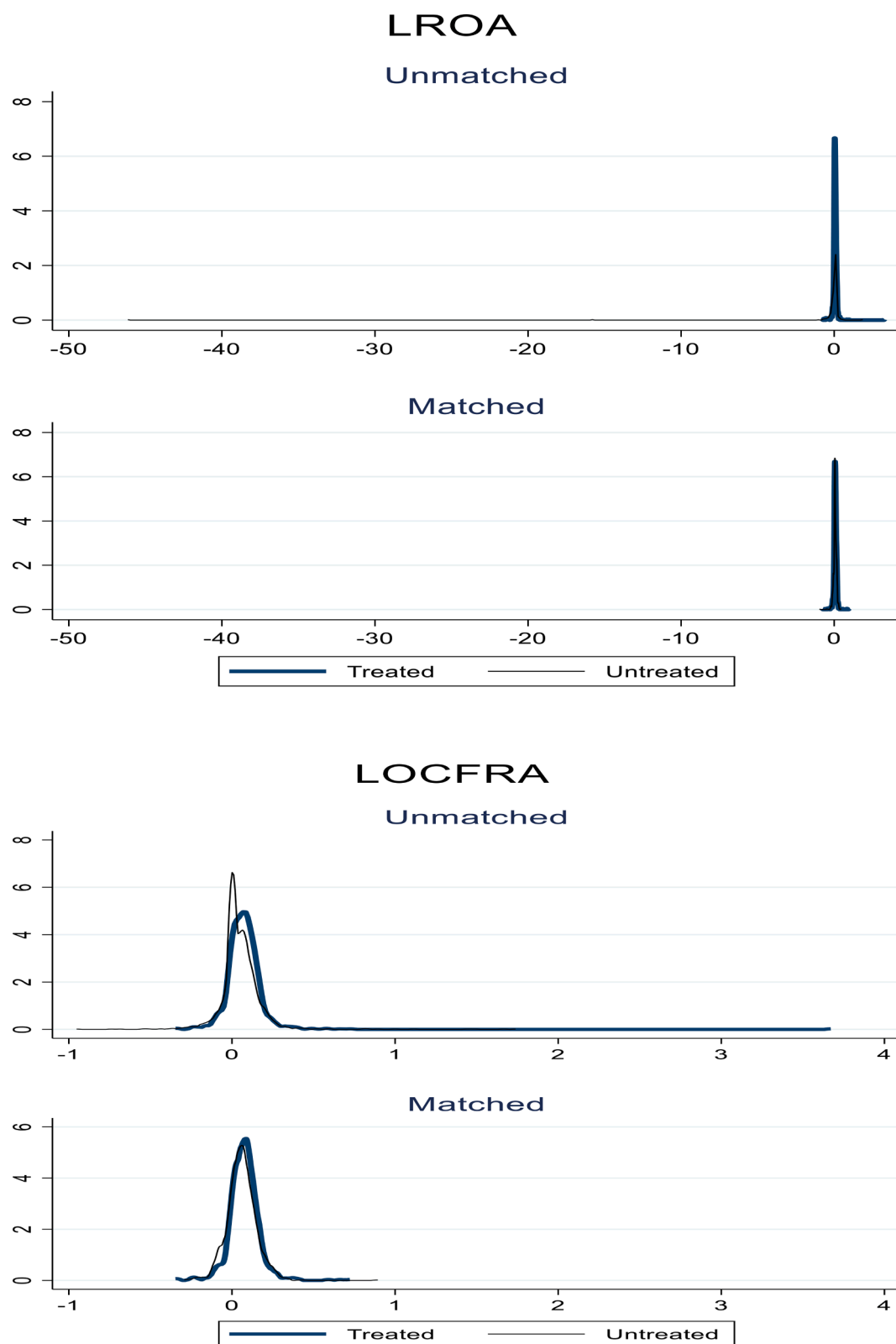


Fig. A1. (continued).

financial distress or may not be effectively utilizing their resources and hence not generating sufficient profits. It suggests that poor performing firms are more likely to be a takeover target in the Indian pharmaceutical industry. Our earlier findings from Table 4 did not support the “cherry picking” hypothesis. Thus, both the results from Tables 4 and 9 favor the argument that targets were performing poorly before mergers

in the Indian pharmaceutical industry.

Finally, it has been argued that R&D expenditures of target firms may not be sufficient to go for new discovery and patenting, and so they merge with some big firms which have patents and enough funding to finance R&D expenditures (Danzon et. al., 2007). Here merger is motivated by growth motives. It has been further argued by Danzon et al.

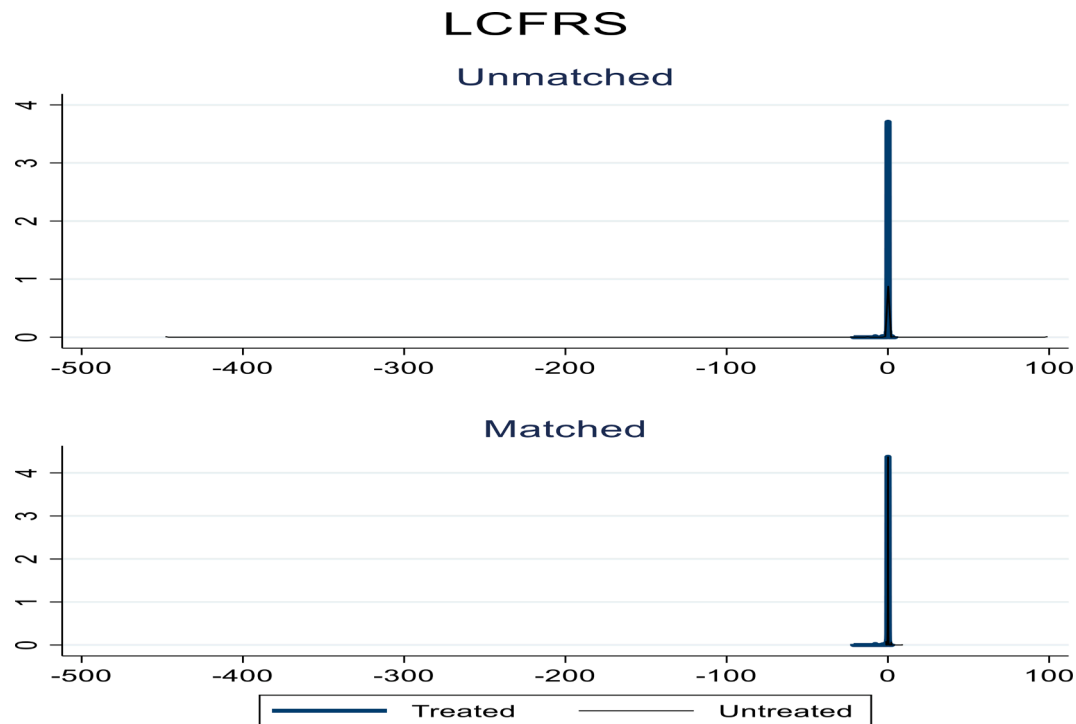


Fig. A1. (continued).

(2007) that as the technology are patent-protected and the human capital is highly specialized, acquiring a firm that owns complementary assets may be cheaper than trying to develop the required assets within the firm. From the evidence of several mergers in the pharmaceutical industry in India, we get support for this argument. For example, SunPharma acquired Ranbaxy on 25 March 2015, the primary motive of which was to enter into the markets of emerging economies and diversify the product portfolios which were complementary in nature for these two firms. Before this merger, Ranbaxy was also facing financial distress (Business Standard 2014). Another significant merger is the acquisition of Piramal Healthcare by Abbott on May 21, 2010 under a Business Transfer Agreement. In this case also the motive was to diversify beyond patented products in emerging markets. This acquisition helped Abbott to acquire all the intellectual property (IP) of the formulation business from Piramal Healthcare by accessing all the patents and trademarks. This merger was also complementary in nature due to different types of expertise of the two companies (Times of India, 2010). Another example is the acquisition of Ranbaxy by Daiichi Sankyo in June 2008. The primary motive of this acquisition was to gain access to research and production activities in India and to diversify Ranbaxy's product portfolio in the generic brands. Hence, the business of Ranbaxy and Daiichi complemented each other through this acquisition. However, this merger was not successful. On April 21, 2015 Daiichi Sankyo announced the sale of its entire 8.9% stake in SunPharma which Daiichi had got in return for its 63.4% stake in Ranbaxy that it had sold to SunPharma (Business Today, 2015). Another example is the acquisition of Elder Pharma by Torrent Pharma in 2013. Product portfolio of these two companies was also complementary in nature and as a result of this acquisition, Torrent expanded its market share in various product segments. This deal also helped Elder Pharma to come out of financial distress (The Hindu, 2013). The above evidences support the arguments that the mergers in the Indian pharmaceutical industry were due to growth motives and these were between firms having complementary advantages in business lines, product portfolios and R&D initiatives.

7. Conclusion

This paper provides a systematic empirical analysis of the impact of mergers, following TRIPS, on the performance of merged firms in the Indian pharmaceutical industry. In order to identify adequately the effect of mergers, we investigate the impact on firm performance of the merged vis-a-vis the non-merged firms in the post-TRIPS period. We pay particular attention to identifying the causal effect, using difference-in-differences and propensity score matching approaches, and examine differences in post-merger effects during the post-TRIPS period.

Our results suggest that firm performance improved in merged firms, following the mergers, during the post-TRIPS period. Depending on the various indicators of firm performance, we find that firm performance improved between 1% and 50%. We further observe that the effects of mergers on firm performance increase over time during the post-TRIPS period. We argue that our finding represents the incidence of "positioning" merger, as argued by Gorton et al. (2009), where managers care about the firm value and would engage in acquisition in order to position their firm as a more attractive target for acquisition by the largest dominant firm, which in turn would create value. Further we argue that firm performance improved in merged firms following TRIPS in the Indian pharmaceutical industry because merged firms have superior management, technology and organization relative to non-merged firms. Merged firms would be able to spend more on R&D as the financial constraints would be relaxed after the merger and hence take advantage of patenting for 20 years. Moreover, many mergers took place between firms who have complementary advantages in R&D initiatives, product portfolios and market segments in the Indian pharmaceutical industry. This transfer of technologies and capabilities helped to improve firm performance in merged firms. We suggest that all the above arguments worked for the improvement of firm performance in merged firms during the post-TRIPS period in the Indian pharmaceutical industry. Hypothesis 2

Our study has many implications for the policy makers in Asian countries because many Asian countries have approved changes to the TRIPS agreement which will have some impact on the pharmaceutical sector of these countries. Pharmaceutical firms in Asian countries have

relatively lower R&D intensity than their counterparts in developed countries. As our findings show that increase in profitability following M&A is mainly due to the improvement in innovation and technology, therefore, Asian firms should invest more in R&D to reap the benefits. For this purpose proper regulation for the protection of intellectual property (IP) rights should be implemented. In India we observe that the number of patents has increased with the amendments to the Indian Patent Act and introduction of the product patent following TRIPS (see Table 10). This phenomenon indicates that a shift to a stronger IP regime resulted in greater thrust in the R&D activity among the domestic firms in India and patenting also increased.

Some scholars are sceptical about M&A because M&A may harm competitiveness among firms due to the increase in concentration. They apprehend that market power will be concentrated at the hands of some big firms and will be harmful for innovativeness of other firms. But as has been argued by Richman et al. (2017), M&A may generate more productive focus and create economies of scale which would be conducive for innovativeness for new entrants and in turn will promote competition. Our study also suggests that M&A as a restructuring strategy is needed for pharmaceutical sector in Asian countries because large size of firms would help to compete effectively in the new business environment following TRIPS. Large firms would remain competitive in the pharmaceutical sector mainly through building technological capabilities as evident from the Indian experience.

Declaration of Competing Interest

We hereby declare that, there is no conflict of interests in this research.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

Acknowledgement

We thank the Editor, Professor Josef C. Brada and the anonymous reviewer for the very useful comments which helped us to improve the paper.

Appendix A

Table A.1., and Fig. A.1.

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