Does Access to Credit Explain Firm Performance and Gender Gap? Evidence from Indian MSME Sector

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Abstract

The literature on gender discrimination in credit access to formal finance and firm performance has found conflicting results. Using a large dataset of firms belonging to Indian MSME sector, we analyze firm performance gap as well as the role of credit market discrimination in explaining gender gap. Among the set of factors considered in understanding gender gap in firm performance, credit market access is found to be playing major role. Other factors like size, concentration in certain sectors, efficiency differences only partly explain the gender gap.

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1. Introduction

It is well recognized that small firms are the engine of innovations and economic growth (Acs and Armington 2006; Baumol 2002). At the same time, many studies have highlighted constraints of the small businesses especially for the women owned enterprises. These barriers widen the performance gap between women and men led enterprises leading to poor performance of female enterprises (Klapper and Parker 2011). This gap which constrain firm performance emanate from the 'preference driven' and 'constraint driven' gap perspective. However, very little empirical work has been carried out to explore the reasons underlying the poor performance of female led enterprises. Among the set of possible factors identified, access to formal finance is often highlighted as the most pressing obstacle to growth of small and medium enterprises (SMEs). Numerous studies have shown the association of availability of capital in promoting growth of small firms (Banerjee & Duflo, 2010; De Mel et al., 2009). Among the various ownership categories of small firms, women owned enterprises particularly suffer from difficulty in obtaining credit from formal sources (Berger and Udell 2006). Previous literature report that women owned firms have lower loan approval rates from formal sources indicating credit market discrimination (Muravyev et al. (2009). As a result, women are dissuaded from entrepreneurship and running business on an efficient scale due to difficulty in obtaining finance. Apart from the credit market discrimination aspect, women businesses face difficulty in the form of cultural and institutional barriers, concentration of business is low productive sectors and small size of the business.

Eventhough both men and women face barrier in access to formal financial services, women face higher obstacles. The reasons for observed gender gap in access to financial services may stem from both the supply and demand sides of the credit market. In a pioneering work, Becker (1956) emphasized taste-based discrimination arising from cultural, institutional factors. Various studies have extended this argument to the bank-level discrimination of the loan application from women-led business. Further, lenders might engage in statistical discrimination by using personal characteristics like gender and believe that women are more likely to default. From the demand side, it is argued that women-led businesses are less likely to apply for loan due to the fear of refusal. Among the set of factors lower demand for credit by the women owned firms arise due to certain characteristics like small size of business, 'risk-aversion',

'perceiving themselves to be less creditworthy' (Watson and Robinson 2003), 'perceiving financial barriers that do not exist', 'lack of self-confidence' (Scott and Roper 2009) and sector of activity.

Our objective of this study is to analyze the factors determining gender gap in firm performance in Indian small-scale sector. We probe into the role of several factors like differences in terms of age, size, choice of business, and most importantly whether businesses operated by women are less likely to obtain formal credit. India presents an interesting case to empirically analyze the firm level factors especially the role of gender in influencing the access to formal credit by small firms. According to a recent report, the MSME sector accounts for more than 95% of the industrial units and contributes 45% of the manufacturing output and 40% of the exports (Ministry of MSME, 2014). In terms of employment, it employed 73.2 million persons spread over 31.1 million enterprises (MSME, 2012:26-27). Therefore, small enterprises play a vital role in generating employment and promoting industrialization in Indian economy.

Our study contributes to growing body of literature on access to finance of small firm the following ways. *First*, empirically, there has been little rigorous research on the gender gap in access to finance and firm performance, particularly in developing countries. Most of the studies were confined to the experience of developed countries and these findings are not easily generalizable to the context of developing economies. Absence of empirical work based on developing countries can be attributed to the due to the lack of reliable data on small firms operating in developing countries. Second, in this study, we use a unique large data set of Indian micro, small and medium enterprises (MSMEs) in analyzing gender differences in obtaining formal finance. Further, our data set is rich in terms of the detailed information about the presence of females in the ownership and management of enterprises. *Finally*, a recent study noted that empirical studies on gender gap in access to finance will provide better insights of credit market functioning, if details of different measures of female participation in the firms are taken into account (Presbitero et al 2014). Since our data set contains information about different measures of female participation in the ownership and management of the firms, enabling us to investigate the presence of a gender gap in access to formal financial instruments.

Rest of the paper is organized as follows. Section two provide summary of the relevant literature. Details of the data source are provided in Section 3. Section 4 presents details of the methodology. Discussion of the results obtained from the empirical exercise is reported in section 5. Section 6 Concludes.

2. Review of Literature

As discussed above observed gender gap can be the result of supply-side discrimination (bank denial) as well as the gap can arise from differences in the characteristics of male and female entrepreneurs (demand-side). Moreover, unequal treatment of entrepreneurs classified to two types i.e. taste-based discrimination (Becker, 1957) or statistical discrimination (Arrow, 1973).

Muravyev et al. (2009) analysed entrepreneurs' gender and financial constraints based on the data from the 2005 Business Environment and Enterprise Performance Survey (BEEPS). Use the binary response model with sample selection introduced by Van de Ven and Van Praag (1981). From the analysis, on the one side, females face lesser probability of receiving a loan and pay higher interest rates. On the other side, the likelihood of female entrepreneurs receiving a bank loan is higher whereas the size of required collateral is lower. Nevertheless gender-based differences in access to financing also appear to depend on country's financial development. However the empirical results find some discrimination against female entrepreneurs.

Bardasi et.al, (2011) made a study on three developing regions that are Eastern Europe and Central Asia (27 countries), Latin America (13 countries), and Sub-Saharan Africa (22 countries) regarding female entrepreneurs perform. For ECA data collected from 2005 Business Environment and Enterprise Performance Survey (BEEPS) and for LA and SSA composed from the 2006 and 2007 World Bank Enterprise Surveys. The performance gaps between male and female owned businesses estimated by using OLS regressions coefficients of female-owned dummy. The overall sales of female-owned enterprises are significantly lesser than those of their male-owned counterparts in each region. The results also discover some evidence of credit constraints on the demand-side, but not on the supply-side, however, the collateral costs are higher for female-owned firms in ECA. The authors did not find evidence of gender-based discrimination in access to formal finance in any of these three regions.

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Aterido et al. (2011) examined the three ways of gender differences in Sub-Saharan Africa. Data obtained from the enterprise surveys collected by the World Bank with local partners. The samples taken from different parts of the SSA region, namely, Ghana, Mali, Mozambique, Senegal, and Zambia, and represent different income groups. It is mainly focused on four areas i.e. formal objectives, monitoring employee performance, process improvements and participation in decision-making. Additional robustness check, also calculate TFP and apply of a simple ordinary least squares (OLS) production function. Results indicated there is a significant gender gap in the labour coefficient and the coefficient on the capital shares is not statistically different. Both men and women's reported motivations to become entrepreneurs differ from the usual stereotypes quite a surprising result. Education is a playing a most important characteristics of successful entrepreneurs. However, decision-making control indicates a 12 percent productivity gap, which is significant.

3. Data Source

Unlike most of the previous work relying on survey of small sample of firms, our study is based on Census data provided by the Ministry of Small Scale Industries, Government of India. We employ unit-level data from the registered manufacturing segment of the Fourth round of the Indian Micro, Small and Medium Enterprises (MSME) census data for the year 2006-7. This rich dataset contains information pertaining to 2.24 million small firms belonging to registered and unregistered sector. The Ministry of Small Scale Industries defines enterprises with investment of up to INR 2.5 million in plant and machinery are classified as micro while enterprises with investment between INR 2.5 million and INR 50 million are classified as small; and enterprises with investment between INR 50 million and INR 100 million are classified as medium enterprises. For the purpose of the present study, we restrict our sample to the registered and unregistered sector firms belonging the manufacturing sector. Database provides information related to the firms year of initial production, the sector of its operation, the gross output for three consecutive financial years, ownership type, export, loan status

4. Methodology

Difference in performance of Male and Female owned firms

We employ a number of indicators to capture the gaps in performance between male-owned and female-owned firms. These indicators include output, employment and capital stock (proxies for firm size), growth of output (proxy for firm growth) and labour productivity and total factor productivity (proxies for firm efficiency). To measure the performance gap, we regress the indicator of performance, as listed above, against the dummy for female owner (*womenent*). We repeat this exercise by using the dummy for female manager (*womenmanager*) and the dummy for female in dual role as owner and manager (*women*).

Gender Gap in Access to Finance: Baseline specification

Inorder to analyze whether businesses with female ownership participation are less likely to use a formal financing channel (loan), we test the following empirical model.

$$Y_i = f(female, size, age, agesq, exporter, account, , quality\ certification,$$
$$networth,\ industry\ dummy, statedummy)$$

where Y_i is a dummy variable indicating firm has access to external finance (loan). Female is a dummy variable which equals 1 indicating female ownership (owner/manager) participation and zero otherwise. We also include a set of usual control variables like industry and state dummies. Since our dependent variable is a binary variable, we employ a logit model for the empirical analysis. Details of the explanatory variables are presented in Appendix.

Blinder–Oaxaca Decomposition

Inorder to disentangle the role of various factors in determining gender gap in access to finance, we use a decomposition technique to understand the extent to which our results are influenced by observables and unobservable components which will indicated the extent of discrimination. Decomposition techniques allow us to explain the gap in the access to credit for the two groups of firms. The gap is decomposed into that part which is due to the group differences in predictors i.e. the part of the gap due to the differences in the average characteristics based on the gender of the owner (the "endowment effects") and group differences in the coefficients, where the latter are sometimes called the unexplained part of the gender gap. We adopted Oaxaca-Blinder (1973) decomposition technique modified for non-linear model. When the outcome of interest is binary i.e. loan status, estimation of outcome equations is based on logit or probit

models. Therefore, differencing in means for non-linear models is not feasible. We use the method suggested by Fairlie (2006) for the decomposition[4] of non-linear models as given below.

$$\bar{Y}^M - \bar{Y}^F = \left[\sum_{i=1}^{N^M} \frac{F(X_i^M \hat{\beta}^M)}{N^M} - \sum_{i=1}^{N^F} \frac{F(X_i^F \hat{\beta}^M)}{N^F} \right] + \left[\sum_{i=1}^{N^F} \frac{F(X_i^F \hat{\beta}^M)}{N^F} - \sum_{i=1}^{N^F} \frac{F(X_i^F \hat{\beta}^F)}{N^F} \right]$$

where N_j denote the sample size for group j, with $\bar{Y}^j$ as the average probability of being financially constrained for group j and $F(.)$ as the cumulative distribution function from the logistic distribution. F represents female owned firms and M denotes male owned firms. In the above expression, male owned firms are considered as the reference group since discrimination in the credit market is measured towards women owned enterprises. Male coefficient estimates $\hat{\beta}^M$ are used as weights in the first term and female distributions of the explanatory variables X_i are used as weights in the second term. Fairlie (2005) show that the above equation holds exactly for a logit model including a constant term. In the above equation, the first term on the right hand side indicate the part of the gender gap in accessing formal finance due to group differences in distribution of X, and second term represent the part of the gap due to the differences in the group processes determining levels of Y. The second part or unexplained part is used to explain the role of unobservables (a proxy for discrimination). We obtain standard errors for the decomposition estimates based on methods employed by Oaxaca and Ransom (Fairlie 2003; Oaxaca & Ransom 1998).

Selection Bias

It is highlighted by the earlier studies on access to finance that firm often self-select not to apply for a loan (Baydad 1992; Bardasi et al 2011). Self-selection for not applying for loan may arise due to absence of need of external finance and some of the applicants may perceive fear of rejection. What we observe in our dataset is set a of firms who have self-selected to receive formal finance. Therefore, it is essential to correct for the self-selection problem in our empirical analysis. Our empirical strategy to over come self-selection problem involves identifying firms as "constrained" and "unconstrained" firms with credit demand (Bigsten et al 2003). We classify sample firms as constrained, if they reported shortage of capital while those firms, which reported to have received

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[4] The decomposition was implemented with the "fairlie" package provided by Jann (2008) for Stata.

loan but did not report capital shortage as unconstrained firms. To address the selection issue, we employ two-step Heckman probit (Van de Ven and Van Praag 1981) procedure analogous to Heckman (1979) approach. Following Cameron and Trivedi (2009), we specify the following latent variable model:

$$y_{1j}^* = z_j'\alpha + \varepsilon_i$$

In the above specification, y_{1k}^* depends on z_j' factors and the observed outcomes $y_{1k} = 1$ when $y_{1j}^* > 0$. Therefore, we can denote outcome equation as:

$$y_{1j} = 1(z_j'\alpha + \varepsilon_{1j} > 0)$$

Since the dependent variable y_{1j} for the observation j is observed only if:

$$y_{2j} = 1(w_j'\beta + \tilde{\varepsilon}_{2j} > 0) \qquad \text{selection equation}$$

The model assumes that $\varepsilon \sim N(0,1)$, $\tilde{\varepsilon} \sim N(0,1)$, and corr $(\varepsilon, \tilde{\varepsilon}) = \rho$. The above outcome and selection equation collapses to two separate probit models when $\rho = 0$. We estimate the outcome equation by maximizing the following log-likelihood function

$$LogL(\alpha,\beta,\rho) = \sum_{y_{1j}=1;y_{2j}=1} \Phi_2(z_j'\alpha, w_j'\beta, \rho) + \sum_{y_{1j}=0;y_{2j}=1} \Phi_2(-z_j'\alpha, w_j'\beta, -\rho)$$
$$+ \sum_{y_{2j}=0} \Phi_2(w_j'\beta)$$

where $\Phi(.)$ and $\Phi_2(.)$ represents univariate and bivariate standard normal CDFs, respectively. In our empirical model, we observe a firm receiving formal finance (y_{1j}=1 or y_{1j}= 0), only if they have a demand for external finance. In the outcome equation (1), the dependent variable is same as defined previously in the case of logit model. This approach requires an exclusion restriction for identification purpose. We use two variables for the purpose of exclusion restrictions[5] (Cameron and Trivedi 2009) and improve identification i.e., (i) growth of annual output growth and (ii) efficient use of capital which influences the selection but not the outcomes. We include these two variables assuming that they influence demand for credit but not the final outcome.

Impact of credit constraint on the performance of (women owned) firms: Propensity score matching (PSM)

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[5] Exclusion restriction means that a variable that affects the selection equation but does not affect the outcome equation (Cameron and Trivedi 2009). Those variables should be correlated with the firm's demand for credit. However, those variables should not be correlated with firm's loan status.

To compare the effects outcome of access to finance, we employ non-parametric matching method. This approach enables us to match enterprises, which are constrained by finance with the unconstrained firms in terms of their performance. We rely on the widely applied propensity score matching (PSM) introduced by Rubin and Rosenbaum (1983). The idea behind this approach is to match by gender with similar observable characteristics and to compare the average engagement behavior for the two sub-samples of individuals. Compared to the traditions least squares approach PSM provides flexibility in terms of absence of rigid functional form restrictions and but assumes that selection is based on observables. Further, it is argued that regression techniques leads to biased estimates when the distribution of covariates differs across two groups of observations and the magnitude of the bias depends on the difference in the covariate distribution of two groups (Rubin 1973).

The matching estimator is based on the following formulation: let T be the treatment (an indicator of the enterprise being constrained); let $Y_i(1)$ be the outcome for the treated enterprise (i.e., the firm performance in terms of labour productivity and vaue added); and let $Y_i(0)$ be the outcome of the non-treated individual. What we are interested to measure is the mean effect on the firm performance of constrained firms vis-à-vis unconstrained firms. We classify firms as constrained (treated) if they report working capital shortage as an obstacle. Form firm i, we denote treatment indicator $D_i = 1$, and the outcome of the treatment is the measure of firm performance w_{1i}. If the firm is unconstrained (do not report working capital shortage), it is denoted as a control firm and treatment indicator $D_i = 0$, and the outcome of the treatment is the measure of firm performance w_{0i}. The treatment effect for firm i is therefore the difference in the firm performance with and without treatment. Formally, it can be represented as $A_i = w_{1i} - w_{0i}$. Since we observe only the post-treatment effect, counterfactual is not observed i.e., it is impossible to observe the value of $Y_i(1)$ and $Y_i(0)$ for the same firm. Eventhough we can estimate $E[Y_i(1) \,|D = 1]$, but we cannot estimate $E[Y_i(0)|D = 1]$. Therefore, the standard approach is to estimate the average treatment effect on the treated (ATT) given below:

ATT $= E(A_i|D_i = 1)$

ATT $= E(w_{1i}|D_i = 1) - (E(w_{0i}|D_i = 1)$

PSM is based on the idea of construction a comparison group as control group, which are identical to treatment group. Matching is carried out using propensity scores P(X) conditioned on vector of observables X. Propensity score which can be interpreted as the predicted probability of participating in a program. A critical factor associated with the matching process is the conditional independence assumption (CIA). It means that there is no issue of selection, potential outcomes are independent of the treatment assignment and there are no unobserved heterogeneity (Heckman and Robb 1985). Further, PSM requires common support assumption i.e., units with same X values have a positive probability of being both treated and non-treated (Heckman, LaLonde, and Smith, 1999)

Following Rosenbaum and Rubin (1983) theorem, the PSM procedure involves two steps. In the first step, we estimate the propensity score $\Pr(D = 1|X)$ using the standard binary discrete choice model (probit or logit). In the second step, entities are matched on the basis of their predicted probabilities of participation using the appropriate matching estimators.

5. Findings

5.1. Gender of the owner and performance

In this section, we begin by discussing the results of the difference in performance between male and women led businesses. As highlighted above, there is already a large body of literature highlighting the significant differences in performance between male and female entrepreneurs. Many of these studies point to the prevalence of substantial gender-specific barriers to entrepreneurship that constrain the performance of female entrepreneurs (Bardasi *et al*., 2011). These barriers also explain the lesser participation of women into entrepreneurship. Available evidence shows that female entrepreneurs are a minority in developing countries as well as in high income countries including United States and United Kingdom (Bardasi *et al.*, 2011). This study though does not probe the reasons behind the lower participation of women in entrepreneurship (female entrepreneurs constitute only 15 per cent in our dataset), locating the constraints that could explain the observed gaps in performance between male and female entrepreneurs can provide some new insights into the lower women participation in

entrepreneurial activities. We begin our empirical analysis by first exploring the relationship between gender of the owner and gaps in performance. In other words, our intention is to see whether there exists any significant difference in performance between firms owned by male and female owners in the micro, small and medium enterprise (MSME) sector in India.

Our estimation results are presented in Table 1. In all cases, we estimate three specifications based on the extent and involvement of women in the ownership and management of firms i.e., *women owned*, *women manager*, *women owner and manager*: without any controls (Col.1), controlling for state effects (Col.2) and controlling for state and industry effects (Col.3).

Our results clearly suggest that there exists a significant gap in performance between firms owned by males and those owned by females. Across all specifications, all measures of performance and all measures of female entrepreneurship, male entrepreneurs do perform better than female entrepreneurs.[6] Controlling for industry and state effects, the annual production of an average female owned firm is 41 per cent less than the annual production for an average male owned firm. The gap is much larger for *womenmanager* (65%) and *women* (72%). Using number of workers as a proxy for firm size, we find an average female owned firm to be $5/6^{th}$ of the size of an average male owned firm. In terms of capital investment too, female run firms are smaller in size as compared to their male counterparts. These findings are robust to our alternate measures of women entrepreneurship (*womenmanager* and *women*) and the gaps are found to be much larger for these alternate measures. However, based on output growth as a measure of performance, we do not observe strong evidence to confirm significant differences in performance between male and female entrepreneurs, since the coefficients of women in all our specifications are not significant though they have the expected negative sign.

Further, we proceed to examine whether female run enterprises are less productive than those operated by males. To capture the productivity differences, we rely on two standard measures: (a) labour productivity, (defined as the ratio of gross value added to number of workers); and (b) total factor productivity (TFP). Following Bardasi *et al*.

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[6] The only exception is with respect to output growth where the coefficient is negative but not significant.

(2011), we compute TFP by estimating a Cobb-Douglas production function from firm level data. The function takes the following form:

$$lnY_{jis} = \beta_0 + \beta_k lnK_{jis} + \beta_l lnL_{jis} + \beta_l F_{jis} + \gamma_i + \delta_s + \varepsilon_{jis} \qquad (1)$$

where Y_{jis} stands for gross value added of firm j operating in industry i and in state s. K and L are capital input and labour input respectively. Real gross fixed assets is used to represent the capital input and the number of workers employed by the firm is used as variable for the labour input. F is our variable of interest which takes the value 1 for female entrepreneur and 0 for male entrepreneur. γ_{is} are industry fixed effects and δ_s are state fixed effects. We transform all the variables (output, capital and labour) to their natural logarithmic values. The estimated coefficient (π) of F in the above equation captures gender differences in TFP.

The results obtained from productivity measures, (labour productivity and total factor productivity), are presented in the lower panel of Table 1 (see the panel under the sub-heading efficiency). Results for all specifications and for alternate measures of women entrepreneurship clearly indicate that female run firms are less efficient than male run firms. Controlling for state and industry, the 'male–female entrepreneurial' gap in labour productivity is 23 per cent and the gap in total factor productivity is 11 per cent. These gaps in efficiency is significantly higher when we use *womenmanager* and *women* as measures of women entrepreneurship. On the whole, our findings point to the underperformance of female entrepreneurs in indicators pertaining to size, growth and efficiency of MSME firms. Based on these results of the preceding analysis, we seek to probe further into the underperformance of female led firms in the MSME. More importantly, why women-owned firms are significantly smaller and less efficient than the firms operated by male entrepreneurs?. Therefore, in the next section, an attempt is made to map the possible factors constraining the growth of female entrepreneurial activities in India.

5.2. Constraints to growth of women-owned firms

We explore here various possible explanations for the significant 'male-female differential' in the performance of firms in the MSME sector in India. Previous studies

provide several explanations for the prevalence of gender-based gaps in entrepreneurial performance. Given the data constraints, our objective is to provide explanations for the following questions: (a) Whether the gender differences in firm age explain the observed gender gaps in performance? (b) Whether the observed differences in performance is due to the smaller size of their concerns? (c) Whether the observed gap in performance is due to the crowding of female firms in specific industrial sectors with low productivity? and (d) Are gender gaps in performance driven by gender differences in access to credit?

Table 1: Gender of the owner and performance gaps (OLS regression coefficients of dummy for female ownership)

Variable	Woman as owner			Woman as manager			Woman as owner and manager		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Size									
a. Ln(output)									
Female	-0.868***	-0.704***	-0.411***	-1.231***	-1.014***	-0.652***	-1.330***	-1.103***	-0.720***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.03	0.17	0.25	0.05	0.19	0.25	0.05	0.19	0.26
b. Ln(employment)									
Female	-0.359***	-0.305***	-0.177***	-0.530***	-0.463***	-0.301***	-0.577***	-0.509***	-0.338***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.02	0.11	0.19	0.03	0.12	0.20	0.03	0.12	0.20
c. Ln(capital)									
Female	-1.074***	-0.784***	-0.414***	-1.416***	-1.085***	-0.627***	-1.515***	-1.183***	-0.696***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.03	0.37	0.44	0.05	0.38	0.44	0.05	0.38	0.44
Growth									
d. Output growth									
Female	-3.131 (15.458)	-7.177 (16.025)	-0.337	-0.969	-4.419	4.505	-4.928	-8.732	0.043
			(16.978)	(16.854)	(17.452)	(18.859)	(17.801)	(18.432)	(19.964)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002
Efficiency									
e. Gross value added per worker (Labour Productivity)									
Female	-0.509***	-0.399***	-0.234***	-0.700***	-0.550***	-0.351***	-0.753***	-0.594***	-0.382***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.02	0.15	0.19	0.04	0.16	0.20	0.04	0.16	0.20
f. Total Factor Productivity									
Female	-0.114***	-0.103***	-0.112***	-0.170***	-0.121***	-0.135***	-0.196***	-0.133***	-0.150***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
Number of observations	1156855	1156855	1156855	1156855	1156855	1156855	1156855	1156855	1156855
R-squared	0.52	0.60	0.60	0.53	0.60	0.60	0.53	0.60	0.60

Note: Female variable stands for dummy for female as owner, female as manager and female as both owner and manager. In model 2 and model 3, we include state fixed effects and state and industry fixed effects respectively. No effects are included in Model 1. ***significant at 1%.

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

a. Differences in firm age and gaps in performance

One possibility is that the differences in the age of the firm owned by males and females could explain the observed gaps in performance of male and female entrepreneurs. This argument emanates from the realization that women are increasingly engaging in entrepreneurial activities, hence their ventures will be much younger than the ones operated by their male counterparts. Their less experience in managing entrepreneurial concerns might well explain their underperformance as entrepreneurs.[7] Female-owned firms in our dataset are indeed much younger than the male-owned firms (Table 2). Average age of the women owned enterprise in our data is around nine years. One can observe from the figures that firms operated by male entrepreneurs are on average four years older than the female-owned firms.

To examine the possibility that differences firm age may be driving the male-female gaps in performance, we re-estimate equation (1), controlling for the age of the firm. Results for complete specification with industry and fixed effects are presented in Table 3. For each measure of women entrepreneurship, we present two columns, one without age as a control variable (Col. 1) and one with age as a control variable (Col. 2). We find that the results are unaffected even after controlling for the influence of the age of the firm. The size and sign of estimated coefficient of *F* (women owner, manager, owner-manager) hardly vary when we introduce *age* as a control variable (compare cols. (1) and (2) in Table 3). Our results thus show that firm *age* do not account for the observed gender differences in firm performance, and the reason for gender gaps in performance therefore has to be found elsewhere.

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[7] It needs to be stated that the relatively lesser age of firms owned by females may be a result of underperformance of women entrepreneurs, as we observed in this study. If the survival rate of women owned firms are lower than that of male owned firms, it is very much possible that the female owned firms are on average younger than male-owned firms. Our data does not permit us to examine this hypothesis, however, it is safer to assume that younger firms are on average less experienced than older firms (Bardasi *et al.* 2011).

(a) Do differences in the age of female and male run firms explain the existence of the gender gap in firm performance?

Table 2: Average firm age by gender of the owner

	Woman as owner	Woman as manager	Woman as owner and manager
Male run firms	13.15	13.18	13.15
Female run firms	9.99	9.12	8.77
Difference	3.16	4.06	4.38
t-statistic	131.40	155.35	158.83
Significant?	Yes	Yes	Yes

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

Table 3: Gender of the owner and performance gaps, Controlling for age of the firm

Variable	Woman as owner		Woman as manager		Woman as owner and manager	
	(1)	(2)	(1)	(2)	(1)	(2)
Size						
a. Ln(output)						
Female	-0.411***	-0.402***	-0.652***	-0.642***	-0.720***	-0.709***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.25	0.25	0.25	0.26	0.26	0.26
b. Ln(employment)						
Female	-0.177***	-0.174***	-0.301***	-0.298***	-0.338***	-0.335***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.19	0.19	0.20	0.20	0.20	0.20
c. Ln(capital)						
Female	-0.414***	-0.404***	-0.627***	-0.615***	-0.696***	-0.683***
	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.006)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.44	0.44	0.44	0.44	0.44	0.44
Growth						
d. Output growth						
Female	-0.337	-7.020	4.505	-3.888	0.043	-9.180
	(16.978)	(17.022)	(18.859)	(18.923)	(19.964)	(20.038)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Efficiency						
e. Gross value added per worker (Labour Productivity)						
Female	-0.234***	-0.228***	-0.351***	-0.344***	-0.382***	-0.374***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.19	0.19	0.20	0.20	0.20	0.20
f. Total Factor Productivity						
Female	-0.112***	-0.110***	-0.135***	-0.132***	-0.150***	-0.146***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Number of observations	1156855	1156855	1156855	1156855	1156855	1156855
R-squared	0.60	0.60	0.60	0.60	0.60	0.60

Note: Female stands for dummy for female as owner, female as manager and female as both owner and manager. Model (1) corresponds to Model (3) in Table 1. In model (2), we also include age of the firm and square of age of the firm. ***significant at 1%.

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

(b) Dominance of smaller firms

Women entrepreneurship is largely skewed towards smaller-sized firms, and this gap in firm size, at least partially, explain the existence of a gender gap in firms' performance.[8] It is argued that majority of women entrepreneurs are often in business because running a small enterprise allows them to bring in additional income with little additional effort and they are unlikely to expand or invest in their businesses. Some studies also show that women tend to display greater risk aversion, which leads women to restrict investment in their business concerns thereby limiting the growth of their firms (Barber and Oden 2001, Dohmen et al 2005). However, the differences in firm size may also be an outcome of the differences in survival rate of male and female owned enterprises. If the female-owned firms do not survive at the same rate as male-owned firms, we would expect the female-owned enterprises to be more skewed towards smaller-sized firms. Though our datatset does not permit us to explore these two questions, it is, however, possible to analyze whether the differences in firm size explain the gender gap in firm performance. In our dataset too, about 97 per cent of firms owned by women entrepreneurs are micro enterprises as against 85 per cent for male-owned firms.

To account for potential differences in performance that can emerge from differences in firm size, we control for the influence of firm size in our complete specification of equation (1). We do this by introducing three different dummy variables for micro, small and medium firms in our dataset. The results of our re-estimation are reported in table 4. Our results clearly show that differences in firm size explain only marginal differences in performance between male and female-owned firms. The estimated coefficient of F is still large in magnitude and negative when we introduce firm size dummies as control variables (compare cols. (1) and (2) in Table 4). Our results are also robust to alternate measures of women entrepreneurship. As a robustness test, we estimate equation (1) separately for micro, small and medium firms. Barring a few exceptions, the coefficients are still negative and significant though lesser in magnitude

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[8] In India, almost 98 per cent of women-owned firms are micro-enterprises, and approximately 90 per cent of women-owned enterprises are in the informal sector (IFC, 2014).

confirming that one has to search for alternate explanations for the underperformance

of women entrepreneurs in the MSME sector in India (Table 5).

Table 4: Gender of the owner and performance gaps, Controlling for firm size

Variable	Woman as owner		Woman as manager		Woman as owner and manager	
	(1)	(2)	(1)	(2)	(1)	(2)
Size						
a. Ln(output)						
Female	-0.411***	-0.340***	-0.652***	-0.558***	-0.720***	-0.615***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.25	0.44	0.25	0.45	0.26	0.45
b. Ln(employment)						
Female	-0.177***	-0.142***	-0.301***	-0.256***	-0.338***	-0.287***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.19	0.36	0.20	0.37	0.20	0.37
c. Ln(capital)						
Female	-0.414***	-0.328***	-0.627***	-0.514***	-0.696***	-0.569***
	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.44	0.62	0.44	0.63	0.44	0.63
Growth						
d. Output growth						
Female	-0.337	1.697	4.505	7.272	0.043	3.160
	(16.978)	(16.985)	(18.859)	(18.871)	(19.964)	(19.978)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.0002	0.0001	0.0002	0.0001	0.0002	0.0001
Efficiency						
e. Gross value added per worker (Labour Productivity)						
Female	-0.234***	-0.198***	-0.351***	-0.303***	-0.382***	-0.327***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Number of observations	1157961	1157961	1157961	1157961	1157961	1157961
R-squared	0.19	0.30	0.20	0.30	0.20	0.31
f. Total Factor Productivity						
Female	-0.112***	-0.124***	-0.135***	-0.157***	-0.150***	-0.175***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Number of observations	1156855	1156855	1156855	1156855	1156855	1156855
R-squared	0.60	0.61	0.60	0.61	0.60	0.61

Note: Female stands for dummy for female as owner, female as manager and female as both owner and manager. Model (1) corresponds to Model (3) in Table 1. In model (2), we also include age of the firm and square of age of the firm. ***significant at 1%.

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

Table 5: Gender of the owner and performance gaps, Controlling for firm type

Variables	Woman as owner				Woman as manager				Woman as owner and manager			
	Overall	Micro	Small	Medium	Overall	Micro	Small	Medium	Overall	Micro	Small	Medium
Size												
a. Ln(output)												
Female	-0.411***	-0.328***	-0.102***	-0.195**	-0.652***	-0.523***	-0.311***	-0.002	-0.720***	-0.573***	-0.409***	-0.211
	(0.004)	(0.004)	(0.017)	(0.098)	(0.005)	(0.004)	(0.023)	(0.145)	(0.005)	(0.004)	(0.029)	(0.222)
Number of observations	1157961	1010055	139815	4916	1157961	1010055	139815	4916	1157961	1010055	139815	4916
R-squared	0.25	0.24	0.51	0.35	0.25	0.25	0.51	0.35	0.26	0.25	0.51	0.35
b. Ln(employment)												
Female	-0.177***	-0.127***	-0.001	0.022	-0.301***	-0.226***	-0.099***	0.038	-0.338***	-0.254***	-0.138***	-0.195
	(0.002)	(0.002)	(0.010)	(0.079)	(0.003)	(0.002)	(0.014)	(0.119)	(0.003)	(0.002)	(0.018)	(0.179)
Number of observations	1157961	1010055	139815	4916	1157961	1010055	139815	4916	1157961	1010055	139815	4916
R-squared	0.19	0.19	0.42	0.17	0.20	0.20	0.42	0.17	0.20	0.20	0.42	0.17
c. Ln(capital)												
Female	-0.414***	-0.312***	-0.065***	-0.013	-0.627***	-0.477***	-0.107***	-0.044*	-0.696***	-0.524***	-0.147***	-0.057
	(0.005)	(0.004)	(0.011)	(0.017)	(0.005)	(0.004)	(0.016)	(0.025)	(0.005)	(0.005)	(0.019)	(0.037)
Number of observations	1157961	1010055	139815	4916	1157961	1010055	139815	4916	1157961	1010055	139815	4916
R-squared	0.44	0.40	0.04	0.04	0.44	0.40	0.04	0.03	0.44	0.40	0.04	0.04
Growth												
d. Output growth												
Female	-0.337	4.096	-69.414	-2.913	4.505	7.994	-63.374	-6.605	0.043	2.410	-45.572	-1.184
	(16.978)	(6.268)	(200.93)	(10.023)	(18.859)	(6.901)	(277.797)	(15.030)	(19.964)	(7.273)	(342.075)	(22.612)
Number of observations	1157961	1010055	139815	4916	1157961	1010055	139815	4916	1157961	1010055	139815	4916
R-squared	0.0002	0.001	0.0002	0.012	0.0002	0.001	0.0002	0.012	0.0002	0.001	0.0002	0.013
Efficiency												
e. Gross value added per worker (Labour Productivity)												
Female	-0.234***	-0.201***	-0.101***	-0.216***	-0.351***	-0.296***	-0.212***	-0.040	-0.382***	-0.319***	-0.270***	-0.015
	(0.003)	(0.003)	(0.014)	(0.088)	(0.003)	(0.003)	(0.019)	(0.132)	(0.004)	(0.003)	(0.024)	(0.198)
Number of observations	1157961	1010055	139815	4916	1157961	1010055	139815	4916	1157961	1010055	139815	4916
R-squared	0.19	0.17	0.30	0.27	0.20	0.17	0.30	0.27	0.20	0.17	0.30	0.27
f. Total Factor Productivity												
Female	-0.112***	-0.149***	-0.067***	-0.232***	-0.135***	-0.186***	-0.198***	0.120	-0.150***	-0.206***	-0.272***	-0.073
	(0.003)	(0.003)	(0.017)	(0.094)	(0.003)	(0.003)	(0.024)	(0.140)	(0.004)	(0.003)	(0.029)	(0.211)
Number of observations	1156855	1009135	139643	4909	1156855	1009135	139643	4909	1156855	1009135	139643	4909
R-squared	0.60	0.49	0.61	0.30	0.60	0.49	0.61	0.30	0.60	0.49	0.61	0.30

Note: Micro = enterprises where the investment in plant and machinery does not exceed twenty five lakh rupees; Small = enterprises where the investment in plant and machinery is more than twenty five lakh rupees but does not exceed five crore rupees; Medium= enterprises where the investment in plant and machinery is more than five crore rupees but does not exceed ten crore rupees; Female variable stands for dummy for female as owner, female as manager and female as both owner and manager. In model 2 and model 3, we include state fixed effects and state and industry fixed effects respectively. The estimated model corresponds to Model (3) in Table 1. ***, ** and * indicate level of significance at 1%, 5% and 10% respectively.

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

(c) Higher concentration of female entrepreneurs in industrial sectors with low productivity

Another explanation cited in the literature related to the underperformance of female entrepreneurs is their higher concentration in low performing and less productive industries. This issue has been previously addressed by Bardasi *et al*. (2011) for three developing regions, Eastern Europe and Central Asia (ECA), Latin America (LA), and Sub-Saharan Africa (SSA). We proceed as follows. First, we investigate whether female-owned firms are heavily concentrated in few industrial sectors. This is done by computing a concentration index at the industrial level. We then compare the performance of firms in these industries (industries where the female entrepreneurs are more concentrated) with those in other industrial sectors. Finally, we examine the relative performance of male- and female-owned businesses in female-dominated and male-dominated sectors.

The distribution of women entrepreneurs across industrial sectors presented in Figure 1 shows that women-owned enterprises are present in all industrial sectors. The same result holds even when we use alternate measures of entrepreneurship (Figure 2). However, very few women entrepreneurs are found in industrial sectors such as transport equipment and parts (automobiles) and electronics. Our estimates suggests that wearing apparel, textiles and food products are the dominant industries for women entrepreneurs. These industries together accommodate 72 per cent of total women entrepreneurs in the MSME sector. Among them, wearing apparel alone constitute about half of the women-owned firms. Using an index of concentration, we find out whether there is a large concentration of women entrepreneurs in few sectors. Following Bardasi *et al*. (2011), we define index of concentration for a sector as the ratio of percentage of female entrepreneurs to total entrepreneurs in that sector to percentage of female entrepreneurs to total entrepreneurs in the MSME sector. Symbolically, the index of concentration $(I_c) = \frac{F_S}{F_T}$, where F_S is the share of female entrepreneurs to total entrepreneurs in a sector and F_T is the share of female entrepreneurs to total entrepreneurs in the MSME sector. If the value of index of concentration is greater than one in a sector, it implies that the female entrepreneurs are overrepresented in that sector in comparison with their representation in the sector as a

whole. We report the index of concentration for all industrial sectors and for all measures of women entrepreneurship in Figure 3. Our findings indicate that the concentration ratio is greater than one in just three industrial sectors namely wearing apparel, textiles and tobacco products. In these three sectors, there is an overrepresentation of women entrepreneurs. The main idea emerge from Figure 1 and Figure 3 is that women are heavily concentrated in few sectors while men are more or less proportionately distributed across industrial sectors.[9]

Given that women-owned firms tend to concentrate in few sectors, it may be possible that the observed underperformance of women enterprises is due to the below average performance of sectors where women entrepreneurs are overrepresented. We now examine this issue. For this, we need to compare the relative performance of female owned firms in the female-dominated industries with those industries where they are not overrepresented. One drawback of such comparison is the presence of endogeneity as it is possible that the lower performance of female-owned enterprises may be explaining the lower performance of sectors where they are overcrowded. In order to overcome this, we measure the relative performance by analyzing the performance of male-owned firms. In otherwords, what we are attempting here is to verify whether the performance of male-owned firms in female-dominated industries is lower than the performance of male-owned firms in other industries (where females are not over represented). To implement this, we first group the industrial sectors into two categories: one category for female-dominated industrial sectors (sectors with $I_c > 1$) and another for male-dominated sectors (sectors with $I_c < 1$). In the next step, we employ the following specification to examine the relative performance of male- and female-owned firms:

$$lnY_{jis} = \beta_0 + \pi F_{jis} + \gamma FD_{is} + \theta F_{jis} * FD_{is} + \delta_s + \varepsilon_{jis} \tag{2}$$

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[9] Our computations show that index of concentration is greater than one for men in many sectors.

Figure 1: Distribution of female firms across industries
(Percent, value sum to 100)
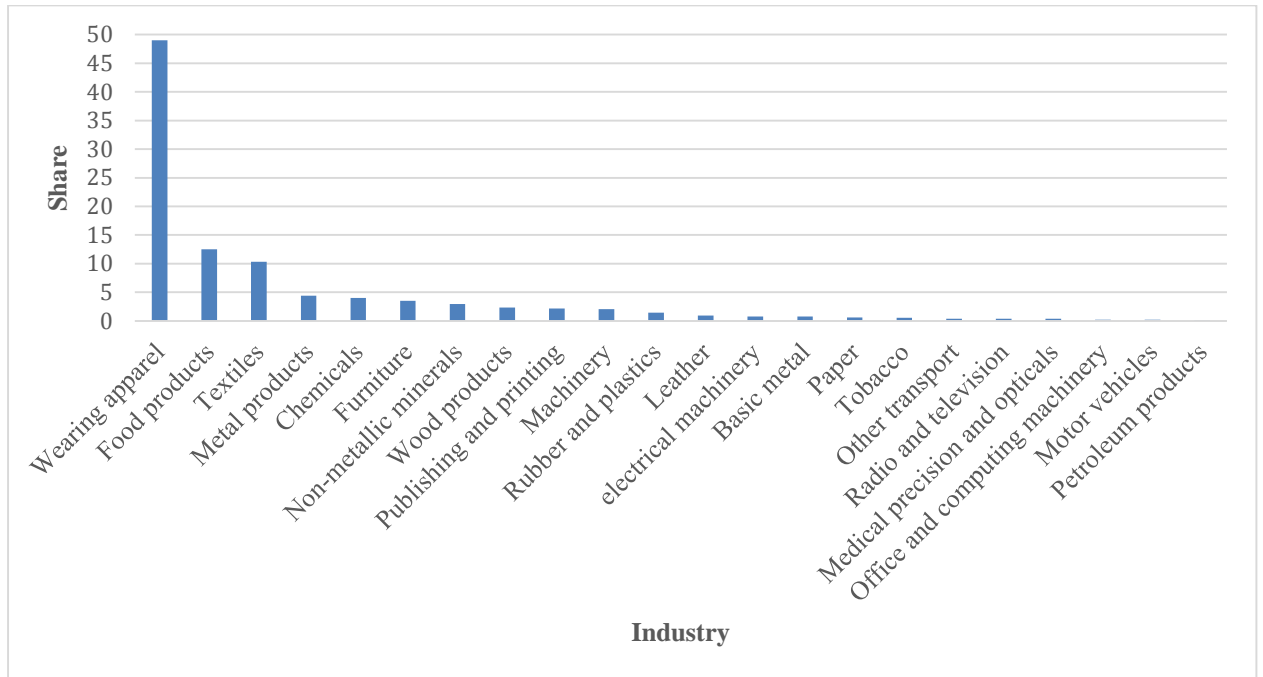
Source: Authors' estimates based on MSME dataset.

Figure 2: Distribution of female firms across industries (Percent, value sum to 100)

Owner

Manager

Owner-Manager
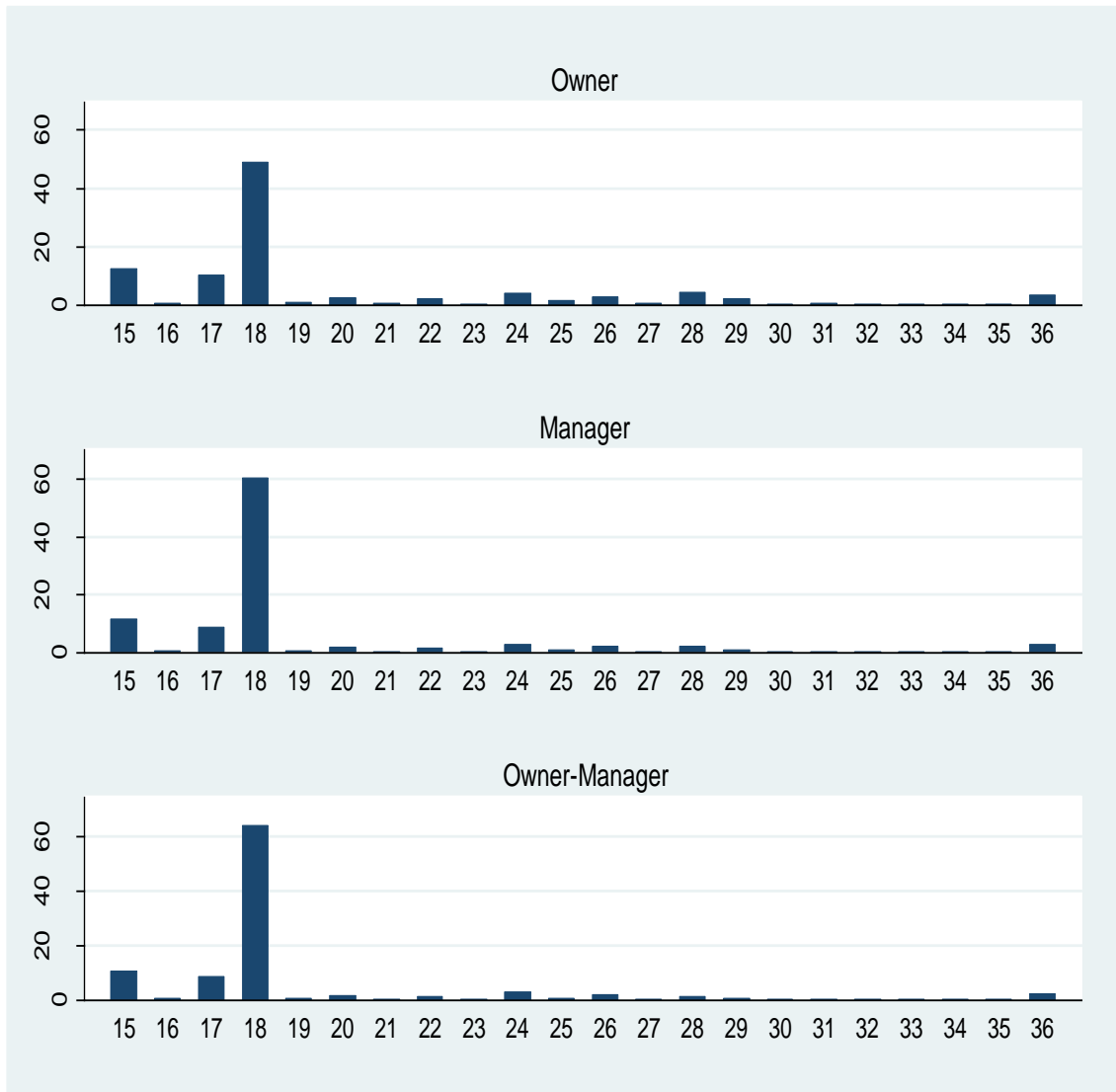
Note: Industries are represented using NIC codes to save space. Appendix I presents industry names against industry codes.

Figure 3: Index of concentration of female entrepreneurs by industry

Source: Authors' estimates.

where Y_{jis} stands for gross value added of firm j operating in industry i and in state s. F is the dummy for female entrepreneur which takes the value 1 for female entrepreneur and 0 for male entrepreneur. The estimated π coefficient of F indicates the overall performance of female firms in our dataset. FD is the dummy variable for female dominated sectors and its coefficient, γ, enables us to capture the differences in performance between firms in female-dominated and male-dominated sectors. The estimated θ coefficient of the interaction term $F*FD$ yields the additional effect associated with female-owned firms operating in a female-dominated sector. δ_s stands for state fixed effects. It is clearly evident that the equation (2) help us to differentiate between two implicit hypotheses of lower performance of the industries and lower performance of women entrepreneurs within these industries.

Results are presented in Table 6. The table report results for two measures of performance, log of output and value added per worker. The estimations are performed for all the three measures of women entrepreneurship (*womenent*, *womenmanagement* and *women*). In all cases, we report results for two specifications of our regression equation (2): (a) without industry and state dummies and (b) with industry and state dummies. Whether the overrepresentation of women in sectors that are underperforming actually constraining the performance of women-owned firms? Our findings do confirm that partial explanation for the underperformance of female entrepreneurs can be derived from our concentration story. Across all estimations, the estimates of coefficients of F, FD and $F*FD$ are negative and significant. These results point to the fact that firms operating in female-dominated sectors are significantly smaller and less efficient compared to firms operating in male-owned sectors. In other words, our results unambiguously indicate that women do concentrate in sectors where firms are on average smaller.

Though these results offer a partial explanation for the underperformance of women entrepreneurs in the MSME sector, what it fails to explain is why female-owned firms indeed would like to based in sectors which are poorly performing. An interesting policy question is whether women entrepreneurs are entering into sectors with smaller and less efficient firms by 'choice' or by 'force'? If it is by choice, what are the key factors that make them attractive towards these sectors? If they are forced to work in

these sectors, what are the key elements that exclude them from the other sectors? Our dataset, however, does not permit us to undertake an analytical exercise for searching answers for these questions. We are indeed able to investigate, in the following section, whether their decision to operate in these sectors is constrained by their access to credit.

Table 6: Gender of the owner and gaps in performance: whether operating in female dominant sectors is a justification?

Variables	Ln(output)						Value added per worker (Labour Productivity)					
	Woman as owner		Woman as manager		Woman as owner and manager		Woman as owner		Woman as manager		Woman as owner and manager	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Female	-0.068***	-0.030***	-0.526***	-0.410***	-0.662***	-0.523***	-0.092***	-0.068***	-0.362***	-0.283***	-0.444***	-0.348***
	(0.008)	(0.007)	(0.009)	(0.008)	(0.010)	(0.009)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.006)
Female dominant sector	-0.155***	-0.136***	-0.349***	-0.309***	-0.370***	-0.325***	-0.168***	-0.147***	-0.270***	-0.236***	-0.281***	-0.245***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Female*Female dominant sector	-1.130***	-0.967***	-0.758***	-0.666***	-0.638***	-0.573***	-0.535***	-0.425***	-0.291***	-0.229***	-0.215***	-0.169***
	(0.010)	(0.009)	(0.011)	(0.010)	(0.012)	(0.011)	(0.007)	(0.006)	(0.007)	(0.007)	(0.008)	(0.008)
Constant	12.572***	12.745***	12.626***	12.754***	12.626***	12.753***	11.488***	11.855***	11.512***	11.851***	11.511***	11.850***
	(0.002)	(0.015)	(0.002)	(0.015)	(0.002)	(0.015)	(0.001)	(0.010)	(0.001)	(0.010)	(0.001)	(0.010)
Number of Observations	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961	1157961
Industry Effects?	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
Regional Effects?	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
R-squared	0.05	0.19	0.07	0.20	0.07	0.20	0.04	0.16	0.05	0.17	0.05	0.17

Note: Female is a dummy variable for women owned enterprises. Female dominant sectors are those where the index of concentration is larger or equal to 1 (the index of concentration represents the ratio between the percentage of women entrepreneurs in a specific industrial sector and the percentage of women entrepreneurs in the dataset). Model (1) corresponds to Model (3) in Table 1. In model (2), we also introduce age of the firm and square of age of the firm. *** Significant at 1%.

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

(e) Are gender gaps in performance driven by gender differences in access to credit?

The significance of credit access for the subsequent growth and performance of firms is well documented in the literature (Binks and Ennew 1996; Rajan and Zingales 1998; Oliveira and Fortunato 2006). A large number of studies carried out in the recent past have focused on the question of whether the financial constraints facing entrepreneurs differ with respect to demographic characteristics, including gender. Some of these studies revealed that female-owned firms tend to have less access to formal credit than male-owned firms (Carter and Rosa 1998; Coleman 2007). If there is a clear discrimination in access to credit, female entrepreneurs are less likely to invest in fixed assets, and in the process finding it difficult to penetrate into industries that require large investments. In other words, women entrepreneurs are more likely to crowd into industries requiring lesser investments, in the presence of discrimination in credit access. This clearly evident from our dataset as female-owned firms are heavily concentrated in industries requiring lesser investments. Nearly about 70 per cent of female entrepreneurs in the MSME sector are in industries that are labor intensive and requiring fewer investments in fixed capital. More importantly, the explanation for the observed gender differences in performance can be found in this gender gap in access to credit. In order to investigate the relationship between the gender of entrepreneurs and their access to formal financing channel (loan), we test the following empirical model:

$$Y_i = \beta_0 + \pi F_{jis} + \delta X_{jis} + \gamma_i + \delta_s + \varepsilon_{jis} \qquad (3)$$

where Y_i is a dummy variable which takes the value 1 if the firm j operating in industry i and in state s has obtained external finance (loan) and 0 otherwise. F is the dummy for female entrepreneur which takes the value 1 for female entrepreneur and 0 for male entrepreneur. As in other estimations, we use three alternate measures of female entrepreneurship: *womenent*, *womenmanager* and *women*. X is a vector of firm specific attributes that could influence the probability of obtaining loan. These firm specific characterizes are also important from the lender's point of view as they reflect the creditworthiness and resources of a firm that the lender will consider while taking decision to grant a loan. To be specific, we include three measure of firm performance

28

or how well the firm is run (measured by performance variables such as profit, labour productivity and net worth of the firms), a measure of export opportunities (a dummy indicating whether or not a firm exports), the financial literacy and ability of the entrepreneur (whether or not the firm is maintaining an account and whether the firm has a quality certificate), a measure of ownership (whether the firm has a single owner or multiple owners), a measure to capture the possible effects of participating in networks (whether the firm is part of a cluster), the stability of the firm (captured by age and age squared) and the size of the firm (measured by two proxies: employment and the amount of sales two years before the current period). To control for the environments in which firms operate, we include dummy for location, which tales the value 1 if the firms are operating from rural areas and 0 if they operate from urban areas. γ_{is} are industry fixed effects and δ_s are state fixed effects.

The main estimation results are reported in Table 8. The table present the estimates for a number of specifications. In all these specifications, the coefficient on variable F, which is our variable of interest, is negative and statistically significant. Controlling for firm performance and other firm characteristics representing creditworthiness, this suggests that female-owned firms in the MSME sector are less likely to obtain a loan as compared to male-owned firms. According to the estimates, female entrepreneurs have about 15-20 per cent lower probability of obtaining a loan than male entrepreneurs. Considering the smaller proportion of firms that receive loans in the MSME sector, this is fairly a large number, indicating the presence of substantial gender difference in financial constraints. As conjectured, our estimations results also lend evidence in support of greater difficulties faced by smaller firms, firms that are located in rural areas and firm that has a single owner in securing external finance. Exporting firms and firm that are part of a cluster have a higher probability of loan approval, which implies that lenders consider less risky to lend to those firms that market their product abroad and that are part of a larger network. Consistent with our prior expectations, we also find that entrepreneurial ability and financial literacy does matter in eliciting a positive response from the lender. Our proxies for ability and literacy (account maintenance and possessing a quality certificate) have yielded positive coefficients signifying the fact that lenders' satisfaction on entrepreneurial abilities increases the likelihood of loan approval. There is also a clear direction from our results that the probability of obtaining loan is significantly higher among firms that

throw up a better performance in terms of profitability and productivity, as the coefficients of all measures of firm performance are positive and significant across all our specifications.

Furthermore, our results are also robust to alternate measures of women entrepreneurship. If we focus on we focus on the variable identifying the gender of the manager rather than female participation in ownership (Table 9), the results again show evidence of gender based discrimination in the credit market, once we condition for firms characteristics. The same result holds even when we use the variable capturing the dual role of women as owner and manager (Table 10).

Table 7: Are female entrepreneurs entering more into industries requiring lesser investments?

Industry	Capital Intensive?	Share of women entrepreneurs
Food products	N	12.5
Tobacco	N	0.6
Textiles	Y	10.3
Wearing apparel	N	49.0
Leather	N	0.9
Wood products	N	2.3
Paper	Y	0.6
Publishing and printing	Y	2.2
Petroleum products	Y	0.1
Chemicals	Y	4.0
Rubber and plastics	Y	1.4
Non-metallic minerals	N	3.0
Basic metal	Y	0.8
Metal products	Y	4.4
Machinery	Y	2.1
Office and computing machinery	Y	0.2
electrical machinery	Y	0.8
Radio and television	Y	0.4
Medical precision and opticals	Y	0.4
Motor vehicles	Y	0.2
Other transport	N	0.4
Furniture	Y	3.5

Note: Labour intensive industries are those industries whose capital-labour ratio (CLR) falls below the median value of CLR. Those industries whose CLR is above the median value are classified as capital intensive industries. N = not capital intensive and Y = capital intensive.
Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

Table 8: Gender of the owner and access to credit

Dependent variable: Whether or not obtained loan (obtained = 1)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Female	-0.187***	-.0324***	-0.186***	-0.223***	-0.172***	-0.178***	-0.191***	-0.192***	-0.154***	-0.140***	-0.169***	-0.131***	-.155***
	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.012)	(0.010)	(0.010)
Age of the firm				-0.039***	-0.037***	-0.037***	-0.038***	-0.037***	-0.039***	-0.038***	-0.042***	-0.040***	-0.039***
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age square				0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size				0.551***	0.558***	0.441***	0.434***	0.234***	0.379***	0.324***			0.219***
				(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)			(0.005)
Location						-0.148***	-0.208***	-0.209***	-0.267***	-0.294***	-0.265***	-0.304***	-0.265***
						(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)
Firm is part of a cluster						0.434***	0.395***	0.394***	0.417***	0.390***	0.414***	0.402***	0.424***
						(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)	(0.012)	(0.012)
Firm maintains an account							0.395***	0.574***	0.434***	0.375***	0.507***	0.388***	0.417***
							(0.012)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Firm has a quality certificate							0.210***	0.180***	0.125***	0.094***	0.057***	0.116***	0.105***
							(0.014)	(0.014)	(0.014)	(0.014)	(0.016)	(0.014)	(0.014)
Firm is exporting							0.275***	0.209***	0.170***	0.211***		0.194***	0.191***
							(0.018)	(0.019)	(0.019)	(0.021)		(0.019)	(0.019)
Log of net worth of the firm									0.193***			0.107***	0.185***
									(0.003)			(0.003)	(0.003)
Value added per worker										0.267***			
										(0.003)			
Log of profit											0.126***		
											(0.003)		
Output two years ago												0.222***	
												(0.003)	
Firm has a single owner													-0.217***
													(0.010)
Constant	-2.023***	-2.127***	-2.034***	-1.647***	-2.163***	-2.132***	-2.171***	-2.175***	-4.354***	-5.259***	-3.370***	-5.889***	-4.030***
	(0.003)	(0.033)	(0.033)	(0.034)	(0.035)	(0.035)	(0.035)	(0.035)	(0.047)	(0.049)	(0.046)	(0.045)	(0.049)
State effects?	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry effects?	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	1157961	1157959	1157959	1157959	1157959	1157959	1157959	1157959	1151271	1157959	814066	1151271	1151271
Pseudo R2	0.0005	0.10	0.11	0.11	0.15	0.15	0.16	0.16	0.16	0.17	0.16	0.17	0.17

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

Table 9: Gender of the manager and access to credit

Dependent variable: Whether or not obtained loan (obtained = 1)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Female	-0.366***	-0.429***	-0.216***	-0.267***	-0.129***	-0.126***	-0.125***	-0.125***	-0.076***	-0.053***	-0.089***	-0.047***	-0.081***
	(0.010)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.014)	(0.012)	(0.012)
Age of the firm				-0.039***	-0.037***	-0.037***	-0.037***	-0.037***	-0.038***	-0.038***	-0.042***	-0.040***	-0.039***
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age square				0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size				0.550***	0.558***	0.441***	0.434***	0.234***	0.379***	0.323***			0.218***
				(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)			(0.005)
Location						-0.149***	-0.209***	-0.210***	-0.268***	-0.294***	-0.267***	-0.305***	-0.266***
						(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)
Firm is part of a cluster						0.428***	0.389***	0.388***	0.413***	0.387***	0.410***	0.399***	0.419***
						(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)	(0.012)	(0.012)
Firm maintains an account							0.570***	0.572***	0.431***	0.373***	0.504***	0.386***	0.415***
							(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Firm has a quality certificate							0.208***	0.179***	0.123***	0.091***	0.054***	0.114***	0.103***
							(0.014)	(0.014)	(0.014)	(0.014)	(0.016)	(0.014)	(0.014)
Firm is exporting								0.271***	0.207***	0.167***	0.207***	0.191***	0.188***
								(0.018)	(0.019)	(0.019)	(0.021)	(0.019)	(0.019)
Log of net worth of the firm									0.194***			0.108***	0.186***
									(0.003)			(0.003)	(0.003)
Value added per worker										0.268***			
										(0.003)			
Log of profit											0.127***		
											(0.003)		
Output two years ago												0.223***	
												(0.003)	
Firm has a single owner													-0.218***
													(0.010)
Constant	-2.011***	-2.170***	-2.060***	-1.675***	-2.191***	-2.160***	-2.201***	-2.205***	-4.393***	-5.302***	-3.410***	-5.927***	-4.067***
	(0.003)	(0.033)	(0.033)	(0.034)	(0.035)	(0.035)	(0.035)	(0.035)	(0.047)	(0.049)	(0.046)	(0.045)	(0.049)
State effects?	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry effects?	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	1157961	1157959	1157959	1157959	1157959	1157959	1157959	1157959	1151271	1157959	814066	1151271	1151271
Pseudo R2	0.002	0.10	0.11	0.11	0.15	0.15	0.16	0.16	0.16	0.17	0.16	0.17	0.17

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

Table 10: Gender of the manager cum owner and access to credit

Dependent variable: Whether or not obtained loan (obtained = 1)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Female	-0.458***	-0.518***	-0.292***	-0.350***	-0.192***	-0.189***	-0.189***	-0.188***	-0.134***	-0.110***	-0.143***	-0.104***	-0.138***
	(0.011)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.015)	(0.013)	(0.013)
Age of the firm				-0.039***	-0.038***	-0.037***	-0.038***	-0.037***	-0.039***	-0.038***	-0.042***	-0.040***	-0.039***
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age square				0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size					0.549***	0.556***	0.440***	0.433***	0.233***	0.379***	0.322***		0.218***
					(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)		(0.005)
Location						-0.149***	-0.210***	-0.210***	-0.268***	-0.295***	-0.267***	-0.305***	-0.267***
						(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)
Firm is part of a cluster						0.428***	0.389***	0.388***	0.412***	0.386***	0.409***	0.398***	0.419***
						(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Firm maintains an account							0.570***	0.572***	0.431***	0.373***	0.504***	0.386***	0.415***
							(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Firm has a quality certificate							0.208***	0.179***	0.123***	0.092***	0.055***	0.114***	0.103***
							(0.014)	(0.014)	(0.014)	(0.014)	(0.016)	(0.014)	(0.014)
Firm is exporting								0.270***	0.206***	0.167***	0.206***	0.190***	0.188***
								(0.018)	(0.019)	(0.019)	(0.021)	(0.019)	(0.019)
Log of net worth of the firm									0.194***			0.108***	0.185***
									(0.003)			(0.003)	(0.003)
Value added per worker										0.267***			
										(0.003)			
Log of profit											0.126***		
											(0.003)		
Output two years ago												0.223***	
												(0.003)	
Firm has a single owner													-0.218***
													(0.010)
Constant	-2.008***	-2.172***	-2.062***	-1.674***	-2.188***	-2.157***	-2.197***	-2.202***	-4.383***	-5.289***	-3.402***	-5.913***	-4.057***
	(0.003)	(0.033)	(0.033)	(0.034)	(0.035)	(0.035)	(0.035)	(0.035)	(0.047)	(0.049)	(0.046)	(0.045)	(0.049)
State effects?	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry effects?	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	1157961	1157959	1157959	1157959	1157959	1157959	1157959	1157959	1151271	1157959	814066	1151271	1151271
Pseudo R2	0.002	0.10	0.11	0.11	0.15	0.15	0.16	0.16	0.16	0.17	0.16	0.17	0.17

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

Our dataset does provide rich information on firm specific characteristics, however, it provides very little information on the characteristics of owners and managers operating the firm. Previous research has shown that while deciding on the loan applications lenders tend to look at attributes of entrepreneurs such as education and personal wealth. Hence it is very much possible that the results of our study may be biased due to the omission if such entrepreneurial characteristics. Following Blanchflower et al. (2003) and Muravyev (2009), we implement a number of sample splits that can take care of these differences in entrepreneurial characteristics, and then compare the regression results. To be specific, we use net worth of the firm, size of the firm and source of credit to perform analysis based on sample splits. The networth of the firm can be considered as a proxy to represent the wealth of the entrepreneur especially in the case of MSME firms, which are our units of analysis. The idea behind splitting the sample based on size of firms is that larger firms in our dataset are less likely to rely on owners' funds to repay loan obligations. We also split the sample based on the source of credit, institutional or non-institutional, which we believe also capture the ability of the entrepreneur. The regression results based on source of loan, networth and firm size are presented in tables 11, 12 and 13 respectively. In all these sub-sample analysis, our variable of interest, F, retain the same sign and significance thereby strengthening our earlier finding that the probability of obtaining loan crucially depends on the gender of the entrepreneur. In other words, we find that a female entrepreneur in the MSME sector has a lower probability of obtaining loan as compared to a male entrepreneur in the same sector.

Table 11: Gender of the owner and access to credit

Dependent variable: Whether or not obtained loan (obtained = 1)

Variables	Institutional loan						Non-institutional loan					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.130***	-0.109***	-0.098***	-0.130***	-0.090***	-0.109***	-0.590***	-0.542***	-0.532***	-0.510***	--0.529***	-0.549***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)	(0.035)	(0.035)	(0.035)	(0.040)	(0.035)	(0.035)
Age of the firm		-0.042***	-0.041***	-0.046***	-0.043***	-0.042***		-0.009***	-0.009***	-0.007***	-0.010***	-0.010***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)		(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Age square		0.001***	0.001***	0.001***	0.001***	0.001***		0.001***	0.0001***	0.0001**	0.0002***	0.0002***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size		0.216***	0.338***	0.297***		0.209***		0.108***	0.202***	0.141***		0.075***
		(0.005)	(0.004)	(0.005)		(0.005)		(0.013)	(0.010)	(0.014)		(0.013)
Location		-0.275***	-0.295***	-0.287***	-0.306***	-0.274***		-0.059***	-0.076**	0.048**	-0.079***	-0.055***
		(0.007)	(0.008)	(0.009)	(0.008)	(0.008)		(0.021)	(0.021)	(0.024)	(0.021)	(0.021)
Firm is part of a cluster		0.459***	0.437***	0.472***	0.448***	0.462***		0.186***	0.167***	0.050	0.174***	0.197***
		(0.012)	(0.012)	(0.014)	(0.012)	(0.012)		(0.035)	(0.035)	(0.042)	(0.035)	(0.035)
Firm maintains an account		0.432***	0.387***	0.492***	0.402***	0.425***		0.230***	0.191***	0.305***	0.194***	0.191***
		(0.009)	(0.008)	(0.010)	(0.009)	(0.009)		(0.024)	(0.024)	(0.027)	(0.024)	(0.025)
Firm has a quality certificate		0.043***	0.018	-0.009	0.041***	0.033**		0.414***	0.388***	0.315***	0.397***	0.370***
		(0.015)	(0.015)	(0.017)	(0.015)	(0.015)		(0.035)	(0.035)	(0.040)	(0.035)	(0.035)
Firm is exporting		0.098***	0.066***	0.095***	0.093***	0.090***		0.157***	0.131***	0.139**	0.141***	0.125***
		(0.020)	(0.020)	(0.023)	(0.020)	(0.020)		(0.049)	(0.049)	(0.057)	(0.049)	(0.049)
Log of net worth of the firm		0.163***			0.099***	0.159***		0.125***			0.061***	0.107***
		(0.003)			(0.003)	(0.003)		(0.008)			(0.009)	(0.008)
Value added per worker			0.218***						0.175***			
			(0.003)						(0.008)			
Log of profit				0.101***						0.084***		
				(0.003)						(0.008)		
Output two years ago					0.184***						0.135***	
					(0.003)						(0.009)	
Firm has a single owner						-0.099***						-0.458***
						(0.011)						(0.028)
Constant	-2.136***	-4.007***	-4.699***	-3.110***	-5.348***	-3.859***	-5.191***	-6.876***	-7.489***	-6.307***	-7.690***	-6.187***
	(0.035)	(0.049)	(0.051)	(0.048)	(0.047)	(0.051)	(0.142)	(0.170)	(0.174)	(0.171)	(0.164)	(0.174)
State effects?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry effects?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	1157959	1157959	1157959	814066	1151271	1151271	1156080	1149399	1156080	812356	1149399	1149399
Pseudo R2	0.11	0.15	0.15	0.14	0.15	0.15	0.04	0.06	0.06	0.06	0.06	0.06

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

Table 12: Gender of the owner and access to credit: Sample Split based on networth

Dependent variable: Whether or not obtained loan (obtained = 1)

Variables	Networth > 136840						Networth<136840					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.077***	-0.086***	-0.073***	-0.113***	-0.068***	-0.084***	-0.253***	-0.272***	-0.224***	-0.257***	-0.211***	-0.273***
	(0.012)	(0.013)	(0.013)	(0.014)	(0.013)	(0.013)	(0.017)	(0.018)	(0.018)	(0.021)	(0.018)	(0.018)
Age of the firm		-0.037***	-0.036***	-0.038***	-0.038***	-0.037***		-0.044***	-0.044***	-0.056***	-0.046***	-0.044***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age square		0.001***	0.001***	0.001***	0.001***	0.001***		0.001***	0.001***	0.001***	0.001***	0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size		0.184***	0.306***	0.272***		0.168***		0.399***	0.500***	0.324***		0.397***
		(0.005)	(0.004)	(0.006)		(0.005)		(0.010)	(0.010)	(0.012)		(0.010)
Location		-0.305***	-0.332***	-0.320***	-0.337***	-0.304***		-0.247***	-0.309***	-0.287***	-0.298***	-0.248***
		(0.009)	(0.009)	(0.010)	(0.009)	(0.009)		(0.013)	(0.013)	(0.015)	(0.013)	(0.013)
Firm is part of a cluster		0.458***	0.432***	0.429***	0.443***	0.465***		0.242***	0.221***	0.322***	0.225***	0.242***
		(0.013)	(0.013)	(0.015)	(0.013)	(0.013)		(0.026)	(0.026)	(0.030)	(0.027)	(0.026)
Firm maintains an account		0.459***	0.385***	0.483***	0.414***	0.437***		0.261***	0.197***	0.264***	0.240***	0.257***
		(0.009)	(0.009)	(0.010)	(0.009)	(0.009)		(0.018)	(0.018)	(0.020)	(0.018)	(0.018)
Firm has a quality certificate		0.158***	0.144***	0.098***	0.156***	0.138***		0.004	-0.035	-0.054	-0.001	-0.0002
		(0.015)	(0.015)	(0.017)	(0.015)	(0.015)		(0.038)	(0.038)	(0.045)	(0.039)	(0.038)
Firm is exporting		0.320***	0.297***	0.321***	0.307***	0.304***		-0.426***	-0.408***	-0.326***	-0.403***	-0.428***
		(0.020)	(0.020)	(0.023)	(0.020)	(0.020)		(0.055)	(0.055)	(0.064)	(0.056)	(0.055)
Log of net worth of the firm		0.180***			0.097***	0.163***		0.085***			0.016**	0.085***
		(0.004)			(0.004)	(0.004)		(0.007)			(0.007)	(0.007)
Value added per worker			0.225***						0.286***			
			(0.003)						(0.007)			
Log of profit				0.098***						0.104***		
				(0.003)						(0.006)		
Output two years ago					0.183***						0.349***	
					(0.004)						(0.007)	
Firm has a single owner						0.168***						-0.103***
						(0.005)						(0.033)
Constant	-1.604***	-3.969***	-4.485***	-2.789***	-5.095***	-3.503***	-2.954***	-3.552***	-5.856***	-3.437***	-6.652***	-3.456***
	(0.039)	(0.061)	(0.059)	(0.054)	(0.057)	(0.065)	(0.070)	(0.105)	(0.108)	(0.098)	(0.117)	(0.110)
State effects?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry effects?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	580050	580050	580050	429229	580050	580050	572766	570775	572766	381368	570775	570775
Pseudo R2	0.10	0.15	0.15	0.14	0.15	0.15	0.11	0.13	0.13	0.12	0.13	0.13

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

Table 13: Gender of the owner and access to credit: Sample Split based on Size of the Firm

Dependent variable: Whether or not obtained loan (obtained = 1)

Variables	Micro			Small			Medium		
	Female as owner	Female as manager	Female as owner and manager	Female as owner	Female as manager	Female as owner and manager	Female as owner	Female as manager	Female as owner and manager
Female	-0.162***	-0.082***	-0.137***	-0.013	0.291***	0.349***	-0.326*	0.012	-0.015
	(0.011)	(0.013)	(0.014)	(0.032)	(0.047)	(0.059)	(0.011)	(0.290)	(0.445)
Age of the firm	-0.043***	-0.043***	-0.043***	-0.019***	-0.019***	-0.019***	-0.006	-0.006	-0.006
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.009)	(0.009)	(0.009)
Age square	0.001***	0.001***	0.001***	0.0002***	0.0002***	0.0002***	0.00001	0.00001	0.00001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.0001)	(0.0001)	(0.0001)
Firm size	0.257***	0.256***	0.255***	0.101***	0.101***	0.101***	0.003	0.003	0.003
	(0.006)	(0.006)	(0.006)	(0.010)	(0.010)	(0.010)	(0.042)	(0.043)	(0.043)
Location	-0.278***	-0.279***	-0.279***	-0.346***	-0.345***	-0.345***	-0.036	-0.033	-0.033
	(0.008)	(0.008)	(0.008)	(0.019)	(0.019)	(0.019)	(0.098)	(0.098)	(0.098)
Firm is part of a cluster	0.462***	0.458***	0.458***	0.163***	0.164***	0.163***	-0.552***	-0.550***	-0.550***
	(0.014)	(0.014)	(0.014)	(0.026)	(0.026)	(0.026)	(0.145)	(0.145)	(0.145)
Firm maintains an account	0.329***	0.326***	0.327***	0.467***	0.470***	0.468***	0.782***	0.784***	0.784***
	(0.009)	(0.009)	(0.009)	(0.027)	(0.027)	(0.009)	(0.195)	(0.195)	(0.195)
Firm has a quality certificate	-0.034*	-0.035*	-0.035*	0.388***	0.385***	0.386***	0.282**	0.281**	0.280***
	(0.018)	(0.018)	(0.018)	(0.024)	(0.024)	(0.024)	(0.102)	(0.102)	(0.102)
Firm is exporting	0.003	-0.001	-0.001	0.407***	0.405***	0.405***	0.599***	0.594***	0.594***
	(0.027)	(0.027)	(0.027)	(0.030)	(0.030)	(0.030)	(0.115)	(0.115)	(0.115)
Log of net worth of the firm	0.204***	0.205***	0.204***	-0.030***	-0.028***	-0.028***	-0.001	0.001	0.001
	(0.003)	(0.003)	(0.003)	(0.007)	(0.007)	(0.007)	(0.035)	(0.035)	(0.035)
Firm has a single owner	-0.145***	-0.146***	-0.146***	-0.360***	-0.363***	-0.364***	-0.710***	-0.702***	-0.702***
	(0.013)	(0.013)	(0.013)	(0.018)	(0.018)	(0.017)	(0.103)	(0.103)	(0.103)
Constant	-4.409***	-4.447***	-4.435***	0.195	0.156	0.161	0.369	0.320	0.320
	(0.057)	(0.056)	(0.057)	(0.144)	(0.144)	(0.144)	(0.741)	(0.740)	(0.740)
State effects?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry effects?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of observations	1003820	1003820	1003820	139394	139394	139394	4890	4890	4890
Pseudo R2	0.15	0.15	0.15	0.26	0.27	0.27	0.32	0.31	0.31

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

Robustness Tests
We carry out three robustness checks. Results are explained in details below:

(i) Self-selection bias: Bivariate Probit Regressions

Since applying for formal credit is voluntary, it is argued that owners self-select into the loan market (Blanchard et al 2008). In the dataset therefore loan status indicating zero may due to the denial, discouraged and absence of need for credit. This introduces a potential selection bias. Following, Asiedu et al (2012), we employ bivariate probit model to correct for the selection bias. Results of our bivariate probit regression estimations after correcting for the self-section bias are reported in Table 14. The various test statistics show that the bivariate probit regressions work well for our estimations. The Wald test of independent equations rejects the null hypothesis (H0: $\rho=0$), validating our model specification. The results are in line with our expectations. The coefficient of our variable of interest F is negative and significant suggesting that the likelihood of receiving a bank loan is higher among male entrepreneurs as compared to female entrepreneurs. Other controls have maintained more or less the same sign and significance as the results for our baseline econometric specification. Our findings are thus essentially robust with regard to concerns arising from self-selection bias, and we are quite confident to conclude that there exists clear evidence to support the existence of gender based discrimination in the credit market.

Table 14: Probit model with sample selection

Variables	Bivariate probit regression		Seemingly unrelated bivariate probit regression	
	Coefficients	Robust standard errors	Coefficients	Robust standard errors
Outcome: Loan				
Female	-0.083***	0.005	-0.007***	0.001
Age of the firm	-0.019***	0.000	-0.001***	0.000
Age square	0.0002***	0.0000	0.00001***	0.00000
Firm size	0.127***	0.003	0.004	0.001
Firm has a single owner	-0.144***	0.006	0.002***	0.001
Location	-0.135***	0.004	-0.005***	0.001
Firm is part of a cluster	0.199***	0.006	-0.011***	0.002
Firm maintains an account	0.214***	0.004	0.008***	0.001
Firm has a quality certificate	0.074***	0.008	-0.005***	0.002
Firm is exporting	0.103***	0.010	0.003	0.002
Log of net worth of the firm	0.093***	0.001	0.007***	0.000
Constant	-2.207***	0.026	-1.316***	0.018
State effects?	Y		Y	
Industry effects?	Y		Y	
Selection: Credit demand				
Female	-0.078***	0.005		
Age of the firm	-0.018***	0.000		
Age square	0.0002***	0.0000		
Firm size	0.126***	0.002		
Firm has a single owner	-0.147***	0.006		
Location	-0.133***	0.004		
Firm is part of a cluster	0.216***	0.006		
Firm maintains an account	0.211***	0.004		
Firm has a quality certificate	0.080***	0.008		
Firm is exporting	0.102***	0.010		
Log of net worth of the firm	0.089***	0.001		
Output growth			7.57E-09*	4.32E-09
Constant	-2.094***	0.025	-1.171***	0.017
Athrho	5.385***	0.070	4.880***	0.024
State effects?	Y		Y	
Industry effects?	Y		Y	
Rho	0.999		0.999	
Wald test (Rho = 0): Chi^2 (1)	5904.58		40211.8	
Prob > Chi^2	0.0000		0.0000	
Number of observations	1151273		1151273	
Log pseudolikelihood	-384906.59		-406680.49	

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

(ii) Modified Blinder-Oaxaca Decomposition

In the table 15, we report the results of the modified version of the Blinder-Oaxaca decomposition technique to explain the gender gap in access to formal finance. As explained above, we use Fairlie (2006) method since our empirical specification is non-linear. The decomposition technique is a kind of a matching where two groups are matched on one-to-one basis. This decomposition technique helps in providing an answer to the extent to which differences in observable group characteristics can explain gender gap in access to credit. The extent to which one may attribute gender gap in credit access will depend on the choice of the reference group. The standard practice is to use the relatively more advantaged group as the reference (male owned firms in our case) and show discrimination against less advantaged female led firms.

We decompose the gender differences in the probability of obtaining formal credit, using indicators of female involvement (ownership, management, ownership and management). From the results of the decomposition, it is evident that differences in observable group characteristics explain a small percentage (11.11%) while 88.89 % is attributed to differences in group processes of the gender gap. While one may attribute 88.89 % indicating discrimination, however caution might be exercised in interpreting this number solely to the discrimination aspect since our dataset is cross-sectional and the number of factors included in the analysis influences interpretation of the decomposition estimates. All the estimates from the decomposition are statistically significant contributors to the part of the gender gap attributed to group characteristics. Within the component of gender gap in credit gap access, group differences in size contributed 26.1%, differences in networth contributed 31.2 %, maintaining accounts contributed 12.1%.

Table 15: Non-linear decomposition of gender discrimination in access to credit using Blinder-Oaxaca decomposition method (n=1151273)

Gender discrimination due to differences in group characteristics (by variables) and group processes		Contribution of group characteristics to gender inequality	Standard error	95% CI	% contribution of group differences to gender discrimination
Age of the firm		-0.0126328***	0.000396	-0.013408 - 0.011858	-70.2
Age square		0.0061830***	0.000321	0.005554 - 0.006812	34.4
Firm size		0.0047012***	0.000098	0.004509 - 0.004894	26.1
Firm has a single owner		0.0008910***	0.000040	0.000812 - 0.000970	5.0
Location		-0.0024200***	0.000074	-0.002566 - 0.002274	-13.4
Firm is part of a cluster		-0.0008670***	0.000028	-0.000921 - 0.000813	-4.8
Firm maintains an account		0.0021692***	0.000054	0.002063 - 0.002276	12.1
Firm has a quality certificate		0.0000309***	0.000004	0.000024 - 0.000038	0.2
Firm is exporting		-0.0000307***	0.000003	-0.000037 - 0.000025	-0.2
Log of net worth of the firm		0.0056083***	0.000116	0.005382 - 0.005835	31.2
State effects?		Y			
Industry effects?		Y			
Contribution to gender discrimination explained by differences in group characteristics*	without industry and state dummies	0.004			20.2
	with industry and state dummies	0.002			11.11
Contribution to gender discrimination explained by differences in group processes		0.016			88.89
Total Inequality		0.018			100

Note: *Total contribution from all variables including industry dummies and regional dummies. CI stands for confidence interval. Our results are robust to alternate measures of women ownership (women managers and women as owners & managers). Results are obtained using the Stata routine FAIRLIE (Jann, 2006)

Source: Authors' estimates based on Fourth All India Census of Micro, Small and Medium Enterprises, 2006-07.

(iii) Impact of Credit and Firm Performance: Propensity Score Matching

In order to further strengthen the results of our study on the effect of credit access gap by gender and firm performance, we adopted propensity score matching approach (PSM). PSM approach match firms financially constrained firms with financially unconstrained firms that have similar characteristics and estimate average effect of credit constraint. As a first step in carrying out PSM, we classify firms into constrained and unconstrained firms. In our data set, firm report whether they are short of financial capital. Therefore, we classified firms as constrained if they reported shortage of capital and unconstrained otherwise. Further, we dropped all those firms which had access to loan from formal and informal sources. Estimates of the effect of credit gap on firm performance using propensity score matching techniques is provided in Table 16. The covariates we used in the estimation of the PSM are same as used previously in the logit model above. We estimated PSM using the caliper matching procedure with a radius of

.001. The treatment effects for the caliper matching estimator are reported in table 16 below. We used three indicators of firm performance labour productivity (outper worker), value added per worker, and profitability.

Table 16. Propensity Score Matching estimates of the impact of credit constraint on small firm performance (with no replacement)

Sample	Treated	Control	ATT	T-stat	Standard Error
Micro Firms					
Output per worker	11.2295624	11.3874446	-.157882159	-7.88***	.020043024
Value added per worker	11.2255053	11.3831389	-.157633564	-7.87***	.020021663
Profits	10.6108106	10.8480938	-.237283188	-7.79***	.030463011
Small Firms					
Output per worker	13.3178584	13.4024291	-.084570703	-0.89	.0951349
Value added per worker	13.31148	13.3957703	-.084290281	-0.89	.095083277
Profits	14.1101623	14.1948704	-.084708053	-0.57	.148174146
Female Firms					
Output per worker	11.0358407	11.2111608	-.1753	-3.00***	.058413662
Value added per worker	11.0321957	11.2072895	-.1751	-3.00***	.058366937
Profits	10.2351511	10.4944286	-.2593	-2.90***	.089405942
Male Firms					
Output per worker	11.418744	11.5417499	-.1230	-5.38***	.022846726
Value added per worker	11.414447	11.5372041	-.1228	-5.38***	.02282138
Profits	10.9362131	11.2216852	-.285	-7.88***	.036215913

Note: *** refers to 1% significance level.

Results from the matching process clearly indicate that credit constraints adversely affect firm performance. Results are significant for all indicators used as firm performance. Based on the estimates obtained it is evident that for micro enterprises which are credit constrained productivity is lower by 15 percentage points and profitability is lower by 23 percent points compared to unconstrained firms. We provide our results based on the disaggregation based on the gender of the owner. In terms of output per worker and value added per work credit constraints is more pronounced. Among the female owned firms which are credit constrained difference in output per worker and value added per worker is lower by 17 percent, while the difference in the

case of male owned credit constrained and unconstrained firms is only 12 percent.

6. Conclusion

We have investigated in this study whether gender gap in access to credit is able to explain firm performance in the Indian MSME sector. To investigate this question we use census data of MSMEs in India operating in the manufacturing industries. Unlike the existing studies, our dataset provide an opportunity to analyze gender gap in credit access using various measures of women involvement in the ownership and management of the enterprises. Our econometric exercise point out unambiguously that irrespective of the extent of the women involvement in the firms, women led business are less likely to obtain formal finance. Our results are robust to alternative specifications. Based on the findings of the present study, we conclude that lack of access to formal credit has a strong negative impact on the growth and performance of women led small enterprises in India.

References

Acs, Z., and C. Armington (2006). Entrepreneurship, Geography, and American Economic Growth. Cambridge, MA: Cambridge University Press.

Asiedu, E, Kalonda-Kanyama, I., Ndikumana, L., & Nti-Addae, A. (2013). Access to credit by firms in sub-Saharan Africa: How relevant is gender? *American Economic Review*, 103, 293–297.

Aterido, R., Beck, T., & Iacovone, L. (2013). Access to finance in sub-Saharan Africa: Is there a gender gap? *World Development*, 47, 102–120.

Banerjee, A.V. & Duflo. E. (2010). "Giving Credit Where It Is Due.*Journal of Economic Perspectives*, 24(3):61-80.

Bardasi, E, Sabarwal, S., & Terrell, K. (2011). How do female entrepreneurs erform? Evidence from three developing regions. *Small Business Economics*, 37, 417–441.

Baumol, W. (2002). The Free-Market Innovation Machine: Analyzing the Growth Miracle of Capitalism. Princeton, NJ: Princeton University Press.

Becker, G. (1957). The economics of discrimination. Chicago, IL: Chicago University Press.

Berger, A. N., & Udell, G. F. (2006) A more complete conceptual framework for SME finance. *Journal of Banking and Finance* 30:2945–2966

Blanchard, L, Zhao, B and J. Yinger. 2008. "Do lenders discriminate against minority and woman entrepreneurs?" *Journal of Urban Economics* 63 (2): 467–97.

Blanchflower, D.G., Levine, P.B. & Zimmerman, D.J. (2003) Discrimination in the small- business credit market Review of Economics &. Statistics 85: 930–943.

Cavalluzzo, K., and J. Wolken (2005). "Small Business Loan Turndowns, Personal Wealth, and discrimination," *Journal of Business* 78(6), 2153–2178.

De Mel, S., McKenzie, D & Woodruff, C (2009) Are Women More Credit Constrained? Experimental Evidence on Gender and Microenterprise Returns *American Economic Journal: Applied Economics*, 1(3): 1-32.

Fairlie, R. W. (2005). An extension of the Blinder-Oaxaca decomposition technique to logit and probit models. *Journal of Economic and Social Measurement*, 30, 305–316.

Jann, B. (2006). FAIRLIE: Stata module to generate nonlinear decomposition of binary outcome differentials. Statistical Software Components. Boston, MA: Boston College Department of Economics.

Klapper, L. F., & Parker, S. C. (2011). Gender and the business environment for new firm creation. *The World Bank Research Observer*, 26, 237–257.

Muravyev, A., Talavera, O., & Schäfer, D. (2009). Entrepreneurs' gender and financial constraints: Evidence from international data. *Journal of Comparative Economics*, 37, 270– 286.

Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. *International Economic Review*, 14, 693–709.

Mayoux, L. 1995. From Vicious to Virtuous Circles? Gender and Micro Enterprise Development. Occasional Paper 3 ed. United Nations Research Institute for Social Development, UNDP.

Presbitero, A.F. Rabellotti, R. & C. Piras (2014) Barking up the wrong tree? Measuring gender gaps in firm's access to finance *Journal of Development Studies*, 50 (10): 1430–1444

Scott J and Roper S (2009) 'Perceived Financial Barriers and the Start-up Decision: An Econometric Analysis of Gender Differences Using GEM Data', *International Small Business Journal*, 27(2): 149–171.

Storey, D. J. (2004). Racial and gender discrimination in the micro firms credit market?: Evidence from Trinidad and Tobago. *Small Business Economics*, 23, 401–422.

Watson J and Robinson S (2003) 'Adjusting for risk in comparing the performance of male and female controlled SMEs', *Journal of Business Venturing*, 18(6): 77 77 3–788

Appendix. :1 Description of the Variables

List of Variables	Description
Loan	This variable takes the value 1 if a firm has received credit from a formal source and 0 otherwise
Credit Demand	This variable takes the value 1 if a firm has received credit from a formal or informal source or those firm that reported they are short of working capital, otherwise 0
Women owner	This takes the value 1 if the firm is owned by women and 0 otherwise
Women manager	This takes the value 1 if the firm is managed by women and 0 otherwise
Women owner manager	This takes the value 1 if the firm is owned & managed by women and 0 otherwise
Size	Measured as the total no of employees
Account	This variable takes a value 1 if an enterprise maintained an account in written form, otherwise 0
Exporter	This variable take the value 1 if the firm is a direct or indirect exporter and zero otherwise
Quality Certification	This variable takes the value 1 for firms that have an recognised quality certification and otherwise 0
Net-worth	Difference between assets and liabilities