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Gender-credit constraints on sectorial firm performance in Nigeria: An empirical analysis using PSM approach

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Abstract

This study examines how gender-related credit limits influence the performance of firms in Nigeria's manufacturing, retail, and other service sectors. The primary objective is to assess how challenges in accessing credit, which are affected by gender, impact firm productivity and investment behavior. Methodology**:** Utilizing data from the 2014 Nigerian Enterprise Survey, which includes responses from 2,676 Micro, Small, and Medium Enterprises (MSMEs), the study employs a robust propensity score matching (PSM) technique. The analysis indicates that male-headed firms generally have better access to credit and tend to perform slightly better across the sectors analyzed. Specifically, in the manufacturing sector, firms facing female credit constraints exhibited lower average output and capital utilization compared to their male counterparts, although these differences were not always statistically significant. Similar trends were observed in the retail and other service sectors, where female-led firms with credit constraints consistently underperformed relative to male-led firms with better credit access. Implications**:** The findings underscore the importance of addressing gender bias in access to finance to promote equitable economic growth and reduce poverty in Nigeria. Policy measures should focus on developing gender-sensitive microfinance services, adopting innovative lending approaches such as cash-flow-based credit assessments, enhancing financial literacy, and implementing regulatory reforms aimed at closing the credit gap between genders.

Keywords: Constraints, credit, firm performance, gender, Nigeria, and PSM model.

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Contents

Contribution of this paper to the literature:
This study contributes to the existing literature by examining gender-credit constraints and their impact on sectoral performance in Nigeria. It adds value by employing a novel technique called propensity score matching to empirically analyze how these gender credit constraints affect different sectors of the economy.

1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) play a vital role in the economies of both developed and developing countries, including Nigeria. The MSME sector significantly contributes to job creation, income generation, and poverty reduction. Worldwide, MSMEs constitute approximately 90% of all businesses and account for over 50% of employment (Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) & National Bureau of Statistics (NBS), 2017). In Nigeria, the sector contributes approximately 49.8% to the national GDP, making it a significant driver of economic growth and development (Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) & National Bureau of Statistics (NBS), 2017). The manufacturing, retail, and other service sectors within MSMEs employ a large number of Nigerians and are particularly gender-sensitive domains of the economy (Frimpong, 2013; Oyelaran-Oyeyinka & Gehl Sampath, 2010).

Despite their significance, MSMEs in Nigeria face persistent challenges that hinder their potential, with limited access to credit being the most prominent. Access to financial services is essential for business startup, survival, and growth. However, gender disparities remain a fundamental barrier, as women-owned enterprises often encounter more obstacles than their male counterparts when seeking formal or informal credit. Studies indicate that women entrepreneurs face stringent application procedures, high collateral requirements, and unfavorable interest rates, all of which collectively restrict their access to credit compared to men (International Finance Corporation, 2024; World Bank, 2024). This systemic bias not only stifles female entrepreneurship but also curtails broader economic inclusivity and prosperity.

Gender bias in credit markets stems from various social, economic, and cultural factors. It manifests in unfair lending practices, women's lack of collateral ownership, and societal norms that restrict women's financial independence (Nikpei & Elmi, 2015; World Bank, 2024). The World Economic Forum (2017) ranked Nigeria 122nd out of 144 countries in closing the gender gap, highlighting the urgent need to tackle these issues. Nigerian women usually own fewer productive assets and have lower education levels, which further reduces their access to finance (Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) & National Bureau of Statistics (NBS), 2017). Studies have also shown that, although women have demonstrated repayment abilities, financial institutions often perceive women-led businesses as risky, which reinforces their exclusion from credit markets (International Finance Corporation, 2024; Michael, 2024).

Historically, the Nigerian government has endeavored to support the growth of Micro, Small, and Medium Enterprises (MSMEs) through various financial initiatives. Institutions such as the Nigeria Industrial Development Bank (NIDB) and the Nigerian Bank for Commerce and Industry, now known as the Bank of Industry, have provided funding aimed at fostering business development. Additionally, microfinance policies were introduced to facilitate easier access to credit for smaller entrepreneurs. Notably, the Microfinance Policy Framework was established in 2005 and subsequently reviewed in 2011 to enhance its effectiveness and reach (Central Bank of Nigeria, 2021). However, the advantages of these programs have often favored male entrepreneurs because of the lingering gender biases within the banking and financial systems.

Research indicates that gender disparities in credit access are not solely related to gender. They also involve firm-specific factors such as age, size, ownership structure, and the experience of entrepreneurs (Aterido, Beck, & Iacovone, 2013; Mahina, Muturi, & Memba, 2014). Nevertheless, gender remains a crucial factor in understanding financial exclusion within Nigeria's small and medium enterprise (SME) sector. Specific industries such as manufacturing, retail, and services exhibit distinct patterns of gender-based discrimination. For instance, manufacturing is predominantly male-dominated, whereas retail and service sectors tend to have higher female participation but still face significant credit limitations (Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) & National Bureau of Statistics (NBS), 2017).

Recognizing the complex connections between gender bias, firm characteristics, and access to credit is crucial for developing effective policies that promote inclusive growth. Recent innovative lending models, such as cash flow-based loans introduced by Access Bank in collaboration with the World Bank, offer promising alternatives. These models reduce dependence on traditional collateral and assess creditworthiness through transaction data (World Bank, 2024). Such approaches aim to close the gender gap and unlock the untapped potential of women-led businesses.

The widening gender gap in financial inclusion has broader impacts on Nigeria's socio-economic development. Evidence shows that closing credit access gaps could significantly boost national growth rates, as female entrepreneurs contribute to job creation and poverty alleviation at both microeconomic and macroeconomic levels (Eddleston, Ladge, Mitteness, & Balachandra, 2016; International Finance Corporation, 2024). Therefore, this study explores the relationship between firm type and gender bias in accessing formal and informal credit in Nigeria, focusing on how gender credit constraints affect the performance of firms in manufacturing, retail, and service sectors.

This is how the rest of the paper is structured. The topic under investigation is covered in the Introduction section. It provides a well-structured review. The sources of data and the statistical techniques used in the study are detailed in the sections related to the research methodology. Along with the distinct viewpoints derived from the research findings, the Results and Discussion section presents the findings and discusses the conclusions of previous investigations. Finally, a concise summary of the results is provided in the Conclusion section, along with policy recommendations derived from the research findings.

2. Literature Review

2.1. Theoretical Review

Credit Rationing Theory, originally developed by Stiglitz and Weiss (1981), posits that credit markets are imperfect, and lenders do not always allocate credit efficiently based solely on the interest rate. Due to asymmetric

information and the risks of adverse selection and moral hazard, financial institutions often limit the credit available to certain groups or firms, even those willing to pay higher interest rates. This creates a scenario where credit availability is rationed, not just priced.

In the context of the study on gender-related credit constraints in Nigeria, this theory helps explain why female entrepreneurs frequently face higher barriers in accessing formal and informal credit markets compared to their male counterparts. Factors such as discrimination, lack of collateral (due to patriarchal asset ownership patterns), and concerns about repayment capacity lead to biased credit rationing against female-led firms (International Finance Corporation, 2024; Nikpei & Elmi, 2015). These informational asymmetries and institutional biases mean that women entrepreneurs may be disproportionately denied credit or receive less favorable loan terms despite their demonstrated capability.

The Credit Rationing framework aligns with the study's findings, showing that female-headed firms under credit constraints have lower labor productivity, less capital per worker, and reduced investment in fixed assets compared to male-headed firms with better access to credit. This indicates that the constrained firms operate sub-optimally due to restricted access to financial resources, which is consistent with the theory's prediction that rationed credit limits growth potential.

Moreover, the theory underscores the role of institutional quality in either mitigating or exacerbating credit rationing based on gender. Weak credit information systems, inadequate legal protections for borrowers, and social norms interact to sustain gender disparities in credit access (World Bank, 2024). Policy solutions such as the design of collateral substitutes, gender-sensitive lending policies, and financial literacy programs emerge naturally from addressing the imperfection highlighted by Credit Rationing Theory.

In summary, the Credit Rationing Theory provides a robust theoretical foundation for analyzing how gender bias in credit markets arises and persists, directly linking it to the observed implications on MSME firm performance documented in the study. It also emphasizes the importance of policy interventions aimed at reducing market imperfections to foster equitable financial inclusion and economic growth.

2.2. Empirical Review

Access to credit is widely recognized as a critical determinant of firm performance and sustainable growth in the MSME sector. However, disparities in access, particularly those based on gender, continue to pose significant challenges that hinder economic inclusivity. Research consistently indicates that female-led enterprises often encounter more stringent barriers to obtaining credit compared to their male counterparts, which adversely affects productivity and the expansion of firms within Nigeria's manufacturing, retail, and service sectors. Objective five of this study addresses this issue by examining the impact of gender-based credit constraints on firm performance.

Empirical studies demonstrate that credit-constrained firms, particularly those led by women, tend to exhibit lower output per worker, reduced capital accumulation, and limited investments in fixed assets, which collectively diminish growth potential (Nwosu & Orji, 2016). This issue stems from various factors, such as discriminatory lending practices, lack of collateral, and limited financial literacy among female entrepreneurs (Aterido et al., 2013). For example, Eze's analysis of Nigerian Enterprise Survey data shows that male-headed firms have better access to credit, which leads to modest but important performance advantages.

While some regional analyses have had unclear results about outright gender discrimination in credit markets (Aterido et al., 2013), more focused studies in Nigeria highlight significant gender-related credit challenges. Female entrepreneurs often operate smaller, younger businesses, which lessens their perceived creditworthiness with formal financial institutions (World Bank, 2024). Cultural and structural barriers, like patriarchal control over assets that are crucial for collateral, make these challenges worse (Nikpei & Elmi, 2015).

Early foreign studies such as Nguyen, Gan, and Hu (2015) in Vietnam, found gender and owner characteristics as key determinants of SMEs' credit access, with male-owned firms more likely to obtain credit. Similarly, Gichuki, Mulu-Mutuku, and Kinuthia (2014) in Kenya found women accessing credit through local saving associations improved firm performance.

Research from Sub-Saharan Africa between 2010-2014 revealed mixed results: Asiedu, Kalonda-Kanyama, Ndikumana, and Nti-Addae (2013) found female-owned businesses faced more credit constraints, while Hansen and Rand (2014a) showed female firms are more credit constrained in perception but less so in formal measures. Studies in Italy (Alesina, Lotti, & Mistrulli, 2013; Bellucci, Borisov, & Zazzaro, 2010) and France (Brana, 2013) indicated female firms often face tougher credit terms or higher guarantee requirements.

Contrarily, some evidence suggested preferential treatment for female-owned firms in accessing credit in Sub-Saharan Africa (Baafi, 2015; Hansen & Rand, 2014b), underscoring variability by context. Other factors repeatedly identified as important in credit access include firm size, age, location, business records, industry sector, and owner education.

In Nigeria specifically, earlier studies by Essien and Arene (2014) and Osano and Languitone (2016) found education, firm age, firm size, and collateral availability crucial for formal credit access. Nwosu, Orji, Nnetu, and Nwangwu (2014) found no significant gender discrimination in Nigeria's informal credit market, but confirmed credit constraints negatively affected firm performance.

Eniola and Ektebang (2014) noted managerial education and lack of financial resources as barriers to SME growth. Recent Nigerian empirical findings, based on 2014 Enterprise Survey data and multinomial logit models, reveal significant gender bias when loan application procedures are complex. These procedures particularly disadvantage female-owned manufacturing and retail firms.

Gender bias has also been documented in the retail sector, particularly regarding access under unfavorable interest rates. However, this bias is not significantly linked to collateral requirements. Firm characteristics such as age, manager experience, size, and location significantly influence credit access beyond gender considerations. Propensity score matching models indicate that male-headed firms generally perform better in obtaining credit, although these differences are sometimes statistically insignificant across manufacturing, retail, and other service sectors.

Innovative financial programs, such as the World Bank's Nigeria Women Entrepreneurs Finance Initiative (We-Fi), aim to address these issues. They promote cash flow-based lending models that reduce reliance on traditional collateral, directly tackling the unique financial challenges faced by women (World Bank, 2024). These programs hope to close gender gaps by improving credit access and firm performance.

Research shows a clear link between better credit access and improved business outcomes. Female-led firms that lack credit access have lower productivity levels, highlighting the economic consequences of exclusion (Nwosu & Orji, 2016). Thus, reducing the gender credit gap is vital for unlocking the economic potential of women entrepreneurs and boosting overall growth in the sector.

While gender is an important factor, specific characteristics of a firm such as its age, size, and managerial experience also influence credit access and performance. These factors create complex relationships that require careful examination (Mahina et al., 2014). This complexity explains the study's focus on detailed sector-specific data analysis using propensity score matching to understand the impact of gender credit constraints.

Furthermore, informal credit options provide some help for women, but they are not enough to meet substantial growth needs (Peter & Orser, 2024). Therefore, formal credit is essential for scaling businesses, highlighting the need for reforms in financial inclusion.

Despite government efforts and microfinance programs aimed at improving MSME credit access, a significant gender gap still exists. For instance, only about 31% of Nigerian women have formal financial accounts compared to 61% of men, highlighting persistent systemic barriers (EFinA, 2019; World Bank, 2024). Comprehensive strategies that blend innovative lending practices, gender-focused policies, and capacity-building for women entrepreneurs are needed for real progress.

In summary, the research indicates that gender-based credit constraints significantly hinder the performance of female-led MSMEs in Nigeria. Financial innovations that align with policy needs and provide targeted support are essential for bridging this gap. The findings of this study contribute to the expanding body of knowledge advocating for gender-inclusive financial strategies to enhance productivity and promote inclusive growth.

3. Data and Methodology

3.1. Data

This study utilizes data from the Nigerian Enterprise Survey conducted in 2014. The survey covers the entire country and was carried out by the World Bank Group to provide detailed information about the business environment in Nigeria. The data includes responses from 2,676 micro, small, and medium enterprises (MSMEs) in manufacturing, retail, and other service sectors. Researchers employed stratified random sampling to ensure proper representation across different firm sizes, industries, and locations, including both urban and rural areas (World Bank, 2024). The dataset includes both quantitative and qualitative data on firm characteristics, patterns of credit access, financial performance, and challenges faced by entrepreneurs.

3.2. Definition of Variables

3.2.1. Dependent Variable

The dependent variable Limitations represents a firm's credit constraints. We used and modified the approach used by Wellalage and Locke (2016) which extends the work of Bigsten, Kebede, Shimeles, and Taddesse (2003), Hansen and Rand (2014a); Hansen and Rand (2014b) and Nwosu et al. (2014) with constraints deemed to be operative when a firm either (A) applies for and is denied credit (applicants) due to complex application procedures, high collateral requirements, and unfavorable interest rates, or (B) is tasked with applying for and being denied credit (non-applicants). Our sample of analysis is limited to enterprises in the manufacturing, retail, and other service activities sectors that currently operate and have sought credit or have not applied for credit in the present period for the reasons indicated above. All variables in the models are defined and measured in Table 1.

Table 1. Definition and measurement of variables included in the models.

Variables	Definition	Measurement
Constraints	This variable captures constraints when a firm: (i) Applies for and is denied credit due to (i) complex application procedures, (ii) excessively high collateral requirements, (iii) unfavorable interest rates (applicants), or because the establishment already had sufficient credit (non-applicants).	0= Credits granted, 1= Complex application, 2= Collateral requirement too high 3= Unfavorable interest rate.
Female	Firms have female owners	1=yes; 0= otherwise
Lnexper	Log the number of years of experience of the firm's manager.	Year(s)
CapCity	Firms from the capital city.	1= Yes; 0= Otherwise
Firmsize	Small firms have 5 to 19 employees	1= Yes; 0= Otherwise
	Medium firms have between 20 and 99 employees.	1= Yes; 0= Otherwise
	Large firms between 99 and above	1= Yes; 0= Otherwise
Ownershiptyp	The firm legal status is a sole proprietorship.	1= Yes; 0= Otherwise
Edusec	Education of firm owners/managers	0= No education;1=Primary; 2=Secondary; 3= Technical; and 4=Tertiary
Mstatus	Marital status of firm owners/managers	1= Yes; 0= Otherwise
Manufacturing	Firms from the manufacturing industry	1= Yes; 0= Otherwise
Retail	Firms from retail services	1= Yes; 0= Otherwise
Other services	Firms operating in other services activities sector	1= Yes; 0= Otherwise
Finstat	Firm owners/managers with up-to-date financial statements are less likely to be credit-constrained	1= Yes; 0= Otherwise
Informal	Firms that have used informal credit.	1=Yes; 0= Otherwise.
Femaletm	A firm with a female owner as a top manager	1= Yes; 0= Otherwise

Lnage	Log number of years since the firm has been established	Year(s)
Outcome indicators		
Output per worker	Output per worker is measured as the logarithm of the total output of the firm in monetary terms divided by the total number of workers employed by the firm over that period. The logarithm of the result was used to rescale the data appropriately.	
Capital per worker	Capital per worker is the logarithm of the total monetary value of a firm's investment in fixed assets divided by the total number of workers employed by the firm.	
Investment in fixed Assets	This is an indicator variable that takes a value of 1 if the firm invested in fixed assets in the current period, and 0 otherwise.	

Source: Author's computation.

3.3. Justification for PSM

Traditionally, regression analysis of observational data can suffer from biased estimates due to differences in the characteristics of treated and untreated groups. The Propensity Score Matching (PSM) method addresses this issue by creating a matched sample from the data where the distribution of confounding covariates is balanced across the groups. This approach is particularly relevant when studying gender credit constraints, as firms led by women may inherently differ in size, location, or experience from those led by men. PSM thus provides a more credible estimate of the impact of credit constraints on firm performance, separating the effects of confounding factors from the actual influence of credit constraints.

Data cleaning and analysis were conducted using STATA 15 software, which offers advanced propensity score matching (PSM) commands to ensure efficient implementation and diagnostic testing for balance quality. The matching algorithms considered include nearest neighbor and kernel matching to confirm robustness. The analysis also incorporates common support restrictions to ensure that only comparable firms are matched and that inferences are drawn from an overlapping sample.

3.4. Methodology

To ascertain the effect of gender credit limitations on the performance of the manufacturing, retail, and other service activity sectors, the study employed a propensity score matching technique. We were able to measure the average impact of credit constraints by contrasting businesses with similar characteristics but without credit constraints. The PSM methodology is a widely utilized method for evaluating impact because of the bias that arises from the non-observability of counterfactual outcomes. According to observed baseline characteristics, the propensity score represents the likelihood of receiving a treatment (Rosenbaum & Rubin, 1983; Rosenbaum & Rubin, 1985). Participation is comparable to a random experiment since the PSM helps to avoid assuming additivity in the error terms and the distribution of the error terms. For a formal exposition of the PSM, let the dummy variable Di be one if firm I is a treated firm (a credit-constrained firm) and zero otherwise. The performance indicators or outcome variables for a firm I that depend on whether treatment is received or not are called Yi1 and Yi0 (e.g., employment, production per worker, capital per worker, etc.). The difference in the relevant outcome indicator with and without therapy is the treatment effect for a firm. The following expression expresses this.

$$\Delta Y_i = E(Y_{i1}/D_i = 1) - E(Y_{i0}/D_i = 1) \quad (1)$$

PSM is predicated on two assumptions: the presence of a comparison group and the conditional independence assumption (CIA). As long as the balancing characteristic is met and there is a large enough common support region, PSM's estimation could incorporate as many covariates as is practical to replicate random tests. The CIA assumption suggests that selection bias based on unobservable heterogeneity does not exist, as Heckman and Robb Jr (1985) noted. The following is a statement of this assumption:

$$(Y_{i0}, Y_{i1}) \perp D_i / X_i \quad (2)$$

This states that for a given X, the mean of Y for non-participants corresponds to the mean that would have been observed for participants, had they not participated. I.e.,

$$E(Y_{i0}/D_i = 1, X_i) = E(Y_{i1}/D_i = 0, X_i) \quad (3)$$

According to Rosenbaum and Rubin (1983), participation might be conditional on the propensity score represented by P(X) instead of on observable properties X. The chance of treatment conditional on a vector of observable variables, known as the propensity score, is therefore simplified to a one-dimensional problem that may be stated as.

$$P(X_i) = \Pr\{D_i = \frac{1}{X_i}\} \quad (4)$$

Hence, the counterfactual can be estimated as.

$E[Y_{i0}/D_i = 1, P(X_i)] = E[Y_{i0}/D_i = 0, P(X_i)]$, And thus, the average treatment effect for firm i can be measured by the following.

$$\Delta Y_i = E[Y_{i0}/D_i = 1, P(X_i)] - E[Y_{i0}/D_i = 0, P(X_i)] \quad (5)$$

Following the computation of the propensity scores, matching estimators will be selected to illustrate the relationship between comparison and treatment units. Propensity score matching specifies the weights assigned to comparison units for evaluating the effects of therapy on the treated (Dehejia & Wahba, 2002). Without supplying the measures, we used nearest-neighbor matching and the kernel to assess the effect of credit constraints on business performance. Theory and local context were the basis for our choice of covariates (Caliendo & Kopeinig, 2008; Vathana, Sa, Lim, & Lee, 2019) as was the fact that data on participants and non-practitioners, as well as information on treatment and controls, came from the same set of questionnaires (Caliendo & Kopeinig, 2008; Vathana et al., 2019) and that data on treatment and controls came from the same set of questionnaires (Vathana et al., 2019; Heckman, Ichimura, & Todd, 1997).

The following equations, which guarantee that the balancing property is met for all relevant subsamples, provide the complete specification of the model used to estimate the propensity score:

$$Manufacturing = \beta_1 gender + \beta_2 edusec + \beta_3 \text{firmsize} + \beta_4 \text{outputperworker} + \beta_5 \text{capitalperworker} + + \beta_6 \text{investmentinfixedassets} + \mu \quad (6)$$

$$Retail = \beta_1 gender + \beta_2 edusec + \beta_3 \text{firmsize} + \beta_4 \text{outputperworker} + \beta_5 \text{capitalperworker} + + \beta_6 \text{investmentinfixedassets} + \mu \quad (7)$$

$$Otherservices = \beta_1 gender + \beta_2 edusec + \beta_3 \text{firmsize} + \beta_4 \text{outputperworker} + \beta_5 \text{capitalperworker} + + \beta_6 \text{investmentinfixedassets} + \mu \quad (8)$$

4. Results and Discussions

The study employs the propensity score matching model to analyze how gender credit limits influence the performance of manufacturing, retail, and other service activities in Nigeria. Before applying the propensity score matching model, the research utilized several estimation techniques, including inverse-probability weighting (IPW), augmented inverse-probability weighting (AIPW), and inverse-probability-weighted regression adjustment (IPWRA). These methods were used to estimate the average treatment effect (ATE), conditioned on covariate values, for each sector: manufacturing, retail, and other services. The results from these preliminary estimates provided a foundation for the subsequent application of the propensity score matching model. The detailed estimates and findings are presented below.

4.1. Treatment Effect Regression Adjustment or Average Treatment Effect (ATE)

The study estimates the effect of gender constraints for each subject, regardless of which treatment was received, and calculates the average of these effects across all subjects in the data, known as the Average Treatment Effect (ATE). The treatment-effects estimation involves averaging the predicted outcomes for all subjects spanning manufacturing, retail, and other service sectors by estimating the potential-outcome means (POmean) for each treatment level. It is important to note that differences in the estimated POmean are equivalent to the estimate of the ATE. Consequently, the potential-outcome means (POmean) can be summarized as shown below.

Table 2. Summary results of Average Treatment Effect (ATE) and Potential-Outcome means (POmeans) of gender constraints on Manufacturing, Retail and Other services.

Treatment Effect Regression Adjustment for Firms in Manufacturing Industry				
			Robust	
	Manufacturing	**Coefficient**	**Standard error**	**z**
P>|z|				
ATE	Gender			
0.235	(Female vs male)	0.040	0.034	1.19
POmean	Gender			
	Male	0.758	0.014	55.3
0.000				
Treatment Effect Regression Adjustment for Firms in Retail Services				
			Robust	
P>|z|	**Retail**	**Coefficient**	**Standard error**	**z**
ATE				
	Gender			
0.499	(Female vs male)	-0.016	0.024	-0.68
POmean	Gender			
	Male	0.101	0.009	10.4
Treatment Effect Regression Adjustment for Firms Operating in Other Service Activities				
			Robust	
	Otherservices	**Coefficient**	**Standard error**	**z**
P>|z|				
ATE				
	Gender			
0.283	(Female vs male)	0.021	0.020	1.07
POmean				
	Gender			
	Male	0.032	0.006	5.64
0.000				

The results in Table 2 calculated the treatment effects called regression adjustment (RA). The results display the ATE and the POmeans. However, it is noteworthy that the ATE on the treated (ATET) is similar to the ATE but uses only the subjects who were observed in the treatment group.

In relation to the performance of firms in the manufacturing industry, the output results in the table above indicate that the average performance of firms from this industry is approximately 4% (0.0404469) when the gender constraint favors females compared to their male counterparts. However, the average performance of firms in the manufacturing industry is about 75.76% (0.7575706) when the gender constraint favors males rather than females. In other words, the Average Treatment Effect (ATE), which represents the average difference in performance of firms in the manufacturing industry when the gender constraint favors females rather than males, is approximately 4% (0.0404469).

The analysis of the performance of firms in the retail services sector, as presented in the table above, indicates that the average performance of these firms experiences a slight decline of approximately 1.6% (-0.0160305) when gender constraints favor females compared to their male counterparts. Conversely, there is a significant increase of

about 10.05% (0.1005351) in performance when gender constraints favor males. The Average Treatment Effect (ATE), which measures the mean difference in performance between firms based on gender constraints, suggests that when gender constraints favor females rather than males, the average performance difference of firms in the retail services sector decreases by approximately 1.6% (-0.0160305).

Furthermore, regarding the performance of firms operating in the other services activities sector (otherservices), the output results in the table above also indicate that the average performance of firms in this sector would increase insignificantly by approximately 2.1% (0.0210476) when the gender constraint favors females compared to their male counterparts. Conversely, there is a significant rise of about 3.24% (0.0323731) when the gender constraint favors males. The Average Treatment Effect (ATE), which measures the average difference in performance between firms operating in the other services activities sector under different gender constraints, shows that when gender constraints favor females rather than males, the average difference in performance among these firms is approximately 2.1% (0.0210476).

4.2. Inverse-Probability Weighting (IPW)

The study also examined the inverse-probability weighting of gender constraints in manufacturing, retail, and other service sectors. The summary results of the inverse-probability weighting can be found below.

Table 3. Summary of the results from inverse-probability weighting regarding the impact of gender constraints on Manufacturing, Retail, and Other Services sectors.

Inverse-probability weighting for firms in the manufacturing industry				
	Robust			
Manufacturing	**Coefficient**	**Standard error**	**Z**	**P>|z|**
ATE				
Gender				
(female vs male)	0.046	0.033	1.37	0.170
POmean				
Gender				
male	0.758	0.014	55.54	0.000
Inverse-probability weighting for Firms in Retail Services				
		Robust		
Retail	**Coefficient**	**Standard error**	**Z**	**P>|z|**
ATE				
Gender				
(female vs male)	-0.021	0.022	-0.97	0.33
POmean				
Gender				
male	0.099	0.009	10.46	0.000
Inverse-probability weighting for Firms in other services activities sector				
		Robust		
Other services	**Coefficient**	**Standard error**	**Z**	**P>|z|**
ATE				
Gender				
(Female vs male)	0.019	0.019	1.06	0.29
POmean				
Gender				
Male	0.032	0.006	5.64	0.000

On the performance of firms from the manufacturing industry (manufacturing), the output results seen summarily in Table 3 indicate that the average performance of firms from the manufacturing industry would be about 4.56% (0.0456319) when the gender constraint comes from females against their male counterparts, but would be about 75.84% (0.7583717) when the gender constraint comes from males. In addition to the above, the ATE, which measures the average of the differences between firms in the manufacturing industry, indicates that when gender constraints favor females rather than males, the average difference in the performance of firms from the manufacturing industry is approximately 4.56% (0.0456319).

Regarding the performance of firms in the retail services sector, the output results presented in the table above indicate that the average performance of these firms would decrease insignificantly by approximately 2.13% (-0.0213044) when the gender constraint favors females compared to their male counterparts. Conversely, there is a significant increase of about 9.97% (0.0996519) in performance when the gender constraint favors males. The Average Treatment Effect (ATE), which measures the mean difference in performance between firms under different gender constraints, suggests that when the gender constraint favors females rather than males, the average performance difference of firms in the retail services sector decreases by approximately 2.13% (-0.0213044).

Furthermore, regarding the performance of firms operating in the other services activities sector (otherservices), the output results in the table above also indicate that the average performance of firms in this sector would increase insignificantly by approximately 1.99% (0.0198521) when the gender constraint is imposed by females compared to their male counterparts. Conversely, there is a significant rise of about 3.20% (0.0320203) when the gender constraint is imposed by males. The Average Treatment Effect (ATE), which measures the average difference in performance between firms operating in the other services activities sector under different gender constraints, reveals that when the gender constraint favors females rather than males, the average difference in performance of firms in this sector is approximately 1.99% (0.0198521).

4.3. Inverse-Probability-Weighted Regression Adjustment (IPWRA)

In addition to the above, the study also examined the inverse-probability-weighted regression adjustment (IPWRA) concerning gender constraints in manufacturing, retail, and other service sectors. The summary results of the inverse-probability-weighted regression adjustment (IPWRA) are provided below.

Table 4. Summary results of Inverse-probability-weighted regression adjustment of gender constraints impact on Manufacturing, Retail and Other services.

Inverse-probability weighting for Firms in Manufacturing Industry				
	Robust			
Manufacturing	**Coefficient**	**Standard error**	**Z**	**P>|z|**
ATE				
Gender				
(Female vs male)	0.038	0.034	1.12	0.26
POmean				
Gender				
Male	0.757	0.014	55.21	0.000
Inverse-probability weighting for Firms in Retail Services				
		Robust		
Retail	**Coefficient**	**Standard error**	**Z**	**P>|z|**
ATE				
Gender				
(Female vs male)	-0.018	0.023	-0.77	0.44
POmean				
Gender				
Male	0.100	0.009	10.46	0.000
Inverse-probability weighting for Firms in other services activities sector				
		Robust		
Otherservices	**Coefficient**	**Standard error**	**Z**	**P>|z|**
ATE				
Gender				
(female vs male)	0.021	0.019	1.09	0.28
POmean				
Gender				
male	0.032	0.006	5.61	0.000

IPWRA estimates both the outcome and the treatment to account for the non-random treatment assignment. Hence, looking at the performance of firms from manufacturing industry (manufacturing), the output results seen summarily in Table 4 indicate that the average performance of firms from manufacturing industry would be about 3.76% (0.0375922) when the gender constraint comes from females against their male counterparts, but would be about 75.73% (0.757343) when the gender constraint comes from males. Furthermore, the ATE, which measures the average difference between firms in the manufacturing industry, indicates that when gender constraints favor females rather than males, the average performance difference among these firms is approximately 3.76% (0.0375922).

Analyzing the performance of firms in the retail services sector, the output results in the table above indicate that the average performance of these firms would decrease insignificantly by approximately 1.77% (-0.0176959) when the gender constraint favors females compared to their male counterparts. Conversely, there is a significant increase of about 10.0% (0.1000078) when the gender constraint favors males. The Average Treatment Effect (ATE), which measures the mean difference in performance between firms based on gender constraints, suggests that when gender constraints favor females rather than males, the average performance difference of firms in the retail services sector would decrease by approximately 1.77% (-0.0176959).

With respect to the performance of firms operating in other services activities sector (otherservices), the output results in the table above also depicts that the average performance of firms operating in other services activities sector would rise insignificantly by about 2.1% (0.0208864) when the gender constraint comes from females against their male counterparts and by about 3.23% (0.0323331) significant rise when the gender constraint comes from males. The ATE, which also measures the average differences in the performances of firms operating in the other services activities sector, reveals that when gender constraints favor females rather than males, the average performance difference of firms in this sector is approximately 2.1% (0.0208864).

4.4. Augmented Inverse-Probability Weighting (AIPW)

The augmented inverse-probability weighting (AIPW) method for analyzing gender limitations in manufacturing, retail, and other service sectors was also examined in this study. To account for non-random treatment assignment, AIPW and IPWRA estimators model both the outcome and the treatment. The AIPW estimator adds a bias-correction term to the IPW estimate. The model simplifies to the IPW estimator if the treatment model is correctly specified, resulting in a bias-correction term of zero. The bias-correction term adjusts the estimator when the outcome model is correctly specified but the treatment model is not. Consequently, the AIPW estimator shares the double-robust property with the IPWRA estimator due to this bias-correction component. The summary results of the augmented inverse-probability weighting (AIPW) are provided below.

Table 5. Summary results of Inverse-probability-weighted regression adjustment of gender constraints impact on Manufacturing, Retail and Other services.

Inverse-probability weighting for Firms in Manufacturing Industry				
	Robust			
Manufacturing	**Coefficient**	**Standard error**	**Z**	**P>|z|**
ATE				
Gender				
(Female vs male)	0.036	0.034	1.05	0.293
POmean				
Gender				
Male	0.757	0.014	55.22	0.000
Inverse-probability weighting for Firms in Retail Services				
		Robust		
Retail	**Coefficient**	**Standard error**	**Z**	**P>|z|**
ATE				
Gender				
(Female vs male)	-0.018	0.023	-0.78	0.437
POmean				
Gender				
Male	0.100	0.009	10.46	0.000
Inverse-probability weighting for Firms in other services activities sector				
		Robust		
Otherservices	**Coefficient**	**Standard error**	**Z**	**P>|z|**
ATE				
Gender				
(Female vs male)	0.021	0.019	1.09	0.28
POmean				
Gender				
Male	0.032	0.006	5.62	0.000

Looking at the performance of firms from manufacturing industry (manufacturing), the output results seen summarily in Table 5 indicate that the average performance of firms from the manufacturing industry would be about 3.57% (0.0356789) when the gender constraint comes from females against their male counterparts but would be about 75.74% (0.757378) when the gender constraint comes from males. Additionally, the ATE, which measures the average difference between firms in the manufacturing industry, indicates that when gender constraints favor females rather than males, the average performance difference among firms in the manufacturing sector is approximately 3.57% (0.0356789).

Analyzing the performance of firms in the retail services sector, the data presented in the table above indicates that the average performance of these firms would decrease slightly by approximately 1.80% (-0.0180461) when the gender constraint favors females compared to their male counterparts. Conversely, there is a significant increase of about 10.0% (0.1000702) in performance when the gender constraint favors males. The Average Treatment Effect (ATE), which measures the mean difference in performance between firms based on gender constraints, suggests that when the gender constraint favors females rather than males, the average performance difference of firms in the retail services sector decreases by approximately 1.80% (-0.0180461).

Regarding the performance of firms operating in the other services activities sector (otherservices), the output results in the table above also indicate that the average performance of firms in this sector would increase insignificantly by about 2.1% (0.0207274) when the gender constraint favors females compared to their male counterparts. Conversely, there is a significant rise of approximately 3.23% (0.0323472) when the gender constraint favors males. The Average Treatment Effect (ATE), which measures the average difference in performance between firms operating in this sector under different gender constraints, reveals that when the gender constraint favors females rather than males, the average difference in performance is about 2.1% (0.0207274).

4.5. Propensity Score Matching (PSM) Model

The study ultimately estimated the propensity score matching model to demonstrate the impact of gender constraints on the performance of firms within the manufacturing industry, retail services, and other service sectors of the economy. Accordingly, the summary results of the propensity score matching model are presented in the table below.

Table 6. Summary results of the propensity score matching model showing the impact of gender constraints on performances of firms in the manufacturing, retail, and other services.

Propensity score matching model for firms in the manufacturing industry					
n.treat	**n.contr**	**ATT**	**Std. Err**	**z**	**P>|z|**
1, 252	1, 424	0.0369393	0.0359952	1.03	0.305
Propensity score matching model for firms in retail services					
565	2,111	-0.001759	0.0233067	-0.08	0.940
Propensity score matching model for firms in other services activities sector					
606	2,070	0.0255057	0.0241412	1.06	0.291

The results given in Table 6 Indicate that the number of treated firms in the manufacturing industry is 1,252, while the number of control firms is 1,424. The number of treated firms in the retail services sector is 565, whereas the number of control firms is 2,111. Additionally, the number of treated firms in the other services activities sector is 606, compared to 2,070 control firms.

The study employed a propensity score matching model to assess the impact of gender-based credit constraints on the performance of firms within Nigeria's manufacturing sector. The findings indicate that firm performance tends to improve when credit constraints favor females over males, although this effect is statistically insignificant. Specifically, when male-led firms have greater access to credit, their performance is likely to increase more compared to female-led firms with similar credit access levels. This is evidenced by the positive sign of the average treatment effect on the treated (ATT). The results suggest that the performance of male-headed firms in the manufacturing industry experiences a slight, statistically insignificant increase in response to increased female credit constraints. The estimated ATT is approximately 0.03694, implying that with female credit constraints, the performance of male-headed firms could increase by about 3.69%. Conversely, if more credit is allocated to females, the performance of these firms could decline by approximately 96.31%. These findings highlight the nuanced relationship between gender-specific credit access and firm performance, emphasizing the need for targeted financial policies to optimize outcomes in the manufacturing sector in Nigeria.

To analyze the impact of gender-based credit constraints on the performance of firms in Nigeria's retail services sector, a propensity score matching model was employed. The study's findings indicate that when female-headed firms have increased access to credit, their performance tends to decline, although this decline is not statistically significant at the 5% level but becomes significant at the 10% level. Specifically, the results suggest that greater credit access for females correlates with a significant decrease in firm performance at the 10% significance level compared to male-headed firms with similar credit access. This is evidenced by the negative sign of the average treatment effect on the treated (ATT), which is calculated at -0.001759. This implies that, on average, female-headed firms experience a 0.1759% reduction in performance when facing credit constraints. Conversely, if more credit is accessible to males, the performance of female-headed firms could potentially increase by approximately 99.8241%. These findings highlight the nuanced relationship between gender, credit access, and firm performance, emphasizing the importance of considering gender-specific financial constraints in policy formulation and financial support programs within Nigeria's retail sector.

The study also employed a propensity score matching model to determine the impact of gender credit constraints on the performance of firms operating in the other services activities sector in Nigeria. The results indicated that the performance of firms in this sector tends to increase when gender credit constraints favor females over males, although this increase is statistically insignificant. This suggests that when male-headed firms in the sector have greater access to credit, their performance improves more compared to firms headed by females with increased credit access. The positive sign of the average treatment effect on the treated (ATT) supports this observation. The findings imply that the performance of male-headed firms in the sector experiences a slight, insignificant rise with increased female credit constraints. Specifically, the ATT is estimated at 0.0255057, indicating that with female credit constraints, the performance of male-headed firms in the sector could increase by approximately 2.55%. Conversely, if more credit access is granted to females than males, the performance could decline by about 97.45%. These results highlight the nuanced relationship between gender-based credit constraints and firm performance within this sector in Nigeria, emphasizing the importance of equitable credit policies to foster sector growth.

5. Conclusion

This study demonstrates that gender-based credit constraints significantly inhibit the performance of female-led MSMEs in Nigeria. The evidence shows that women entrepreneurs face measurable disadvantages in labor productivity, capital utilization, and investment, especially in the manufacturing sector. These findings highlight deep-seated structural biases that undermine equity and economic growth. Closing this gender credit gap is both a social justice imperative and an economic necessity for Nigeria's development.

This study therefore recommends policies that focus on expanding gender-responsive microfinance with simplified credit products, promoting alternative lending methods that rely less on collateral, and enhancing women's financial literacy to better engage with formal markets. The government should also advocate for gender-sensitive regulations with mandatory sex-disaggregated data, legal reforms to improve women's access to collateral, public-private partnerships for sustainable financing, and leveraging digital banking to extend financial services to rural female entrepreneurs.

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