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Do Women on Corporate Boards Impact Financial Performance? A Study of Indian Firms

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Keywords

gender quotas, corporate boards, women, equality

Disciplines

Economics

DO WOMEN ON CORPORATE BOARDS IMPACT FINANCIAL PERFORMANCE? A
STUDY OF INDIAN FIRMS

By

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An Undergraduate Thesis submitted in partial fulfillment of the requirements for the
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May 4 2020

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This study examines the impact of a quota in India which mandated that all firms with an annual revenue of over Rs.300 crore (equivalent to USD\$40M) have at least one woman on their board. Using a difference-in-difference regression analysis, I find that having a woman on the board results in a 0.4483 percentage point increase in return on invested capital for firms which did not already have a woman on their board prior to the quota being enacted. I also exploit the revenue cutoff in the quota to conduct a regression discontinuity analysis which produces results consistent with the above. These benefits existed even when the cost of appointing a woman was low, demonstrated by the fact that even firms well below the revenue cutoff appointed a woman, and that most of the women appointed did not have relevant industry experience. This study therefore provides causal evidence for the effect of corporate board gender diversity on firm performance, a relationship that has been understudied within the context of developing countries.

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1. Introduction

The issue of gender diversity in corporate leadership has been a point of controversy for many decades. As social activists, policymakers, and women within firms push for gender equality in the business world, rigorous evidence on how female leaders impact the decision-making and wellbeing of firms will be essential to making the business case for gender equality. If diversity can be tied to a business return, employers could be more likely to view the hiring, training, and promotion of women as long-term investments.

To this effect, academics have studied the impact of women on corporate boards. Besides painting an important picture of how women can break into the highest echelons of management, women in these positions can also have a strong impact on other women in the firm by acting as role models, mentors, sponsors, and advocating for female-friendly firm policies. To date, the majority of this literature has focused on large, public Western European and US corporations (Carter, Simkins and Simpson 2003; Erhardt, Werbel and Shrader 2003). Yet the issues faced by women in developing countries have for the most part been overlooked, despite the unique and complex challenges faced. Firstly, women in developing countries may face vastly

different sets of structural barriers. For example, women in Indian firms face anything from “glass ceilings” (which prevent them from reaching the top of the corporate ladder), “leaking pipelines” (referring to the high levels of attrition as they climb), and “sticky floors” (which render them less likely to even start climbing the corporate ladder in the first place) (Catalyst 2013 and McKinsey 2012). At 27%, India’s female labor force participation rate presents a puzzle to economists and policymakers. It is much lower than countries with a comparable level of economic development, and declining despite the rise of women’s education (World Bank 2019). Yet as the Indian economy is experiencing a slowdown as a result of underinvestment in structural productivity, harnessing the skills and talents of women will become even more necessary.

Secondly, firms in developing countries also tend to be structured differently, with family firms and concentrated ownership much more widespread and corporate governance less substantial. This ownership structure has implications for how diversity on corporate boards may impact the rest of the firm as the principal-agent problem faced by public corporations shifts into one of aligning incentives between family owners and minority shareholders.

However, the literature on women in firms in developing countries has thus far been very sparse, particularly as it relates to corporate boards. Some studies have suggested that gender diversity can improve firm performance in China (Liu et al 2015), Vietnam (Nguyen et al 2015) and India (Sarkar and Selarka 2015). Though these studies paint a useful picture, they rely on regressions with instrumental variables as their methodology - as opposed to some studies on developed countries which have exploited gender quotas for corporate boards as exogenous shocks (Matsa and Miller 2013, Nygaard 2011, Ahern and Dittmar 2012) (though Sarkar and Selarka mention the quota extensively in their study, they ultimately rely on an instrumental variable to get around their endogeneity problem rather than the exogenous quota itself). I argue that the latter allows for better causal identification because it is completely exogenous whereas instrumental variables may still be correlated with the independent variable on unobservable characteristics.

Furthermore, whilst the development economics literature has explored the impact of gender empowerment on the household and policymaking spheres, the impact of gender representation on firm outcomes has received less attention. Therefore, this study aims to fill a gap in the literature studying the impact of corporate board diversity on firm performance, and the literature studying the impact of gender diversity on economic outcomes in developing countries. To do this, I examine the impact of an Indian law, Section 149(1)(b) of the Companies’ Act of 2013, which imposed a quota of at least one female director on the board of listed companies and any public company, having a paid-up share capital of 100 crore or more rupees (equivalent to USD\$14M) or a turnover of 300 crore or more rupees (equivalent to USD\$40M). In section II, I will present a review of the current field of study. Section III will discuss my data and methodologies and Section IV my

results. I will discuss my findings in Section V and Section VI will conclude.

2. Literature Review

2.1 Why women are underrepresented on corporate boards

Corporate boards serve several purposes. Firstly, boards mediate the relationship between principals (shareholders) and agents (directors and managers) to facilitate the alignment of incentives and resolve the principal-agent problem. When outside directors act independently from their inside counterparts, they will act as good monitors for a shareholders' interests (Aguilera et al 2008). Secondly, under resource dependency theory (Pfeffer and Salancik 1978), boards allow businesses which depend on external resources to reduce their dependencies and therefore risk. In doing so, boards provide advice, council, legitimacy, and communication.

Women are vastly underrepresented on corporate boards across the world but particularly in India where just 13.8% of corporate board seats are held by women (Deloitte 2019). The hypotheses for the state of gender disparity can be divided into two branches - supply side factors and demand side factors.

On the supply-side, women may shy away from the competition for promotions or stress and work-life imbalance (Niederie and Vesterlund 2007). They may also suffer from career interruptions due to childbearing (Bertrand, Golden and Katz 2010) and make fewer investments in education and work experience compared to men (Tharenou, Latimer and Conroy 1994). On the demand-side, the existence of institutional "glass-ceilings" block progress at the highest corporate levels. Women may find it difficult to access male-dominated professional networks and mentors and sponsors, who are likely to mentor or sponsor those who are similar to them (Athey, Avery and Zemsky 2000). Social identity theory also states that individuals may also prefer to surround themselves with and provide higher evaluations for those who share similar demographic profiles (Tajfel and Turner 1986). This means the standards of ability for low-status groups may also be higher than those for high-status groups, rendering even equally qualified women at a disadvantage (Biernat and Kobrynowicz 1997).

2.2 Why female representation is important

A long standing subset of literature has examined the relationship between gender equality and economic development in the household and political spheres. In the household sphere, Udry (1994) finds that women's farming plots in Burkina Faso were more productive than that of their male counterparts and allocating

more fertilizer and labor could increase household income by 6%. Udry and Goldstein (2002) also found that women's plots in Ghana achieved lower profits because they were left fallow for much shorter periods than the plots of their spouses. In the political sphere, Chattopadhyay and Duflo 2004 found that a quota which randomly reserved seats in Indian Village Councils for women led to more investment in infrastructure to improve water access. Bhalotra and Clots-Figueras (2014) also found that women's political representation in state legislatures in India led to a reduction in neonatal mortality. Therefore, it is clear that empowering women may lead to improved economic outcomes in the household and policymaking spheres. However, when it comes to the corporate sphere, causal empirical evidence is less common. There has been some evidence on the impact of injections into women-run businesses (Fafchamps et al 2014). However, women in medium and larger businesses have been severely understudied. The literature on the impact of female political representation on business representation is slightly richer. Ghani and Kerr (2014) find that political gender quotas led to a doubling of female ownership in the Indian manufacturing business from 1994 to 2005, though there was no effect on overall employment. They hypothesize that this was due to increases in local public goods and infrastructure favored by women, or role model effects. Terjesen and Singh (2008) also find in a 43 country study that countries with a longer tradition of women's political representation are more likely to have high proportions of women on corporate boards. Nevertheless, none of these studies causally relate female empowerment within firms to firm performance.

Despite this, there has been some evidence to suggest that women board of directors may behave differently from male directors and in particular enhance the goals of corporate boards outlined in Section 2.1 - that is, under principle agency and resource dependency theories.

Firstly, research suggests that women board of directors may be better monitors and thus better at resolving the principal-agent problem with regard to management and shareholders. Brown et al (2002) found that boards with three or more women were 27% more likely to explicitly monitor the implementation of corporate strategy compared to all male boards. They were also more likely to have higher levels of board accountability and promote communication with stakeholders. However, Nygaard (2011) did find that having new women only made boards better monitors in firms where information asymmetry was low. Studies have also found that women tend to have higher ethical standards and are more ready to ask awkward and tough questions, thus increasing board independence (Rhode and Packel 2014, Gul et al 2007).

Secondly, more diverse boards are more likely to fulfill a firm's need for resources. Women tend to rely on social and other networks rather than individual systematic practices (Brush 1992), suggesting that they may be able to diversify a firm's network. Studies have also found that women directors were more likely to consider non-financial measures such as customer and employee satisfaction, innovation, and CSR (Brown et

al 2002, Hisrich and Brush, 1987), and also be more risk averse (Johnson and Powell 1994). Diversity on boards can also lead to a better understanding of market conditions, better creativity and quality in board decision-making and ultimately more effective problem-solving (Carter et al (2003).

2.3 Quotas as a potential policy tool

Quotas for women on gender boards have been widely discussed and studied. To date, quotas have been implemented in the US, India, Kenya, Israel, Brazil, and all across Europe (Terjesen, Aguilera and Lorenz 2014; Sarkar and Sekara 2015). The following table is a non-comprehensive list of corporate board quotas around the world as of 2020.

Country	Quota	Applied to	Compliance date	Penalty
Norway	40 percent	PTFs, SOEs	2008	Dissolve company; fines
Spain	50 percent	PTFs with 250+ employees	2015	Impact consideration for public subsidies and govt contracts
Finland	40 percent	SOEs	2005	NA
Quebec (Canada)	50 percent	SOEs	2011	NA
Israel	1 woman	PTFs	1999	NA
Iceland	40 percent	PTFs with 50+ employees	2013	NA
Kenya	33 percent	SOEs	2010	NA
France	40 percent	PTFs with 500+ employees or 50+ M euro in revenues	2017	Directors lose office and have benefits suspended
Italy	33 percent	PTFs, SOEs	2015	Fines; directors lose office
Belgium	33 percent	PTFs, SOEs	2017	Directors lose office and have benefits suspended
India	1 woman	PTFs with 300+ crore INR in revenue	2015	Fines

(continued)

Country	Quota	Applied to	Compliance date	Penalty
Germany	30 percent	PTFs	2016	Fines
Netherlands	30 percent	PTFs with over 250 employees	2013	None
California (USA)	1 woman if < 5 board directors; 2 women if 5 board directors; 3 women if > 5 board directors	PTFs	2021	Fines
Denmark	40 percent	PTFs	2013	Fines
Brazil	40 percent	SOEs	2022	NA
Pakistan	1 woman	Public interest firms	2020	NA
Australia	30 percent	PTFs	2018	None

Quotas can be an effective tool to improving gender equality if path dependence is a key factor in the underrepresentation of women. That is, women cannot climb the corporate ladder because of an absence of networks which is due to the underrepresentation of women itself. In this context, quotas could be useful in breaking the cycle (Bertrand et al 2018). Quotas can also allow women to serve as role models for each other and provide enhanced mentoring and networking opportunities for younger women (Bilimoria 2000).

However, if high quality women cannot be found to fill positions, quotas may backfire and reinforce negative stereotypes. This may result in a “patronizing equilibrium” whereby women invest less in their careers (Coate and Loury 1993). If a quota only results in one woman on the board, it may also result in tokenization and the one woman being stereotyped with sex-role characteristics (Kanter 1977).

Quotas are particularly useful as a tool which can allow us to examine the empirical impact of having more women on board. By acting as an exogenous change, they allow us to overcome the endogeneity problem whereby it is unclear if a firm having more women on a board performs better because there are more women, or because the types of firms to have more women on their board are better performing due to other reasons.

2.4 Impact of women directors

The empirical evidence around corporate board gender diversity has focused predominantly on women in North America and Western Europe. I will examine two types of evidence - those which exploit quotas and those which do not. As noted above, quotas can be a more robust way of testing the impact of gender diversity on boards as they allow us to circumvent the endogeneity problem cleanly.

2.4.1 Impact on financial performance

Thus far, the findings regarding the effect of corporate board gender diversity on firm performance in studies which do not examine quotas have been mixed. The following table chronicles the results of a non-exhaustive set of studies. As can be seen, the majority of studies regard corporate boards in the US, UK or Western Europe. Among the studies in the table, nine find a positive association between gender diversity and firm performance, two find a negative association, and four find mixed or no association. The studies are fairly consistent in their methodology, mostly using regressions with instrumental variables and 2SLS, and Tobin's Q or ROA (return on assets) as the dependent variable. Some scholars have suggested that market-based measures such as Tobin's Q tend to suffer more from having a woman on board, whereas accounting-based measures such as ROA and ROI (return on investment) do not (Haslam and Ryan 2010, Willows and van der Linde 2016).

Study	Sample	Dependent variable	Methodology	Finding
Sarkar and Selarka (2015)	1348 Indian public firms from 2005-14	Tobin's Q and ROA	Regression using IV (% of men serving on other boards with women)	Positive association - a one standard deviation increase in total number of women directors on board led to a 1.7% increase in market value
Lee and James (2007)	30 Singaporean firms from 1988-2001	Stock market valuation	Stock market event study	Positive association - appointment of a female director resulted in a 2.3% increase in share value over the next two days

(continued)

Study	Sample	Dependent variable	Methodology	Finding
Carter, Simkins and Simpson (2003)	638 US Fortune 1000 firms from 1998-2002	Tobin's Q and ROA	Regression using OLS and 2SLS	Positive association - a 1 unit increase in women on board improved Tobin's Q by 9.42 units
Erhardt, Werbel and Shrader (2003)	112 US Fortune-listed public companies from 1993-1988	ROI and ROA	Correlation and hierarchical regression analysis	Positive association - a 1 unit increase in board diversity led to a 0.32 unit increase in ROI and 0.25 unit increase in ROA
Singh, Vinnicombe and Johnson (2001)	100 UK FTSE 100 firms	Market cap	Correlations	Positive association - female directors were found in bigger, more profitable firms with the largest turnovers
Liu, Wei and Xie (2015)	Over 2000 firms listed in the Chinese (Shanghai and Shenzhen) stock exchanges from 1999-2011	Return on Sales, ROA	Regression using 1 year lagged measures; Regression using IV (% of women directors in the firm's industry and % of female employment in the firm's industry); Regression with Arellano-Bond dynamic panel estimator	Positive association - a 1% increase in women on board improved ROS and ROA by 0.13% and 0.03% respectively.

(continued)

Study	Sample	Dependent variable	Methodology	Finding
Nguyen et al (2015)	120 publicly listed Vietnamese firms from 2008-2011	Tobin's Q	Regression using lagged measures; static OLS; dynamic OLS; two-stem system GMM model	Positive association - a 1% increase in women on board improved Tobin's Q by 0.5%, but this increase ceases when the percentage of female directors reaches 20%.
Adams and Ferreira (2009)	US S&P 500, MidCaps and SmallCap firms from 1996-2003	Tobin's Q	Regression using IV (% of male directors with board connections to female directors)	Positive association when corporate governance was weak, negative association when corporate governance was strong due to the counter productivity of over-monitoring
Willows and van der Linde (2016)	40 publicly listed South African firms in 2013	Tobin's Q, ROA, ROE	OLS Regression	Positive association when using accounting-based measures (ROA, ROE) but negative association when using market-based measures (Tobin's Q)
Carter, D'Souza, Simpkins and Simpson (2010)	641 S&P 500 firms from 1998-2002	Tobin's Q, ROA, ROE	OLS and 3SLS Regression	No relationship - find that diversity is endogenous
Rose (2007)	Publicly listed Danish firms from 1998-2001	Tobin's Q	OLS Regression	No relationship

(continued)

Study	Sample	Dependent variable	Methodology	Finding
Smith, Smith and Verner(2006)	2500 large Danish firms from 1993-2001	NA	Regression with OLS, random effects, IV (average length of education of the spouses of the other CEOs in the firm)	Mixed effects varying from no to positive relationship, depending on measure of financial performance. Authors suggest that this may have been because coordination of more diverse management teams is costlier and consensus is less likely, reducing efficiency and therefore competitiveness.
Campbell and Minguez-Vera (2008)	68 non-financial Spanish firms from 1995-2000	Tobin's Q	Regression with 2SLS and IV (Blau and Shannon indices of diversity)	No relationship when only 1 woman, but positive association with share of women
Shrader et al (1997)	200 US Fortune 500 firms	ROE, ROA, ROI, ROS	Correlations and hierarchical regression	Negative association - a 1 unit increase in women on board reduced financial eprformance by 0.12 units
Haslam and Ryan (2010)	126 FTSE 100 firms from 2001-2015	Tobin's Q, ROA, ROE	Bivariate correlations	Negative association - companies with a male-only board enjoyed a valuation premium of 37% relative to firms with a woman on the board. However, these market perceptions are not aligned with the underlying realities of company performance.

For studies which examine the impact of quotas, findings are also mixed but tend to be more negative. However, most of these studies have centered on the impact of a 2003 Norwegian law which mandated that

40% of firms' directors be women.

Ahern and Dittmar (2012) find that the quota led to a significant drop in stock price at the time of the announcement and a large decline in Tobin's Q over the following years. While Ahern and Dittmar (2012) use prequota variation in female directors, Matsa and Miller (2013) use a firm's form of legal organization (public or private) to proxy for exogenous variation in board changes mandated by the quota. Despite different methods, they reach essentially similar conclusions - operating performance declined because firms made fewer layoffs and costs increased because newly appointed female directors were more altruistic and long-term-oriented than male directors.

Johansen and Sandnes (2008) also argue that stocks declined with the announcement. However, these findings have been disputed. Nygaard (2011) found that stock prices actually increased with the 2005 announcement and Eckbo et al (2016) also found the change was overall value-neutral.

An important caveat to note is that firm performance should not be the only metric on which quotas are evaluated. As we can see from Matsa and Miller (2013), even if value may decline, this may hint at better long-term governance or altruism, which could be conceived as more important than short-term performance. Therefore, we will examine two more dimensions of quotas below: their impact on the types of women promoted, and their impact on other women in the firm.

2.4.2 What types of women were promoted?

As a whole, non-quota studies have found that women directors are significantly younger than their male counterparts in the UK (Sealy, Singh and Vinnicombe 2007), Australia (Ross-Smith and Bridge 2008) and US (Peterson and Philpot 2007). Women also hold fewer directorships, have less powerful titles, occupy more staff positions and earn less than men (Zelechowski and Bilimoria 2004). However, women do tend to be more experienced in other ways - of the FTSE 100 firms in the UK, women are more likely to have MBA degrees and international experience, though less likely to have CEO or COO experience (Singh, Terjesen and Vinnicombe 2008).

Even when women are on boards, they are less likely to be on key committees (Peterson and Philpot 2007). Women are also generally more likely than men to serve in precarious management positions ("glass cliff") and in boards of poorly performing companies during periods of decline (Ryan and Haslam 2005).

The only quota study to examine the impact on the types of directors concurs with the findings above - Ahern and Dittmar (2012) also find that the new board directors as a result of the Norwegian quota were

younger and had less CEO experience but were more highly educated.

2.4.3 Impact on other women in the firm

Matsa and Miller (2011) find in a panel study of US publicly traded firms from 1997 to 2009 that having more female board members can lead to having more females in a management. Furthermore, Bilimoria (2006) find that the number of women corporate directors on US Fortune 500 boards is positively related to the number of women officers, women holding line management jobs, and women in the top earners of the company. Women directors also may be more likely to advocate for women's issues, though this may also be a "poisoned chalice" which some do not wish to respect (Ashford et al 1998; Bradshaw and Wicks 2000). Smith et al (2006) also find that more diverse boards increase the talent pool for female managers, boosting productivity by enlarging the internal pool of candidates for top positions.

However, Bertrand et al (2018) find no robust evidence that this occurred in response to the quota enacted in Norway. Though the gender gap in earnings within boards fell substantially, there was no robust evidence that this impacted highly qualified women whose qualifications mirrored those of board members but were not appointed, nor were there changes in female enrollment in degrees or labor market outcomes.

2.5 Women on boards in an Indian context

Several factors, ranging from different gender dynamics to different firm structures, to different quotas, mean that a study in the Indian context is likely to differ from the studies which have thus far predominantly focused on Western Europe and the US.

2.5.2 Different firm structure

India has a very high concentration of family firms, which account for almost 80% of market capitalization (Sarkar and Selarka 2015). Despite family firms having unique ownership structures and agency problems, the literature on the impact of quotas on these types of firms has been sparse. Unlike public corporations where there is a separation of ownership and control, family firms have concentrated insider ownership and control (Sarkar and Selarka 2015). Therefore, unlike the agency problems faced by public firms, the key issue in family firms is opportunistic behavior by founding family members who extract private benefits of control at the expense of minority shareholders (Anderson and Reeb 2003, Masulis 2009). Therefore, instead

of aligning interests of managers and shareholders, the firm instead must align the interests of two major blocks of shareholders (DeMott 2008).

If firms have chosen their board structures to maximize the private benefits of management (as we may expect with family firms) gender quotas may lead to a positive effect as monitoring may improve with more female directors (Bebchuk and Fried 2005). This is in contrast to firms which have already chosen their board structures to maximize firm value, for which any artificial restriction could have a negative impact on value (Demsetz and Lehn 1985) (as we may expect for public firms).

However, this will only occur if the women themselves are independent board of directors. Indeed, Sarkar and Selarka (2015) find that whilst women board of directors affiliated to the family have no significant effect on value, independent women do. There is also some evidence that women may be less prey to the perils of a family firm - they may be more universalist and benevolent (Schwartz 1992), and less security oriented or tradition bound - therefore less influenced by norms and practices such as hierarchical structure and deference (Adams and Funk 2011). However, other evidence suggests that women could magnify the harms of family firms as they are, like family firms, more inclined to stakeholderism compared to shareholders (De Mott 2008).

2.5.3 Differences in the quota employed

There may be additional concerns around compliance to the quota. India's penalty is much lighter than that of other quotas which have been studied (for example, Norway threatened delisting of firms which did not comply, Ahern and Dittmar 2012). Instead, the Companies Act initially imposed a financial penalty of Rs.10000 (US\$140) with a penalty of Rs.1000 (US\$14) per day in violation. This fine was increased to Rs.50000 (US\$700) in March 31, 2015 with an additional penalty of Rs.5000 (US\$70) per day in violation. The law also threatens action against promoters and directors if firms remain non-compliant beyond 6 months, though does not specify what this action is (Shanmugam 2019).

Furthermore, unlike many of the quotas implemented in Europe which have mandated that corporate boards be comprised of at least 30% women, the Indian Companies Act required there be just one. However, many scholars have documented the need for a critical mass (generally considered to be three or more) women in order to create a culture where women are no longer seen as outsiders (Asch 1951). A single woman is likely to face tokenism - the dominant group sees them first as female, embodying the sex role stereotype, and only later as individuals, making it difficult for them to be listened to on an equal basis with other board members. This issue is reduced with two more more female directors but some scholars believe that only with three or more female directors do women feel less constrained (Kanter 1977, Erkut et al 2008, Konrad et al 2008).

3. Data and Methods

3.1 Data Source

I use data from Compustat of publicly listed Indian firms from 1999 to 2018 to obtain information about industry, revenue, and financial performance. My sample consisted of 326,083 firm-year observations or 40,817 firms. In order to test for compliance with the quota, I use BoardEx data which contained 4832 firm-year observations or 748 firm-level observations of publicly listed Indian firms from 2010 to 2018.

In some instances, this data was supplemented manually with additional sources. Company websites and Zauba Corp were used to obtain further information on board characteristics, and the Wall Street Journal for financial metrics.

Merging these data sources gave me a final dataset of 3909 firm-year observations or 281 firms with board information.

3.2 Methodology

I examine the impact of an Indian law, Section 149(1)(b) of the Companies' Act of 2013, which imposed a quota of at least one female director on the board of listed companies and any public company having a paid-up share capital of Rs.100 crore or more (equivalent to USD\$14M) or a turnover of Rs.crore or more (equivalent to USD\$42M).

3.2.1 Association between financial performance and having a woman on the board

First, I test the association between having at least one woman on the board and a firm's financial performance using the following OLS regression on the entire sample (3909 firm-year observations, 281 firms):

$$y_{it} = \beta_1 x_{it} + \beta_2 year + \beta_3 \tau_{it} + \varepsilon_{it}$$

- y : ROIC or ROA for firm i in year t (`logrev`, `roic`, `roa`)
- x_{it} : dummy for whether firm i had a woman on the board in year t (`dummy_women`)
- τ : control variables for firm i in year t
 - Industry (`industry`)
 - Board size (`no_directors`)

- Proportion of directors that were independent (`prop_indep`)

I controlled for the proportion of directors which were independent to account for the fact that the independent status of directors might be particularly important in an environment where many firms are family firms.

I also test for the impact of having at least two or three women on the board.

3.2.2 Effect of treatment on financial performance: Difference in difference

Secondly, I examine the impact of the quota on a subset of the data which did not have a woman on the board in the years 2011 to 2014 (that is, since the time when the law was first discussed to Parliament). With this sample, I examine the impact of being subject to the quota (that is, having a revenue of over Rs.300 crore in 2015) using the following OLS regression on this subset (1923 firm-year observations, 106 firms).

$$y_{it} = \beta_1 x_i + \beta_2 year + \beta_3 \tau_{it} + \varepsilon_{it}$$

- y : ROIC or ROA for firm i in year t (`roic`, `roa`)
- x_i : dummy for whether firm i had an annual revenue over Rs.300 crore in 2015 (`treat.factor`)
- τ : control variables for firm i in year t
 - Industry (`industry`)
 - Board size (`no_directors`)
 - Proportion of directors that were independent (`prop_indep`)

Based off the rate of non-compliance, I also calculate a Complier Average Causal Effect (or CACE) in addition to the Intention to Treat calculated by the regression above. The compliance rate α is calculated as follows.

$$y_{it} = \alpha x_i + \varepsilon_{it}$$

- y : dummy for whether or not firm i had a woman on the board in year t
- x_i : dummy for whether firm i had an annual revenue over Rs.300 crore in 2015 (`treat.factor`)

3.2.3 Effect of treatment on financial performance: Regression discontinuity

Lastly, I employed a regression discontinuity to exploit the revenue cutoff imposed by the quota which only applies to companies with a turnover of over Rs.300 crore. I argue it is often difficult for companies to predict their exact turnover as a myriad of factors such as the weather, global markets, or competitor actions could significantly alter turnover. Therefore, for companies which had a previous year's revenue which was close to

the cutoff, whether or not they fall above or below the cutoff the next year is essentially random as there are so many factors that could pull them one way or the next. Assuming randomness, by comparing firms which fall just above and just below the cutoff, we can then detect the causal impact of the quota on firm performance.

I examine a smaller subset of the dataset examined in Section 3.2.2 of firms with revenues close to the cutoff - that is, between Rs.100 crore and Rs.500 crore (479 firm-year observations or 27 firms). The variables are defined in the following manner:

- Running variable: revenue of the firm in 2015 (`revtinr`)
- Treatment variable: whether or not the firm had an annual revenue over Rs.300 crore in 2015 (`treat.factor`)
- Dependent variable: Return on invested capital (`roic`) and return on assets (`roa`)

To my knowledge, this is the first study which examines the impact women on corporate boards using a regression discontinuity design.

3.3 Additional considerations

3.3.1 Issues with defining treatment

In my analysis, I define treatment as a firm having a revenue in 2015 of over Rs.300 crore. However, in reality this poses an arbitrary cutoff for two reasons. Firstly, firm revenues change from year to year, so there were some firms which may have fluctuated around the cutoff but were nevertheless defined as either treated or controlled based on where they happened to fall in 2015. Secondly, this does not capture firm expectations. That is, a firm could have a revenue less than Rs.300 crore prior to 2015, but could be expecting sustained growth over the next few years that would make it want to start putting a woman on its board to comply with the law. Similarly, a firm might expect to make a revenue less than 300 crore rupees but decide to play it safe and appoint a woman director anyway as it decides that this is less costly than facing the fine. Indeed, this may have explained why so many firms below the revenue cutoff complied.

In this case, these cutoffs make it particularly difficult to conduct the regression discontinuity analysis as there is not necessarily a sharp assignment to the treatment or control group in reality. Furthermore, the regression discontinuity focuses on firms close to the cutoff, which are most likely to experience the issues noted above. Therefore, I also decided to perform the the difference in difference analysis as it includes more

firms which are definitely in the treatment group and definitely in the control group.

3.3.2 Defining financial performance variables

Another concern regarding defining financial performance variables is the time lag that may occur between appointing a woman on the board and the realization of decisions or investments which that board makes. This is very difficult to avoid as the time to realization differs for each decision and project for each firm. I follow the practice of most literature which examines the performance of the firm in the same year that the woman was appointed.

3.3.4 Firms shirking the quota

Another concern is that companies will deliberately shirk the quota. For example, the Norwegian quota resulted in a 30% increase in the number of private firms and 30% decrease in the number of publicly listed firms (Ahern and Dittmar 2015). There may be a similar shift in India, where we see firms intentionally delisting or suppressing their revenue so they are no longer quota-eligible. In order to address this, I follow the practice of Bertrand et al (2018) who track the effect of the reform on firms that were quota-eligible both at present and at the time of the announcement, thus building an intention to treat sample. At worst, this will merely underestimate the impact of the quota on firms which actually take it up, so form a lower bound for the results.

4. Results

4.1 Descriptive statistics

4.1.1 Did firms comply with the quota?

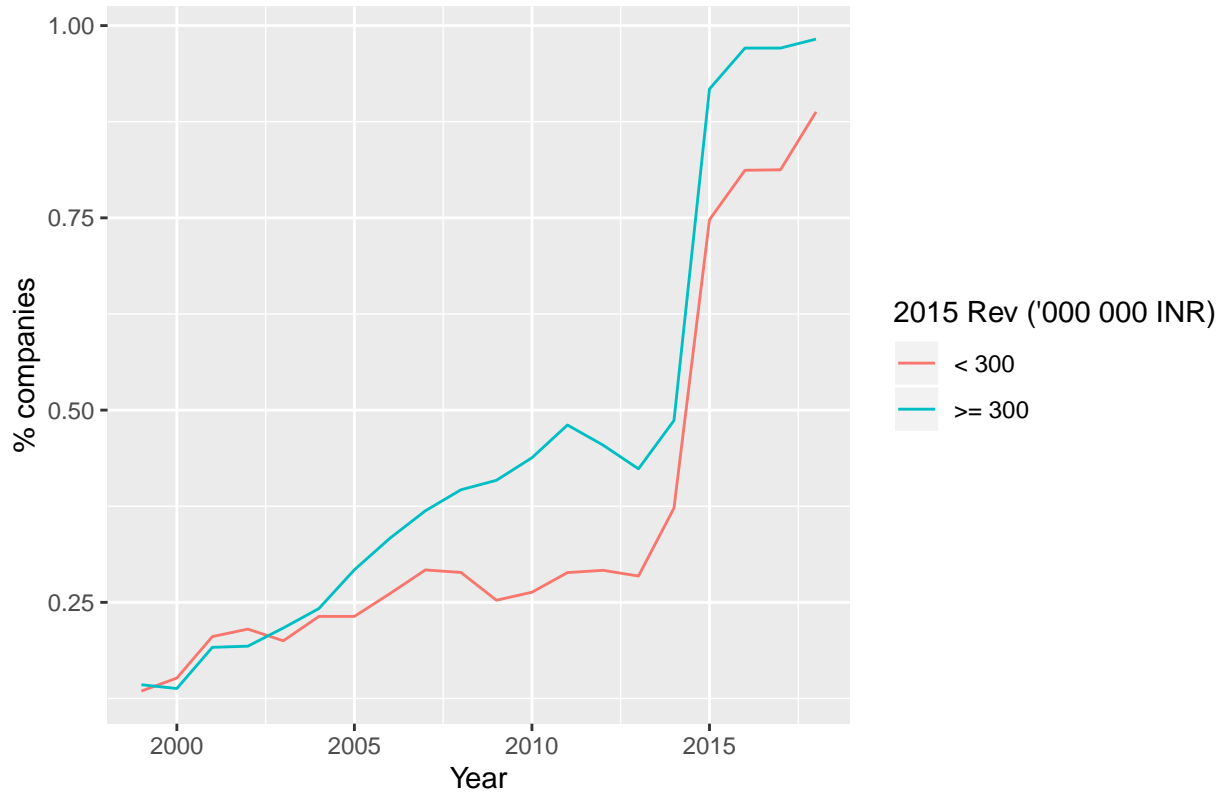
The vast majority of firms complied with the quota. Overall, 95.25% of firms above the annual revenue cutoff of Rs.300 crore complied and even when firms below the revenue cutoff were included, the compliance rate was 90.67%. On average, firms had 1.13 women on their boards.

Table 1a: Overall compliance and women on boards

Compliance rate (all firms, %)	Compliance rate (above rev cutoff, %)	Female directors (all firms, no)
90.668	95.251	1.131

The following figure further illustrates the impact of the quota on 3909 firm-year observations or 281 firms (107 with revenue below Rs.300 crore, 174 with revenue above Rs.300 crore). In 2015, the year the quota was enacted, there is a sharp increase in the percentage of firms with at least one woman on the board. This effect is present even for firms to which the quota did not apply, suggesting strong spillovers.

Fig 1: Proportion of companies with at least 1 woman on board over time



These rates did vary widely by industry. Though some industries such as Capital Goods, Consumer Durables & Apparel, Consumer Services, Health Care Equipment & Services, Household & Personal Products and Telecommunication Services had full compliance to the quota, other industries such as Energy had as low as an 83.3% compliance rate for firms above the revenue cutoff.

Though it was generally true many firms below the revenue cutoff still had a woman on the board, there were also some industries where firms did change their behavior. For example, while 75% of all firms in the Commercial & Professional Service industry complied with the quota, 100% of firms in the industry above

the revenue cutoff did.

Table 1b: Compliance rates by industry (%)

industry	All firms	Firms above rev cutoff	No female directors (all firms)
Capital Goods	100.0000	100.0000	1.1548
Consumer Durables & Apparel	100.0000	100.0000	1.0000
Consumer Services	100.0000	100.0000	1.3333
Health Care Equipment & Services	100.0000	100.0000	1.1111
Household & Personal Products	100.0000	100.0000	1.3750
Retailing	100.0000	100.0000	1.1667
Telecommunication Services	100.0000	100.0000	1.0000
Software & Services	97.9592	97.9592	1.3061
Automobiles & Components	95.0000	95.0000	1.1000
Transportation	91.6667	100.0000	0.9167
Materials	89.3333	95.8549	1.1187
Food, Beverage & Tobacco	88.8889	93.9394	1.1944
Media & Entertainment	86.6667	86.6667	0.8667
Banks	86.3014	86.3014	1.2055
Energy	83.3333	83.3333	1.0000
Commercial & Professional Services	75.0000	100.0000	0.7500

4.1.2 What types of women were appointed as directors?

The results on compliance rates show an encouraging rate of adherence to the quota. However, it is more difficult to ascertain what kinds of women were actually promoted to the board. In order to more closely examine this question, I examined the characteristics of women promoted to the board of 55 firms in the materials industry in Mumbai (so chosen as it was the industry/city combination with the largest number of firms in my sample). I used biographical information available on company websites to obtain information on whether board members had master's degrees, and whether they were "industry" directors - that is, had relevant industry experience or worked in the company itself, or whether they were "professional services" directors - most commonly lawyers or accountants.

As the table below illustrates, women directors were 4.9% more likely to have a master's degree but 49.46%

less likely to have relevant industry experience. This suggests that the quota may have provided increased opportunities for advancement for women in the professional services industry (that is, who were lawyers or accountants), but did not for women in other industries or within the firm itself. Therefore, the equity benefits of the quota may not have been realized by as broad a spectrum of women as may have been otherwise anticipated if the benefits of mentorship or role modelling are concentrated for a smaller subset of women. Furthermore, the efficiency benefits of the quota (that is, impacts on financial performance) may also not be realized as expected if women on boards are lacking industry relevant experience.

Table 1c: Director characteristics

% women masters	% men masters	% women industry	% men industry
40.8951	35.9888	13.3013	62.7652

4.2 Association between women and financial performance

An OLS regression suggests that there is no significant association between having at least one woman on the board and a firm's financial performance using any of the metrics (revenue, return on invested capital, and return on assets). There is a slight negative association between having a woman on the board and the return on invested capital, with having a woman on the board associated with a 4.4% decrease in return on invested capital. This association not significant at the 10% level. Interestingly, board independence has a significant positive association with firm revenues (though not with ROIC or ROA), and a larger board size has a significant positive association with all three financial metrics. This suggests that there may be benefits to a larger and more independent board.

Table 2a: OLS Results, 1+ woman

Variable	Statistic	OLS log(Revenue)	OLS ROIC	OLS ROA
1 (Intercept)	Estimate	-15.069	12.999*	6.155**
2	Std Err	[27.745]	[6.658]	[2.939]
5 dummy_women	Estimate	0.114	-0.044*	0.014
6	Std Err	[0.095]	[0.023]	[0.010]
9 industryBanks	Estimate	0.515***	0.163***	-0.046**
10	Std Err	[0.186]	[0.045]	[0.020]
13 industryCapital Goods	Estimate	-0.530***	-0.035	0.009

Variable	Statistic	OLS log(Revenue)	OLS ROIC	OLS ROA
14	Std Err	[0.199]	[0.048]	[0.021]
17 industryCommercial & Professional Services	Estimate	-3.282***	0.036	0.070
18	Std Err	[0.533]	[0.128]	[0.056]
21 industryConsumer Durables & Apparel	Estimate	-1.899***	0.109	0.049
22	Std Err	[0.583]	[0.140]	[0.062]
25 industryConsumer Services	Estimate	-2.155***	-0.106	-0.015
26	Std Err	[0.394]	[0.094]	[0.042]
29 industryEnergy	Estimate	1.049***	-0.032	-0.015
30	Std Err	[0.260]	[0.062]	[0.028]
33 industryFood, Beverage & Tobacco	Estimate	-1.257***	0.110**	-0.010
34	Std Err	[0.230]	[0.055]	[0.024]
37 industryHealth Care Equipment & Services	Estimate	-2.477***	0.019	0.023
38	Std Err	[0.336]	[0.081]	[0.036]
41 industryHousehold & Personal Products	Estimate	-1.561***	0.092	0.060*
42	Std Err	[0.298]	[0.071]	[0.032]
45 industryMaterials	Estimate	-1.173***	0.026	0.022
46	Std Err	[0.195]	[0.047]	[0.021]
49 industryMedia & Entertainment	Estimate	-1.637***	0.070	0.057
50	Std Err	[0.342]	[0.082]	[0.036]
53 industryRetailing	Estimate	-1.234***	0.044	0.028
54	Std Err	[0.475]	[0.114]	[0.050]
57 industrySoftware & Services	Estimate	-0.533**	0.035	0.044*
58	Std Err	[0.218]	[0.052]	[0.023]
61 industryTelecommunication Services	Estimate	-1.084***	-0.124*	-0.060*
62	Std Err	[0.295]	[0.071]	[0.031]
65 industryTransportation	Estimate	-3.621***	-0.040	0.010
66	Std Err	[0.301]	[0.072]	[0.032]
69 fyear	Estimate	0.012	-0.006*	-0.003**
70	Std Err	[0.014]	[0.003]	[0.001]
73 prop_indep	Estimate	0.403***	0.011	0.005
74	Std Err	[0.128]	[0.031]	[0.014]

Variable	Statistic	OLS log(Revenue)	OLS ROIC	OLS ROA
77 no_directors	Estimate	0.186***	0.008*	0.007***
78	Std Err	[0.019]	[0.004]	[0.002]
81	N	893	893	893
82	R2	0.554	0.109	0.080
83	adj R2	0.544	0.089	0.060
84	AIC	2738.484	189.315	-1270.988

4.3 Effect of women on financial performance: Difference in difference

To take a more causal approach to the relationship between women on boards and financial performance, I conduct an analysis considering only firms which did not have a woman on the board during 2011 to 2014 (the time after the law was first discussed in Parliament but before it came into force). This sample consisted of 1923 firm-year observations or 106 firms, with 56 firms in the control group (< Rs.300 crore revenue in 2015) and 50 firms in the treatment group (\geq Rs.300 crore revenue in 2015)

4.3.1 First stage: effect of the quota on women on boards (parallel trends assumption)

The figure and table below illustrate the compliance of both treated and controlled firms to the quota. A very similar proportion of firms in both the treatment and control groups have at least one woman on the board from 1999 to 2014. Though the same proportion (0%) is enforced by design from 2011 to 2014, the similarity persists back to 1999, suggesting that the parallel trends assumption is satisfied. However, in 2015, the proportion of firms with at least one woman on the board diverges. Though firms in the treatment and control group both experience a sharp increase in the proportion of firms with women on the board, this increase is from 12.55 to 32.46 percentage points higher for firms in the treatment group.

Fig 3: % of firms with at least 1 woman on board

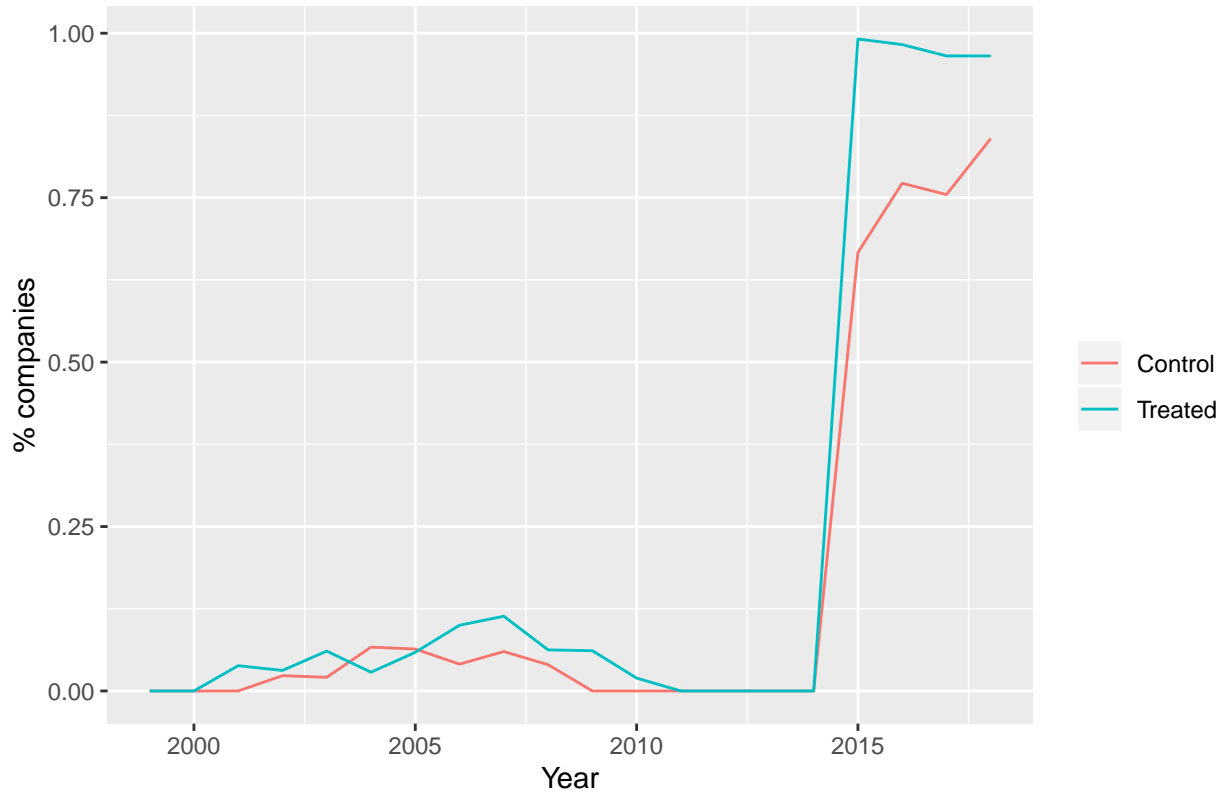


Table 3a: % of firms with at least 1 woman on the board

Year	% Control	% Treatment	% Treatment - % Control
1999	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000
2001	0.0000	0.0385	0.0385
2002	0.0233	0.0312	0.0080
2003	0.0208	0.0606	0.0398
2004	0.0667	0.0286	-0.0381
2005	0.0638	0.0588	-0.0050
2006	0.0408	0.1000	0.0592
2007	0.0600	0.1136	0.0536
2008	0.0400	0.0625	0.0225
2009	0.0000	0.0612	0.0612
2010	0.0000	0.0196	0.0196
2011	0.0000	0.0000	0.0000

Year	% Control	% Treatment	% Treatment - % Control
2012	0.0000	0.0000	0.0000
2013	0.0000	0.0000	0.0000
2014	0.0000	0.0000	0.0000
2015	0.6667	0.9912	0.3246
2016	0.7719	0.9828	0.2108
2017	0.7547	0.9655	0.2108
2018	0.8400	0.9655	0.1255

A first-stage OLS regression also finds that being in the treatment group was positively associated with having at least one woman on the board after 2015, significant at a 1% level.

Table 3b: First stage DiD

	Variable	Statistic	OLS
1	(Intercept)	Estimate	0.756***
2		Std Err	[0.021]
5	treat.factor	Estimate	0.223***
6		Std Err	[0.027]
9		N	505
10		R2	0.119
11		adj R2	0.117
12		AIC	228.424

Therefore, the first stage illustrates that the quota did result in an increase in the proportion of firms with at least one woman on the board, especially for firms in the treated group.

4.3.2 Second stage: effect of the quota on financial performance

An OLS difference in difference regression finds that having at least one woman on the board of a firm results in a 0.065 percentage point increase in return on invested capital, significant at the 5% level. There is no significant impact on the return on assets.

This result holds only for firms which did not have a woman on the board in the years prior to the quota being enacted. It also assumes that all possible differences have been controlled for - that is, there are no unobserved sources of difference which could act as third variables to drive both financial performance and whether or not a firm was treated (that is, whether their revenue was above Rs.300 crore).

Table 3c: Effect of quota on financial performance

Variable	Statistic	OLS ROIC	OLS ROA
1 (Intercept)	Estimate	6.996**	0.101
2	Std Err	[3.067]	[1.639]
5 treat.factor	Estimate	0.065*	0.017
6	Std Err	[0.036]	[0.019]
9 industryBanks	Estimate	0.359***	-0.043
10	Std Err	[0.049]	[0.026]
13 industryCapital Goods	Estimate	0.017	0.012
14	Std Err	[0.028]	[0.015]
17 industryEnergy	Estimate	0.011	0.024
18	Std Err	[0.031]	[0.017]
21 industryFood, Beverage & Tobacco	Estimate	-0.015	0.014
22	Std Err	[0.042]	[0.022]
25 industryHousehold & Personal Products	Estimate	0.135***	0.073***
26	Std Err	[0.031]	[0.017]
29 industryMaterials	Estimate	0.089***	0.057***
30	Std Err	[0.025]	[0.014]
33 industrySoftware & Services	Estimate	0.079**	0.068***
34	Std Err	[0.038]	[0.020]
37 industryTelecommunication Services	Estimate	-0.127***	-0.065***
38	Std Err	[0.035]	[0.019]
41 industryTransportation	Estimate		
42	Std Err		
45 fyear	Estimate	-0.003	-0.000
46	Std Err		
49 prop_indep	Estimate	0.057***	0.018***

Variable	Statistic	OLS ROIC	OLS ROA
50	Std Err	[0.002]	[0.001]
53 no_directors	Estimate	0.006	0.004
54	Std Err	[0.033]	[0.018]
57	N	288	288
58	R2	0.605	0.476
59	adj R2	0.588	0.453
60	AIC	-709.813	-1070.759

These results also differ substantially by industry. In particular, women had a much more positive impact on the financial performance of Banks and Household & Personal Products, but much less on Telecommunication Services. Again, we see that the independence of directors has a significant impact on both ROIC and ROA (causing an increase of 0.057 points and 0.018 points respectively). However, the size of the board is no longer as important.

4.3.3 Calculating CACE (complier average causal effect)

There are many instances of non-compliance in the sample, primarily driven by firms in the control group taking up the treatment (that is, putting a woman on the board). Therefore, though the effect on financial performance found in Section 4.3.2 does illustrate the impact of the quota, it does not necessarily illustrate the impact of having a woman on the board due to the rates of non-compliance.

To find the impact of having a woman on the board on the financial performance of a firm which did not already have a woman on the board, I find the complier average causal effect by dividing the intention to treat (a 0.065 percentage point increase on return on invested capital) by the compliance rate.

To first find the compliance rate, I regress the impact of being treated by the quota on whether or not a woman was on the board. I find the compliance rate to be 14.5%.

Table 3d: Compliance rate

Variable	Statistic	OLS, Compliance
1 (Intercept)	Estimate	0.181***
2	Std Err	[0.014]

	Variable	Statistic	OLS, Compliance
5	treat.factor	Estimate	0.145***
6		Std Err	[0.020]
9		N	1923
10		R2	0.028
11		adj R2	0.027
12		AIC	2198.389

Hence, the complier average causal effect is equal to 0.065 divided by 0.145, or 0.4483. Therefore, though the effect of the quota on the ROIC of treated firms was an increase of 0.065 percentage points, the effect of actually putting a woman on the board on the ROIC for firms which did not previously have a woman on the board was an increase of 0.4483 percentage points, a substantial effect given that the average return on invested capital in the sample was 17.6%. The CACE estimate does relies on the assumption that the firms which did not comply were a random sample of all firms in the dataset - that is, there was no underlying factor which drove both non-compliance and the financial performance.

4.4 Effect of women on financial performance: Regression discontinuity

As discussed in Section 4.3 above, a difference in difference analysis cannot control for unobservable factors. However, a regression continuity can by making the argument that assignment to the treatment around the cutoff is essentially random - therefore, all unobservable and observable factors are the same.

I thereform perform a regression discontinuity on firms with revenues between Rs.100 crore and Rs.500 crore in 2015. This gives me a sample of 27 firms - 22 in the contol group and 5 in treatment. This is a very small sample. Therefore, these results should be viewed as a check on the findings from the larger sample difference in difference analysis from Section 4.3.

4.4.1 First stage: effect of the quota on women on boards (parallel trends assumption)

The figure and table below illustrate a similar relationship to the one found in the overall sample in Section 4.3. A very similar proportion of firms in both the treatment and control groups have at least one woman on the board from 2001 to 2014. Though the same propotion (0%) is enforced by design from 2011 to 2014, the similarity persists back to 1999, suggesting that the parallel trends assumption is satisfied. However, in 2015,

the proportion of firms with at least one woman on the board diverges. Though firms in the treatment and control group both experience a sharp increase in the proportion of firms with women on the board, this increase is from 12.5 to 33.33 percentage points higher for firms in the treatment group.

Fig 4a: % of firms with at least 1 woman on board

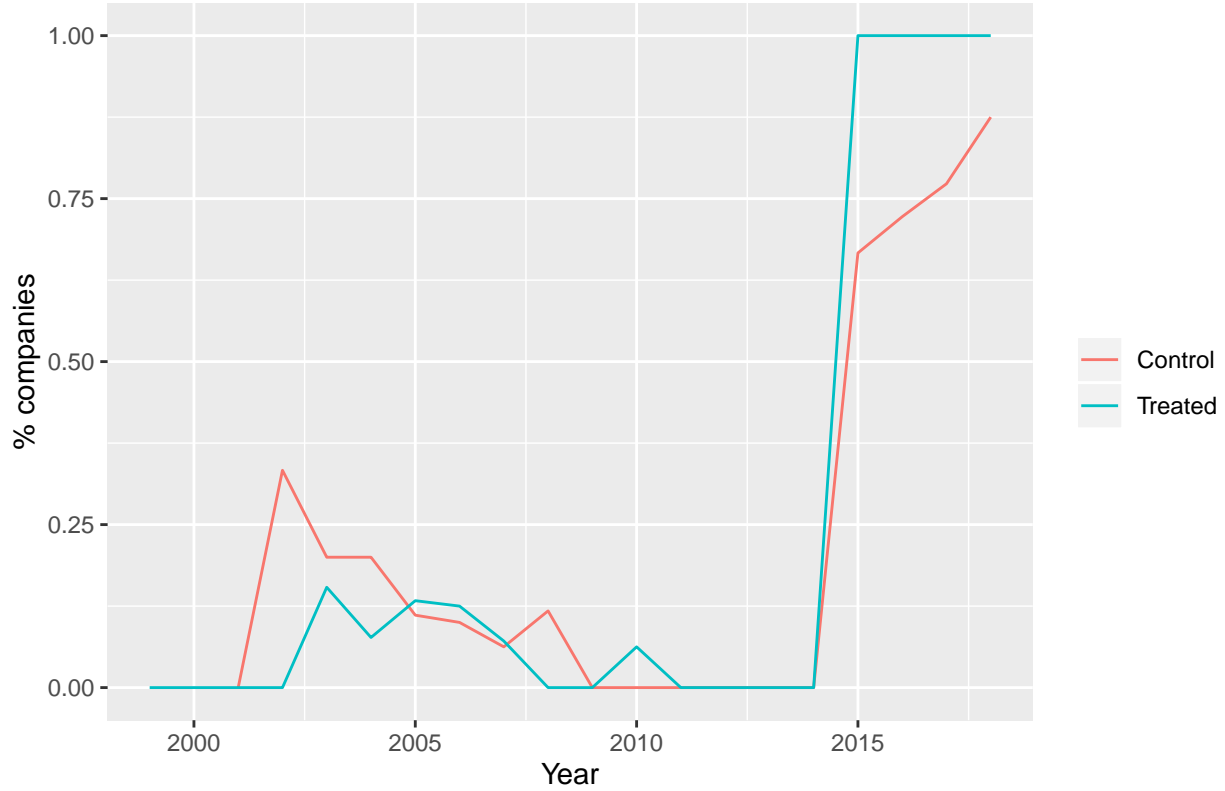


Table 4a: % of firms with at least 1 woman on the board

Year	% companies (Control)	% companies (Treatment)	% Treatment - % Control
2001	0.0000	0.0000	0.0000
2002	0.3333	0.0000	-0.3333
2003	0.2000	0.1538	-0.0462
2004	0.2000	0.0769	-0.1231
2005	0.1111	0.1333	0.0222
2006	0.1000	0.1250	0.0250
2007	0.0625	0.0714	0.0089
2008	0.1176	0.0000	-0.1176
2009	0.0000	0.0000	0.0000
2010	0.0000	0.0625	0.0625

Year	% companies (Control)	% companies (Treatment)	% Treatment - % Control
2011	0.0000	0.0000	0.0000
2012	0.0000	0.0000	0.0000
2013	0.0000	0.0000	0.0000
2014	0.0000	0.0000	0.0000
2015	0.6667	1.0000	0.3333
2016	0.7222	1.0000	0.2778
2017	0.7727	1.0000	0.2273
2018	0.8750	1.0000	0.1250

A first-stage OLS regression also finds that being in the treatment group was positively associated with having at least one woman on the board after 2015, significant at a 1% level.

Table 4b: First stage DiD

	Variable	Statistic	OLS
1	(Intercept)	Estimate	0.765***
2		Std Err	[0.042]
5	treat.factor	Estimate	0.235**
6		Std Err	[0.101]
9		N	103
10		R2	0.051
11		adj R2	0.042
12		AIC	101.853

Therefore, the first stage illustrates that the quota did result in an increase in the proportion of firms with at least one woman on the board, especially for firms in the treated group.

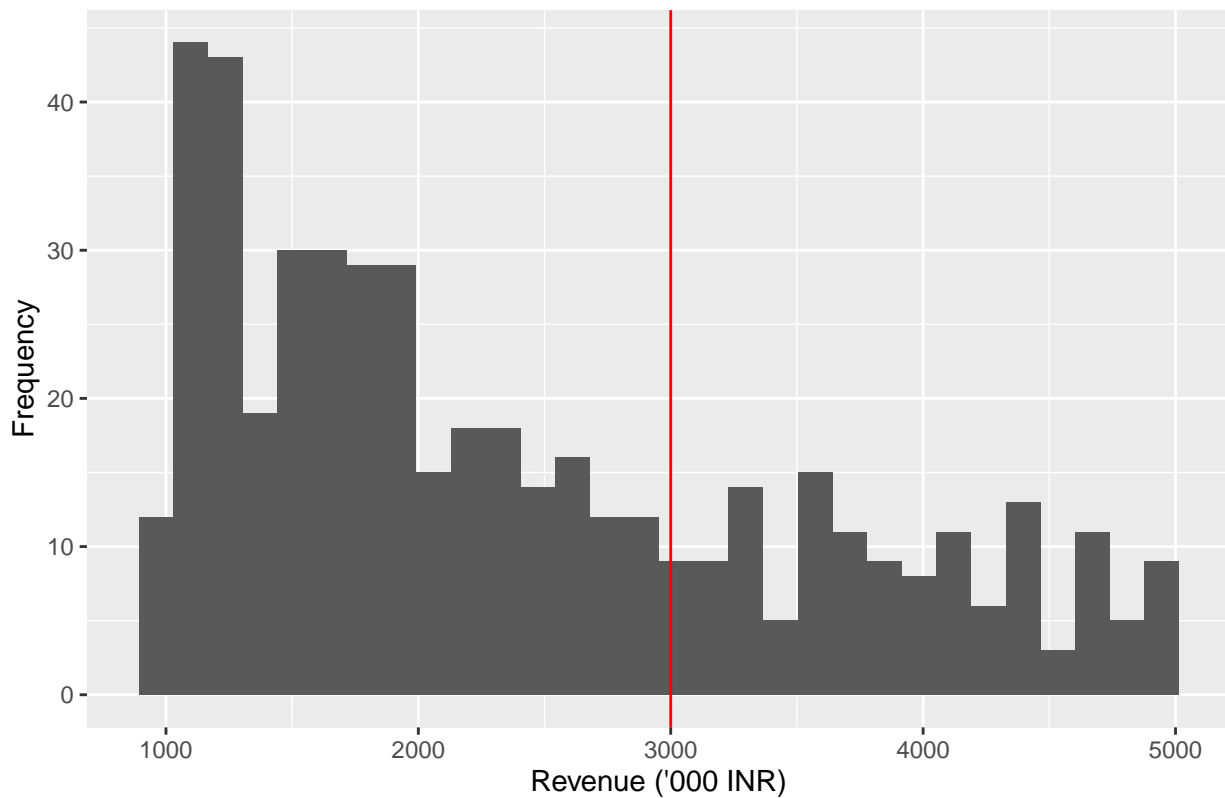
4.4.2 RD Assumption: Continuity of other factors around the cutoff

Before conducting the regression discontinuity itself, I will first need to prove that firm performance is only being affected around the cutoff through this quota - that is, nothing else is changing around the cutoff.

The Companies Act mandated several other changes in addition to the gender quota. These changes included mandates that every company should have at least 3 directors if it is public, 2 if it is private, and 1 if it is a sole person company, with a maximum of 15 directors total. Companies were also mandated to appoint independent directors and participate in CSR initiatives. However, the gender quota was the only law which has a revenue cutoff at 300 crore imposed. Therefore, using this revenue cutoff as the treatment variable means that the analysis not be including the impact of other reforms.

Furthermore, I also find that the number of firms does not change around the revenue cutoff which suggests that firms are not artificially depressing their revenues to avoid the quota).

Fig 4b: Revenue distribution across firms



4.4.3 Second stage: effect of the quota on financial performance

The regression discontinuity plots suggest that there is indeed a discontinuous positive impact of treatment on both the return on invested capital, and return on assets of a firm. If the assumption that firms are randomly assigned around the cutoff holds, then this suggests that the quota has a positive causal effect on firm financial performance.

RD Plot for ROIC

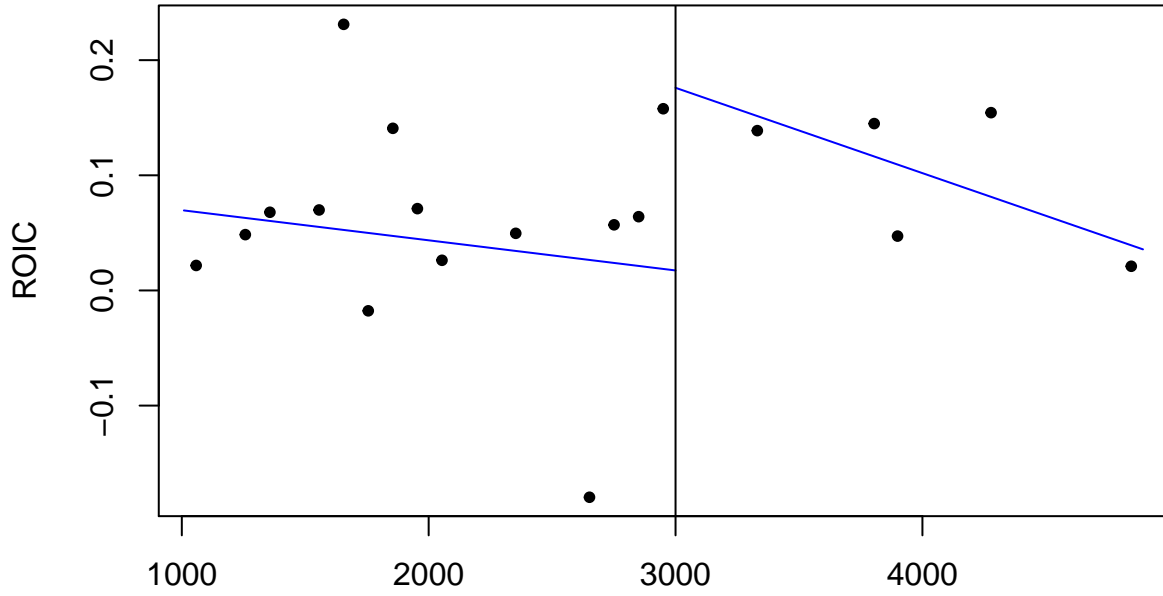


Fig 4c: Revenue in 2015 ('000 INR)

RD Plot for ROA

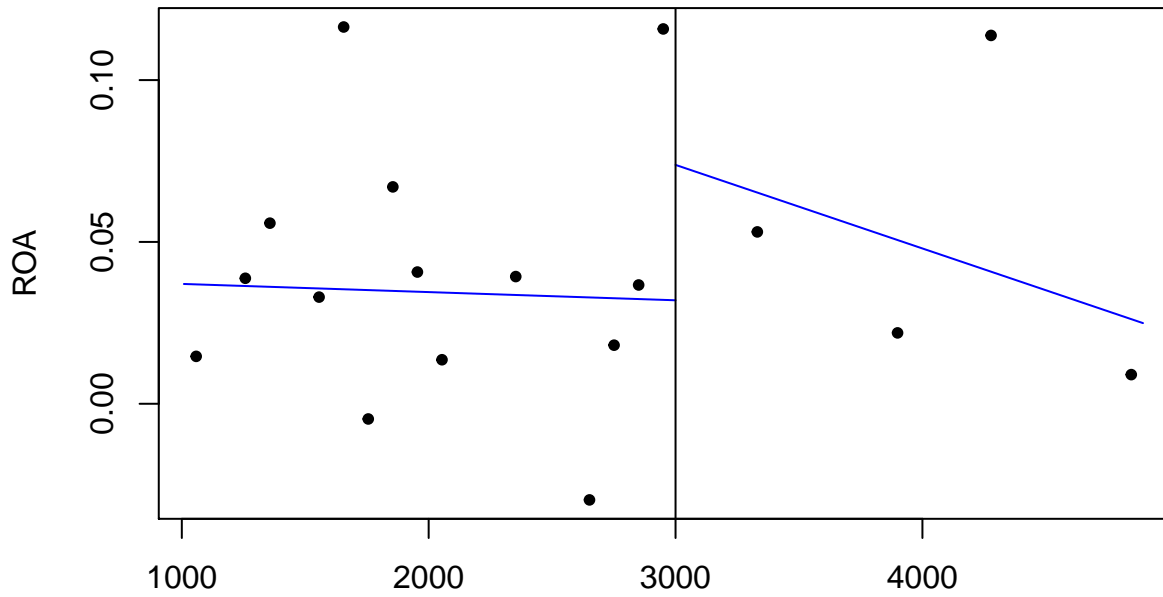


Fig 4d: Revenue in 2015 ('000 INR)

4.5 Association between critical mass of women and financial performance

In the literature, having three or more women on the board is often considered to be a critical mass. Some authors have found that having a critical mass is important in allowing the women on the board the power to effect change. I therefore decide to examine the association between having two or three women on the board and a firm's financial performance.

4.5.1 Descriptive statistics

Firstly, the table below illustrates that there is a steep drop in the proportion of firms with at least two or three women on the board. Overall, though 90.67% of firms had at least one woman on the board in years 2015-2018, only 19.40% had at least two women on the board and only 2.65% had at least three women.

Table 5a: % of firms with women on board, overall

% with 1+ woman	% with 2+ women	% with 3+ women
90.6679	19.3962	2.6532

These proportions differed greatly by industry, with the Banking and Software & Services industries performing much better than the Commercial & Professional Services, Consumer Durables & Apparel, Media & Entertainment, Telecommunication Services and Transport industries, where no firms had more than one woman on the board.

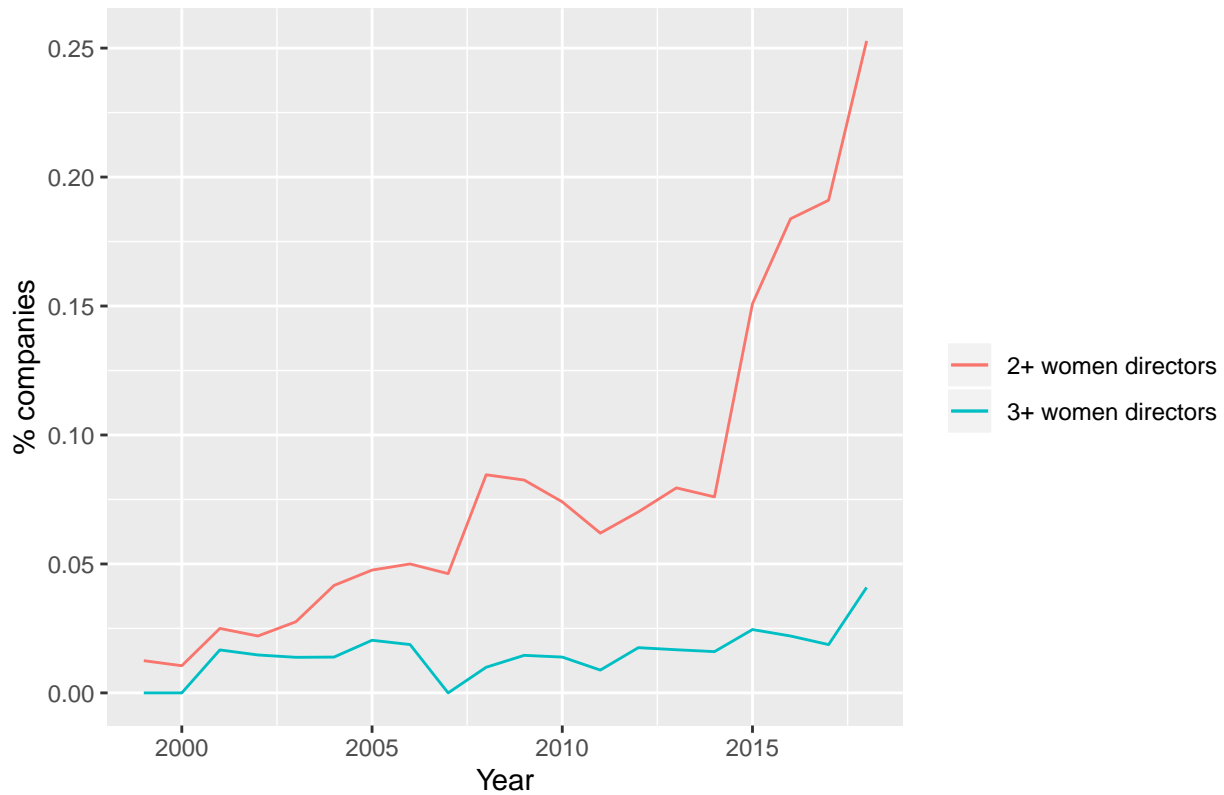
Table 5b: % of firms with women on board, by industry

industry	% with 1+ woman	% with 2+ women	% with 3+ women
Household & Personal Products	100.0000	37.5000	0.0000
Consumer Services	100.0000	33.3333	0.0000
Banks	86.3014	31.5068	2.7397
Food, Beverage & Tobacco	88.8889	30.5556	0.0000
Software & Services	97.9592	24.4898	8.1633
Materials	89.3333	19.2000	2.8000
Retailing	100.0000	16.6667	0.0000
Capital Goods	100.0000	15.4762	0.0000
Health Care Equipment & Services	100.0000	11.1111	0.0000

industry	% with 1+ woman	% with 2+ women	% with 3+ women
Automobiles & Components	95.0000	10.0000	5.0000
Energy	83.3333	8.3333	8.3333
Commercial & Professional Services	75.0000	0.0000	0.0000
Consumer Durables & Apparel	100.0000	0.0000	0.0000
Media & Entertainment	86.6667	0.0000	0.0000
Telecommunication Services	100.0000	0.0000	0.0000
Transportation	91.6667	0.0000	0.0000

The figure below displays the proportion of firms with at least 2 or 3 women directors on their board over time. There was a large increase in the proportion of firms with at least 2 women directors on their board after 2015, suggesting that the quota may have had spillover effects. However, there was not much change in the proportion of firms with at least 3 women directors on their board.

Fig 5: % of companies with at least 2 or 3 women on board over time



4.5.2 Association between 2+ or 3+ women on board and financial performance

The OLS regression suggests that having at least two women on the board has a small positive impact on the revenue of a firm, with having at least two women associated with a 20.5% increase in revenue. However, this effect is only significant at the 10% level. This regression was run on a sample of 3909 firm-year observations or 281 firms, where 87 firms had at least two women on the board.

Table 5a: OLS Results for at least 2 women

Variable	Statistic	OLS log(Revenue)	OLS ROIC	OLS ROA
1 (Intercept)	Estimate	-21.071	18.402***	4.603*
2	Std Err	[25.074]	[6.035]	[2.661]
5 two_women	Estimate	0.205*	-0.012	0.009
6	Std Err	[0.114]	[0.027]	[0.012]
9 industryBanks	Estimate	0.481**	0.159***	-0.046**
10	Std Err	[0.187]	[0.045]	[0.020]
13 industryCapital Goods	Estimate	-0.562***	-0.037	0.008
14	Std Err	[0.200]	[0.048]	[0.021]
17 industryCommercial & Professional Services	Estimate	-3.305***	0.038	0.069
18	Std Err	[0.532]	[0.128]	[0.057]
21 industryConsumer Durables & Apparel	Estimate	-1.866***	0.098	0.053
22	Std Err	[0.582]	[0.140]	[0.062]
25 industryConsumer Services	Estimate	-2.184***	-0.115	-0.013
26	Std Err	[0.394]	[0.095]	[0.042]
29 industryEnergy	Estimate	1.019***	-0.032	-0.016
30	Std Err	[0.261]	[0.063]	[0.028]
33 industryFood, Beverage & Tobacco	Estimate	-1.287***	0.104*	-0.009
34	Std Err	[0.231]	[0.056]	[0.025]
37 industryHealth Care Equipment & Services	Estimate	-2.474***	0.006	0.027
38	Std Err	[0.335]	[0.081]	[0.036]
41 industryHousehold & Personal Products	Estimate	-1.600***	0.097	0.058*
42	Std Err	[0.298]	[0.072]	[0.032]
45 industryMaterials	Estimate	-1.194***	0.021	0.022
46	Std Err	[0.195]	[0.047]	[0.021]

	Variable	Statistic	OLS log(Revenue)	OLS ROIC	OLS ROA
49	industryMedia & Entertainment	Estimate	-1.632***	0.064	0.058
50		Std Err	[0.342]	[0.082]	[0.036]
53	industryRetailing	Estimate	-1.249***	0.029	0.031
54		Std Err	[0.474]	[0.114]	[0.050]
57	industrySoftware & Services	Estimate	-0.563**	0.029	0.044*
58		Std Err	[0.218]	[0.053]	[0.023]
61	industryTelecommunication Services	Estimate	-1.100***	-0.124*	-0.060*
62		Std Err	[0.295]	[0.071]	[0.031]
65	industryTransportation	Estimate	-3.641***	-0.041	0.009
66		Std Err	[0.301]	[0.072]	[0.032]
69	fyear	Estimate	0.015	-0.009***	-0.002*
70		Std Err	[0.012]	[0.003]	[0.001]
73	prop_indep	Estimate	0.385***	0.012	0.005
74		Std Err	[0.129]	[0.031]	[0.014]
77	no_directors	Estimate	0.184***	0.007	0.008***
78		Std Err	[0.019]	[0.004]	[0.002]
81		N	893	893	893
82		R2	0.555	0.105	0.079
83		adj R2	0.545	0.085	0.059
84		AIC	2736.607	192.876	-1269.447

The effect is much larger for having at least three women on the board (`critical_mass`), with having at least three women on the board associated with a 68.5% increase in revenue. This effect is significant at the 5% level. This regression was run on a sample of 3909 firm-year observations or 281 firms, where 18 firms had at least three women on the board.

Table 5b: OLS Results for critical mass of women

	Variable	Statistic	OLS log(Revenue)	OLS ROIC	OLS ROA
1	(Intercept)	Estimate	-26.085	18.474***	4.099
2		Std Err	[24.607]	[5.924]	[2.614]
5	critical_mass	Estimate	0.685**	-0.073	-0.016

Variable	Statistic	OLS log(Revenue)	OLS ROIC	OLS ROA
6	Std Err	[0.330]	[0.079]	[0.035]
9 industryBanks	Estimate	0.515***	0.158***	-0.044**
10	Std Err	[0.185]	[0.045]	[0.020]
13 industryCapital Goods	Estimate	-0.530***	-0.038	0.010
14	Std Err	[0.198]	[0.048]	[0.021]
17 industryCommercial & Professional Services	Estimate	-3.301***	0.039	0.070
18	Std Err	[0.532]	[0.128]	[0.057]
21 industryConsumer Durables & Apparel	Estimate	-1.868***	0.098	0.052
22	Std Err	[0.581]	[0.140]	[0.062]
25 industryConsumer Services	Estimate	-2.150***	-0.116	-0.010
26	Std Err	[0.392]	[0.094]	[0.042]
29 industryEnergy	Estimate	1.016***	-0.030	-0.014
30	Std Err	[0.261]	[0.063]	[0.028]
33 industryFood, Beverage & Tobacco	Estimate	-1.244***	0.102*	-0.007
34	Std Err	[0.229]	[0.055]	[0.024]
37 industryHealth Care Equipment & Services	Estimate	-2.453***	0.006	0.029
38	Std Err	[0.334]	[0.080]	[0.036]
41 industryHousehold & Personal Products	Estimate	-1.561***	0.094	0.059*
42	Std Err	[0.297]	[0.072]	[0.032]
45 industryMaterials	Estimate	-1.160***	0.020	0.024
46	Std Err	[0.194]	[0.047]	[0.021]
49 industryMedia & Entertainment	Estimate	-1.629***	0.064	0.059
50	Std Err	[0.342]	[0.082]	[0.036]
53 industryRetailing	Estimate	-1.213**	0.028	0.035
54	Std Err	[0.473]	[0.114]	[0.050]
57 industrySoftware & Services	Estimate	-0.553**	0.031	0.048**
58	Std Err	[0.217]	[0.052]	[0.023]
61 industryTelecommunication Services	Estimate	-1.090***	-0.124*	-0.059*
62	Std Err	[0.294]	[0.071]	[0.031]
65 industryTransportation	Estimate	-3.632***	-0.041	0.011
66	Std Err	[0.301]	[0.072]	[0.032]

	Variable	Statistic	OLS log(Revenue)	OLS ROIC	OLS ROA
69	fyear	Estimate	0.018	-0.009***	-0.002
70		Std Err	[0.012]	[0.003]	[0.001]
73	prop_indep	Estimate	0.392***	0.012	0.006
74		Std Err	[0.128]	[0.031]	[0.014]
77	no_directors	Estimate	0.185***	0.007	0.008***
78		Std Err	[0.018]	[0.004]	[0.002]
81		N	893	893	893
82		R2	0.555	0.106	0.078
83		adj R2	0.546	0.086	0.058
84		AIC	2735.533	192.205	-1269.122

It is important to note however that both of these relationships are only associations. It is likely that a two-way relationship exists whereby the types of firms which are willing to put more women on their board are also likely to have higher revenues. This relationship does tend to be stronger as the number of women on the board increases.

5. Discussion of findings

5.1 Impact of the quota on women on boards

I find that the quota had a very strong effect on the number of firms with at least one woman on the board with compliance rates being very high. There were also strong spillover effects whereby firms to which the law did not apply (that is, firms with revenues below the cutoff) also appointed a woman to the board. Furthermore, there was a large increase in the number of firms with at least two women on the board around the time of the quota being implemented. The behavior of firms which fell well below the revenue cutoff and therefore would have no fear of facing a fine suggests that there were low costs to appointing a woman director.

This hypothesis is further supported by the fact that the majority of women board members were lawyers and accountants as opposed to women from the industry or firm themselves. This suggests that firms may have incurred low search costs as they promoted women which may have been doing business with the firm

in another capacity rather than grooming internal talent.

However, this also means that it is unclear if the secondary impacts of having more women on boards on gender empowerment writ large were realized. There may not have been much done to facilitate the rise of women within an organization, nor in a diverse range of industries and occupations. Furthermore, the follow-on impacts of mentorship and role modelling in the broader organization may be limited when only a few occupations are seen to lead to high positions. In terms of financial performance, this may also mean that the findings that women directors had a better understanding of market conditions (Carter et al 2003) or increased the talent pool for female managers, boosting productivity (Smith et al 2006) may not apply in this situation. Nevertheless, there is still reason to believe that the benefits of women directors outlined in Section 2.2 could still be realized without industry specific knowledge - that is, monitoring, providing a diverse perspective, and a different style of leadership.

Overall, both the high compliance rates of firms which were even below the revenue cutoff (and therefore not subject to the law) as well as the backgrounds of the women who were promoted (which suggests that there may not have been much searching done) suggests that it was not very costly for firms to promote a women director.

5.2 Impact of women on boards on financial performance

There does not seem to be a strong relationship between financial performance and women directors in the sample of all firms. Indeed, there seems to be a slightly negative association between having at least one woman on the board and the return on invested capital, though there is a positive association between having two or three women on the board and the revenue of the firm. These relationships are correlations and are probably subject to a two-way relationship whereby the firms which do have woman on the boards are systematically different from those which do not.

However, examining a subset of firms which did not have a woman on the board before the quota returns stronger results, suggesting that there is a positive effect of women directors on financial performance. A difference in difference analysis finds that having at least one woman on the board resulted in a 0.4483 percentage point increase in the return in invested capital (ROIC) of a firm. This analysis does rely on there not being unobserved factors which could have impacted both the number of women on the board and the ROIC. Should this not be the case, the observed effect on ROIC may not be entirely due to the treatment, compromising the internal validity of the results.

To address this issue of unobserved factors, I also run a regression discontinuity where I make the argument

that a firm's revenue from year-to-year is essentially random within a certain range as it depends on random shocks such as the environment or global events. Therefore, whether a firm was treated by the quota and therefore had a woman on its board (that is, had a revenue which subjected it to the law) was essentially random. From this analysis, I find that having at least one woman on the board resulted in a positive increase in the ROIC and return on assets (ROA) of a firm. However, one concern with this was that the sample size of this was very small. Therefore, the effects may not be representative of all firms and the external validity of the results are low. Another point to note is also that this result applies only to firms within the range analyzed - that is, firms with revenues between Rs.100 crore and Rs.500 crore. This also limits the external validity of these results. Nevertheless, these results still serve as a good check on the larger difference in difference analysis conducted.

Industries such as Banking, Household & Personal Products, Software & Services and Materials experienced much larger positive effects on their ROIC than industries such as Telecommunications Services. Interestingly, the same industries which experienced these positive impacts were also more likely to go above the law and have more than one woman on their board, and the firms in industries which experienced negative impacts were the least likely to have more than one woman on their board. This could suggest that some industries may be more accommodating towards women directors, either because of the attitudes of individuals within these industries, or the fact that the monitoring and diverse perspectives that women bring could be more valuable.

Overall, I find that there is indeed a positive causal impact of women on boards on return on invested capital for firms which did not already have a woman on the board before the quota was enacted. These positive impacts on a firm's financial performance were realized despite the fact that it was not very costly for most firms to promote a woman to the board - even women without relevant industry experience caused improvements. However, the concentration of directors in the professional services could mean that spillover impacts to other women could have been limited. Part of these issues may be due to there not being enough women in the pipeline within a firm and therefore may improve as the quota persists for longer.

6. Conclusion

Though corporate board gender diversity has been studied from the perspective of numerous developed countries, an investigation into the societal conditions of developing countries has remained limited. This study is one of the first to examine the causal impacts of women on corporate boards on financial performance in a developing countries and also the first within the corporate board gender diversity field to use a regression

discontinuity design to examine causal impacts.

Ultimately, an examination into a quota imposed by the Indian Companies' Act (2013) which mandated that there be at least one woman on the board of firms above a certain revenue cutoff found that there was indeed evidence of a causal relationship between gender diversity and financial performance, with a woman on the board associated with a 0.4483 percentage point increase in return on invested capital (ROIC) for firms which did not already have a woman on their board prior to the quota being enacted. This benefit was attained despite the low cost for firms to promote a woman to the board. This relationship was also stronger within industries which were more hospitable towards women. However, the spillover impacts of the quota on other women within the firm are unclear as the majority of these new directors did not have industry backgrounds.

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