Perceived Glass Ceiling? Women's Self-Selection out of the Credit Market in Africa

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Abstract

Women in Africa are disproportionately disadvantaged in terms of access to finance. Little is understood about demand-side factors' contribution to the gender gap in access to finance. This paper provides empirical evidence on how women managers' perceptions about their creditworthiness contribute to the observed large gender gap in Africa, particularly in the Northern region. In a simple and parsimonious theoretical model of the credit market with imperfect and asymmetric information, we show that loan applicants' perception of their creditworthiness is an important demand-side factor for self-selectivity out of the credit market even in the absence of discriminatory practice on the side of the banks. We use firm-level data from the World Bank Enterprise Survey, covering 47 African countries. We find that women entrepreneurs are more likely to self-select themselves out of the credit market due to low perceived creditworthiness compared with their male counterparts. The results also suggest that the observed self-selection behavior is not a response to discriminatory lending practices by the banks. The findings will inform policies supporting greater financial inclusion of women in the region.

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1. Introduction

Access to finance helps start-ups grow into large enterprises and incumbent firms innovate and become competitive, creating job opportunities and contributing to economic growth. In most parts of the developing world, however, low access to external finance has been a key constraint for entrepreneurs. Women are at a particular disadvantage. For instance, according to the World Bank 2017 *Global Findex Report*, women represent 56 percent of the adult population in the developing world who do not have access to a bank account, with a 9 percentage point gender gap. In sub-Saharan Africa, only 37 percent of women have a bank account compared with 48 percent of men, a gap that has widened over the past several years. The figures are even more drastic in North Africa, where about two-thirds of the adult population do not have access to a bank account. At 18 percentage points, the North Africa region has the largest gender gap in the world (Demirguc-Kunt et al., 2018). The large gender gap in access to finance at individual level is also reflected on women entrepreneurs' ability to access finance from formal financial institutions. As a result, they are disproportionately shunned from effectively participating in the market economy, which at a macro level limits countries from realizing their full growth and employment potential (Aterido et al., 2013).

Several studies have shown that supply-side factors play a major role in the exclusion of women from the formal credit market. When they do have access to finance, they face stringent loan configurations—higher interest rate or higher collateral—compared with men (Muravyev et al., 2009). There is also evidence that credit rationing through high interest rates disproportionately discourages women entrepreneurs from applying for a loan, while lack of a collateral reduces their access to loans than men (Aterido et al., 2013). Moreover, women are more likely to be excluded from the formal financial sector in countries where there are gender discriminatory laws and norms, lower participation of women in the labor market, and high

state ownership in the banking sector (Morsy and Youssef, 2017). This is particularly the case in most North Africa countries, where the gender gap, driven by socioeconomic and cultural factors, is pervasive.

While supply-side factors are important in limiting women's access to finance, women's decision-making behavior also plays an important role in the observed gender gap. Aterido et al. (2013), for instance, found that the observed gender gap in South and East Africa could be attributed to lower levels of income and education of women compared with men. Similarly, an earlier study by Buvinic and Berger (1990) found that female entrepreneurs in Peru decide to not apply for loans due to complicated application procedures. In addition, the literature establishes that women entrepreneurs could decide to not apply for loans—self-select themselves out of the credit market—due to low financial literacy, risk aversion, and fear of failure, even in the absence of discrimination by the banks.

However, there is little evidence on how financial behavior of women in Africa contributes to the observed gender gap in access to finance. Do women entrepreneurs in Africa systematically self-select themselves out of the credit market compared with their male counterparts, and why? It is important to understand how women entrepreneurs make financial decisions in an environment in which credit is highly rationed if one is to design the right policies and interventions.

This paper fills the knowledge gap in the literature by examining whether women-managed formal enterprises self-select themselves out of the formal credit market in Africa based on their perceived creditworthiness. We focus on the North Africa region, where the gender gap is the highest in the world. In a parsimonious theoretical framework of credit market with imperfect information regime, we show that some applicants could self-exclude themselves out of the credit market based on their perceived creditworthiness. We use data from the World

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Bank Enterprise Survey (ES) project, taking advantage of the detailed survey information on why firms exclude themselves from the credit market. The survey covers 47 countries in Africa, of which four—Egypt, Mauritania, Morocco, and Tunisia—are in North Africa. We use an Instrumental Variable (IV) method to address potential endogeneity, and control for various confounding factors that are potentially correlated with leadership by women managers and self-selection based on perceived creditworthiness.

Our paper disentangles self-selection based on low perceived creditworthiness from self-selection based on actual or perceived discriminatory lending practice by banks. The literature, drawing mainly from developed countries, distinguishes between two types of discrimination in the credit market: statistical and taste-based discrimination (Phelps, 1972; Becker, 1971). On the one hand, statistical discrimination occurs when there is information asymmetry and lenders reject certain types of applicants based on some observed characteristics. This is because lenders use a set of loan applicants' characteristics—for instance, age, gender and race/ethnic group—to predict creditworthiness and decide whether to accept or reject certain group of applicants. Taste-based discrimination, on the other hand, emanates from an animus or a prejudice toward one group of applicants based on race, gender, religion and other personal characteristics (Becker, 1971). This type of discrimination imposes a higher cost on the decision-maker because taste can only be enjoyed at a positive cost (Becker, 1971; Neilson and Ying, 2016).

Regardless of the type of discrimination, women loan applicants form their beliefs about their creditworthiness and respond in different ways. For instance, Weller (2008) found that minority applicants in the United States are disproportionately discouraged from applying for credit. These applicants face higher denial rates, higher mortgage interest rates, and higher payment-to-debt ratios. Similarly, in the U.S. mortgage market, Longhofer and Peters (2005)

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show the existence of a self-selection behavior among minorities in response to taste-based discrimination by banks.

In a developing-country context, Agier and Szafarz (2013) found evidence of a glass-ceiling effect against women among large project applicants in a large Brazilian microfinance institution, although they did not detect a discriminatory lending practice. As a response mechanism to discrimination, women also resort to informal finance which often carries higher interest cost compared to finances from formal financial institutions. Based on a survey of small enterprises in three African countries—Ethiopia, Tanzania and Zambia—Richardson et al. (2004), for instance, found that women entrepreneurs were more likely to rely on their own or informal financing mechanisms to finance their businesses than men entrepreneurs. While these studies are informative about women entrepreneurs' financial behavior, there is a huge gap in our understanding of women's self-selective behavior in the context of Africa.

In line with the works of Muravyev et al. (2009) and Aterido et al. (2013), among others, in the literature, the paper also disentangles self-selection based on perceived creditworthiness from other supply-side factors including difficulty in loan application procedures, unfavorable loan terms, and other reasons. This is particularly important as potential loan applicants internalize supply-side factors including high interest rates, high collateral requirements, and complicated application procedures, which could be confounding factors in applicants' belief formation processes about their creditworthiness. We model the different supply-side reasons based on which applicants self-select along with self-selection based on perceived creditworthiness.

Our paper provides fresh evidence on how women entrepreneurs' perceptions about their creditworthiness limit their access to finance even in the absence of discriminatory lending practices. We find that self-selection based on perceived low creditworthiness contributes to

the large gender gap in Africa, particularly in the Northern region. After controlling for observed manager, owner, and firm characteristics as well as county and temporal factors, we find that female managers and owners significantly self-select themselves out of the credit market compared to their male counterparts. We find that compared with male managers and owners, females do not systematically self-select based on supply-side factors including complexity of the loan application procedure and unfavorable loan terms. The findings of our paper inform policies toward greater financial inclusion of women in the region by supporting women form better and objective belief about their entrepreneurship acumen.

The rest of the paper is organized as follows. Section 2 describes the data used in our analysis and presents some descriptive statistics; section 3 introduces our conceptual framework of self-selection in the credit market; section 4 discusses the empirical strategies employed; section 5 presents the key findings of the paper; and section 6 concludes by discussing the implications of the findings for policy and directions for future research.

2. Data and Descriptive Analysis

This study is based on data from the standardized ES, a firm-level survey jointly conducted by the World Bank, the European Bank for Reconstruction and Development, and the European Investment Bank. We use the harmonized data set that covers more than 135,000 firms in 189 countries, conducted between 2006 and 2016. The survey covers more than 37,000 firms in 47 African countries, with more than 6,000 firms in four North African countries (Egypt, Mauritania, Morocco, and Tunisia).[2]

The survey covers firms in manufacturing and services sectors that correspond to ISIC codes 15–37, 45, 50–52, 55, 60–64, and 72 (ISIC Rev. 3.1). The distribution between sectors

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[2] A comprehensive description of the data and survey methodology is provided online at:
www.enterprisesurveys.org.

is determined according to the sectors' relative contribution to GDP in each country. Formal (registered) firms with more than five employees are included in the survey. Services sector activities include construction, retail, wholesale, hotels, restaurants, transport, storage, communications, and information technology. Firms with 100 percent government ownership are not eligible for the survey. The sampling methodology is stratified random sampling.

We use direct survey information to construct our key dependent variable, which is self-selection out of the credit market. The ES directly asks respondents whether they applied for a new loan or a line of credit in the last fiscal year. If the response is "No", respondents are asked to select the major reason why they did not apply. The reasons offered are: 1) "*Don't know*" 2) "*No need for a loan*"; 3) "*Complex application procedures*"; 4) "*Interest rates were not favorable*"; 5) "*Collateral requirements are too high*"; 6) "*Insufficient size of loan and maturity*"; 7) "*Did not think it would be approved*"; and 8) "*Other reasons.*" We considered a respondent to self-select herself/himself out of the credit market, if her/his main reason for not applying is "*Did not think it would be approved.*" We construct an additional dependent variable to reflect whether women entrepreneurs face higher rejection rate on their applications for loans or lines of credit based on respondents' answers to a question about the outcome of the most recent application for loan/line of credit (accepted or rejected).

Our explanatory variable of interest is the gender of the entrepreneur, that is, the firm's top manager.[3] Table 1 shows the reasons for "not applying" for new loans or new lines of credit by gender and region. For firms in need of a loan, the top two reasons for not applying reported by female managers in Africa are "*interest rates were not favorable*" and "*application procedures were complex.*" The top two reasons for female-managed firms in the North Africa

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[3] The descriptive statistics and estimations' results by the gender of the firm's *owner* are provided in Appendix A.

region are "*application procedures were complex*" and they "*did not think it would be approved,*" revealing important differences.

Table 1: Reasons for not Applying for New Loans/Lines of Credit in the Last Fiscal Year
(percent, by gender of top manager)

Reason	Africa			North Africa		
	Male	Female	Pooled	Male	Female	Pooled
No need for a loan*	67.6	55.3	62.8	75.9	66.6	75.3
Application procedures were complex	9.2	10.9	10.4	8.6	11.0	8.8
Interest rates were not favorable	8.6	11.5	10.9	6.4	6.2	6.4
Collateral requirements were too high	5.2	8.3	5.8	2.0	3.2	2.1
Size of loan and maturity were insufficient	1.1	1.1	1.2	0.7	0.4	0.7
Did not think it would be approved (low perceived creditworthiness)	**3.5**	**6.5**	**4.1**	**3.2**	**9.3**	**3.6**
Other reasons	4.7	6.4	4.7	3.1	3.2	3.1
Number of Observations			37,699			6,097

* Establishment had sufficient capital. Survey-weighted data are used (Stata's svy prefix).

While 6.5 percent of female-managed firms in Africa reported that they did not apply for new loans or credit line because they perceived that their application would not be approved, only 3.5 percent of male-managed firms reported that as a main reason. The difference is much larger for respondents in North Africa, with 9.3 percent of female-managed firms reporting that they did not apply because they "*did not think their application would be approved,*" only 3.2 percent of male-managed firms reported that as the main reason for not applying. This yields a gender gap of over 6 percent in North Africa vis-à-vis 3 percent for the entire continent.

The observed gender gap in self-selection out of the credit market could be explained by two main reasons: either female-managed firms have a lower probability of getting their application approved because they have lower creditworthiness, and/or they perceive themselves to be of lower creditworthiness than they are.[4]

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[4] If the latter is the case, and female managers are, on average, less confident and more risk averse than male managers (Nekby et al., 2007), then the pool of female applicants is likely to consist of women managers whose

Our formal econometric analysis controls for the following variables: sales per worker that reflects the productivity of the firm or the firm's profitability in the broad sense[5], sector of operation, firm size, locality size, whether the firm is located in the official capital city, legal status of the firm, share of foreign ownership, firm age, number of employees, top manager's years of experience, whether the firm holds an internationally recognized quality certification, share of direct exports in total sales, and whether the firm's financial statements were checked and certified by an external auditor. Our set of control variables also includes year and country dummies. Moreover, we use the proportion of full-time female employees in the total workforce as an instrument for "female manager." We discuss the instrument more in the empirical methods section.

The differences in firms' characteristics by gender of top manager are reported in Table 2. On average, in both Africa and North Africa, female-managed firms are more concentrated in the services' sector, are smaller, are more likely to be located in the official capital city, have lower foreign ownership's share, are younger, have fewer number of employees, have fewer top manager's experience years, and are less likely to hold an internationally recognized quality certification, compared with male-managed firms. Such differences can have serious implications for access to finance. For instance, younger and smaller firms are typically less favored by bankers (Robb, 2013). Also, being in the main capital city can be associated with a negative effect as firms face fiercer competition and thus need to meet higher requirements in order to be successful in their application for credit. On the contrary, being a big exporter and having a manager with more years of experience can make the firm more confident to apply for credit.

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businesses have superior characteristics of performance and creditworthiness (and thus, more likely to get their application approved). This will, in turn, result in a higher share of female successful applicants.
[5] This is a key indicator used by financial institutions or banks to assess the creditworthiness of a firm.

Table 2: Differences in Baseline Firm Characteristics

(percent, by gender of top manager)

Characteristic	Africa			North Africa		
	Male	Female	Pooled	Male	Female	Pooled
Sector (%)						
Manufacturing	48.6	39.3	47.5	64.4	60.5	64.2
Services	51.4	60.7	52.5	35.6	39.5	35.8
Firm Size (%)						
Small	53.0	68.9	54.9	40.6	46.3	40.9
Medium	31.2	23.3	30.2	34.8	34.3	34.8
Large	15.8	7.8	14.8	24.6	19.4	24.3
Locality Size (%)						
Main Business City*	19.0	16.2	18.7	34.0	40.1	34.3
Over 1 million	40.7	43.2	41.0	17.3	14.5	17.1
250,000 - 1 million	25.7	27.6	25.9	20.6	18.5	20.5
50,000 - 250,000	10.4	10.2	10.4	15.8	15.4	15.8
Less than 50,000	4.2	2.8	4.1	12.3	11.4	12.2
Official Capital City (%)	41.5	45.0	41.9	26.2	29.3	26.3
Firm Legal Status (%)						
Shareholding Company with Shares Traded in the Stock Market	6.5	4.1	6.2	7.9	7.8	7.9
Shareholding Company with Non-Traded/Privately Traded Shares	17.4	12.9	16.9	29.0	26.7	28.9
Sole Proprietorship	49.6	57.2	50.5	32.3	32.0	32.2
Partnership	12.1	10.1	11.8	19.3	18.3	19.3
Limited partnership	12.2	13.7	12.4	10.3	13.0	10.5
Other	2.3	2.0	2.3	1.3	2.2	1.3
Share Foreign Ownership (%)	11.774	9.017	11.594	6.470	5.900	6.492
Firm Age (years)	17.747	15.281	15.875	21.098	20.718	20.645
Number of Employees	82.262	39.027	65.506	138.991	102.991	132.212
Top Manager Experience (years)	16.994	13.677	15.197	22.001	18.707	21.425
Quality Certification (%)	17.5	12.3	16.9	24.1	19.5	23.9
Log Sales Per Worker	10.369	10.212	10.490	10.900	10.835	10.887
Direct Exports Share of Sales (%)	5.873	4.612	4.823	9.204	9.658	8.999
Externally Audited (%)	56.9	49.7	56.0	77.5	77.8	77.5
Number of Observations			37,699			6,097

For continuous variables (share foreign ownership, firm age, number of employees, top manager experience years, log sales per worker and direct exports share of sales), we report means instead of proportions.
*Main business cities are defined as cities with "major economic activity."

We also observe that the variation by gender in some of the key firms' characteristics, such as firm's size and age, is lower in the North Africa region compared with the whole continent, suggesting that systematic reasons for self-selection are less significant in the region. If this is the case, and the estimation results provided later exhibit a stronger evidence of self-selection in North Africa, we may conclude that women entrepreneurs' self-selection behavior in this region is more sensitive to their perceptions. In this regard, it is imperative to note that no differences are observed in firm true creditworthiness (proxied by sales per worker) between female- and male-managed firms in either Africa or North Africa.

3. Conceptual Framework

Imperfect and asymmetric information in the credit market gives rise to incentive problems in the form of adverse selection and moral hazard. Stiglitz and Weiss (1981) show that banks reject some borrowers due to information asymmetry, leading to credit rationing even in a perfectly competitive credit market. This is because, at higher interest rates and collateral requirements, only the risky firms apply, giving rise to adverse selection. Besides, a higher interest rate incentivizes borrowers to choose riskier projects with higher returns, increasing the risk of bankruptcy and moral hazard. Even with risk-neutral borrowers, as shown in Wette (1983), a higher collateral requirement can push safe projects out of the market, decreasing banks' profits. However, Bester (1985) shows that if banks compete on collateral requirements and use the interest rate to screen borrowers' riskiness, then no credit rationing will occur in equilibrium because using different contracts acts as a self-selection mechanism. High-creditworthy borrowers tend to accept loan contract configurations that have higher collateral requirements for a certain reduction in the interest rate than do low-creditworthy borrowers. Building on Bester (1985), Han et al. (2009) further show that high-creditworthy borrowers can offer collateral as a signal to lenders to obtain lower interest rate than low-creditworthy investors with riskier and low-return projects.[6]

Within the standard credit market model, we introduce loan applicants' perception toward their creditworthiness. Following the literature (such as Bester, 1985; Han et al., 2009; Longhofer and Peters, 1999), our key simplifying assumptions are as follows: (1) both banks and borrowers are risk neutral, and risk-free interest rate is normalized to zero; (2) banks' loan offers depend on the observed signals that the loan applicants send; (3) banks can objectively

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[6] This sorting behavior is referred to as "sorting-by-private-information," whereby collateral is used by applicants as a signal to banks.

predict applicants' creditworthiness based on the signals banks receive; and (4) borrowers have imperfect information about their true creditworthiness.

Now, consider a project that succeeds with probability p and fails with probability $1 - p$. The probability of success depends on the borrowers' quality (or type), which we assume to be equal to its creditworthiness θ. When the project succeeds, the borrower/entrepreneur earns a return of $R = (1 + \tilde{r})I$, otherwise zero, where $\tilde{r}$ is the rate of return on the project and I is the investment amount. Given the borrower's risk type θ, the expected return from the investment is given by $R = \theta (1 + \tilde{r})I$. If the project succeeds, the expected benefit from the loan is the sum of initial wealth (denoted by W) that is presented as a collateral and the return of the project. If the project fails, the borrower must transfer the collateral to the bank. Then, for a borrower of risk type θ, the expected net benefit of undertaking the project using a loan offered under contract γ_θ is given by

$$E\Pi(\gamma_\theta) = \theta\left[W + (1 + \tilde{r})I - (1 + r)I\right] + (1 - \theta)[W - C]$$

$$= W + (\tilde{r} - r)\theta I + (1 - \theta)C \tag{1}$$

where r is the interest rate charged by the bank. Based on the signals the bank receives from the loan applicant and the applicants' pool, it forms its posterior belief distribution about the types of loan applicants. For the sake of simplicity, we assume that the bank receives applications from two groups of loan applicants: high-creditworthy applicants H with probability α, and low-creditworthy applicants L with probability $1 - \alpha$. Then, the bank offers contracts $\gamma_H = \{r_H, C_H\}$ to high-creditworthy applicants and $\gamma_L = \{r_L, C_L\}$ to low-creditworthy applicants. This set of loan contracts should maximize the bank's expected profit and serve as a self-selection mechanism, satisfying the individual rationality (IR) and incentive compatibility (IC) conditions. The IR condition stipulates that the entrepreneur applies for the

loan if and only if the expected benefit of undertaking the project through bank financing is greater than the initial wealth:

$$E\Pi(\gamma_i) = W + (\tilde{r}_i - r_i)\theta_i I + (1 - \theta_i)C > W => \theta_i - \frac{1}{1 - (\tilde{r}_i - r_i)\frac{I}{C}} > 0, \qquad (2)$$

where $i = \{L, H\}$. The IC condition implies that a borrower of type i accepts only a loan contract designed for her/him if and only if the following conditions are satisfied:

$$E\Pi_H(\gamma_H) > E\Pi_H(\gamma_L) \text{, and } E\Pi_L(\gamma_L) > E\Pi_L(\gamma_H). \qquad (3)$$

Under imperfect information, the borrower does not have full information about her/his true risk type θ_i and about the set of information that the bank has on the pool of applicants. Instead, the applicant uses her/his self-assessed (perceived) creditworthiness $\tilde{\theta}$ to make the decision on whether to apply for a loan or not. We denote the borrower's perceived creditworthiness by $\tilde{\theta}_i = \theta_i + \zeta_i$, where $\zeta_i \sim iid(0, \sigma_\zeta^2)$ is the perception bias toward her/his creditworthiness. Then, the potential borrower applies for a loan if and only if:

$$E\Pi(\tilde{\gamma}_i) = W + (\tilde{r}_i - r_i)\tilde{\theta}_i I + (1 - \tilde{\theta}_i)C > W => (\tilde{r}_i - r_i)\tilde{\theta}_i I + (1 - \tilde{\theta}_i)C > 0. \qquad (4)$$

After simplifying, equation (4) can be written as the probability of loan application term as:

$$Pr(Apply_i = 1|.) = Pr\left[(\theta_i + \zeta_i) - \frac{1}{1 - (\tilde{r}_i - r_i)\frac{I}{C}} > 0\right] \qquad (5)$$

The first part inside the squared bracket of equation (5) is the true creditworthiness which is assumed to correspond with the bank's unbiased predicted creditworthiness based on the applicant's profiles plus the subjective perception of the loan applicant. The second part of

equation (5), i.e., $\frac{1}{1-(\tilde{r}_i-r_i)\frac{I}{C}}$, is the profitability of the project which remained the same as in equation (2) regardless of the creditworthiness parameters.

The implications are straightforward with three empirically testable predictions:

(1) If $\zeta_i = 0$, the bank's unbiased prediction and the applicant's perceived creditworthiness coincide. In this case, the model is similar to the standard credit market model in the literature in that the borrower's decision to apply for the loan is based on the objective prediction of her/his creditworthiness and expected profit.

(2) If the applicant's perceived creditworthiness is lower than her/his true creditworthiness ($\zeta_i < 0$), she/he decides to not apply even if her/his true creditworthiness is higher and the loan application has higher likelihood of being accepted by the bank.

(3) If the applicant's perceived creditworthiness is higher than her/his predicted creditworthiness ($\zeta_i > 0$), then the entrepreneur applies for a loan even if her/his true creditworthiness is lower and the loan application has lower likelihood of being accepted by the bank.

4. Empirical Methods

4.1. Baseline Specification of Self-Selection

We use a multinomial logistic regression to model self-selection based on various reasons. We take advantage of the direct question of self-selectivity in the World Bank Enterprise Survey. The survey asks respondents whether they have applied for new lines of loans or lines of credit. If the responses are "no," follow-up questions on the reasons for "not applying" for new bank loans or lines of credit are asked. Respondents then provide several reasons for self-selecting themselves out of the credit market. Our empirical specification follows the structure of the

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questionnaire which aligns with our primary interest of examining whether women entrepreneurs self-select out of the credit market based on their low perceived creditworthiness compared with men entrepreneurs.

We use a multinomial logit specification to jointly estimate all the reasons for "*not applying*" while accounting for potential correlation between the different reasons. As described in the data section above, we consider an entrepreneur to self-select out of the credit market on the bases of low perceived creditworthiness, if she/he did not apply for a loan or a line of credit because she/he "*did not think it would be approved*." Accordingly, we write the multinomial model as:

$$Pr(ReasonNotApplied_i = j | Applied_i = 0) = \Lambda(\alpha_j + \varphi_j Female_i + \beta_j Z_i), \tag{5}$$

where $\Lambda(\cdot)$ is a multinomial log function. $ReasonNotApplied_i$ is a categorical variable taking values $j = 1$ if the reason was "*there was no need for loan*"; $j = 2$ if the reason was "*the application procedures were complex*"; $j = 3$ if the reason was "*the loan/credit terms were unfavorable (interest rates were not favorable, collateral requirements were too high, or size of loan and maturity were insufficient)*"; $j = 4$ if the reason was "*did not think its application would be approved*" (our proxy of self-selection based on low perceived creditworthiness); and $j = 5$ if the response was "*other reasons.*" $Female_i$ is our explanatory variable of interest and is a dummy variable taking a value of 1 if the firm is female-managed and 0 otherwise. Z_i is a vector of control variables including proxies for firm's creditworthiness, a set of firm characteristics, and country and year dummies. α_j, φ_j and β_j are vectors of coefficients to be estimated.

If φ_j is statistically significant, we infer that there is gender-based self-selection out of the credit market due to reason j conditional on all other factors. We run the model in equation (5) separately for Africa and for the subsample of the North Africa region.

One of the challenges is that we lack information on discriminatory lending practices by banks and/or because they perceive themselves as having low creditworthiness. To rule out the possibility that past or current discriminatory lending practice determines how women entrepreneurs form their beliefs, we need to empirically establish that there are no gender-based differences in loan rejection rates. Therefore, we estimate the probability of rejection on a recent loan application using a logit model as

$$Pr(AppReject_i = 1|Applied_i = 1) = \Lambda(\alpha + \gamma Female_i + \sigma W_i), \qquad (6)$$

where $AppReject_i$ indicates if the application for a new loan or a line of credit was rejected, W_i is a vector of control variables, and γ is our coefficient of interest, capturing gender differential (discrimination) in the probability of loan application rejection. All other variables are as defined before. If we find no statistically significant evidence of discrimination by banks, it is plausible to rule out feedback effect from gender-based discrimination on perception about creditworthiness.

4.2. Instrumental Variable Approach

A potential challenge for our model specification is endogeneity, as φ could be biased due to a problem of one or more omitted variables. We suspect that other observed and unobserved factors could systematically affect women entrepreneurship and self-selection behavior in the credit market based on their belief about their creditworthiness. For instance, in addition to perceptions of their creditworthiness, women and men could have systematic differences, say on their levels of risk aversion, which could be correlated with women entrepreneurship and

self-selection out of the credit market. As a result, the estimated coefficient could be biased, picking up the effects of other observed and unobserved factors that differ by gender. Depending on the direction of correlation, the bias could be positive or negative.

To correct for such bias, we estimate our model using an IV method. We use the proportion of full-time female employees in the firm as an instrument for "female manager." The instrument is both plausible, with a strong underlying economic rationale, and passes important statistical tests. In terms of economic rationale, organizational theory establishes that there is a positive gender spillover between bosses and lower-rank employees. As described in Kunze and Miller (2017), there are two channels for the positive correlation between women managers and the proportion of female workers in the firm. First, higher-ranking women serve as mentors, role models, and advocates for their lower-ranking coworkers. Second, decisions to promote or hire are often based on taste-based or statistical discrimination of current leaders.

Moreover, female management is correlated with a higher proportion of women employees in the firm by weakening the associations of formal employment with masculinity. Although the spillover could be negative, there is an overwhelming evidence that the relationship between female management and the proportion of female employment is positive (Maida and Webber, 2019). The proportion of female employees, however, is orthogonal and exogenous to self-selection out of the credit market. Hence, the proportion of female workers in the firm is a plausible IV for "female manager."

In addition, our checks show that the instrument meets the criteria of strong relevance and exogeneity.[7] The proportion of female employees is significantly and positively correlated with

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[7] For an IV approach to be a reasonable identification strategy, any instrumental variable Z is required to be correlated with the likelihood of becoming a manager being a woman (assumption 1), while it should not be correlated with neither the dependent variable "self-selection" nor the error term "unobservables" (assumption 2). If either of these two identification assumptions is violated, employing Z as an instrument is not a viable approach.

the "female manager" variable. The first-stage F-statistic for the significance of the instrument further supports its strong relevance from a statistical standpoint. Besides, the overidentifying restrictions' tests provide evidence of the instrument's exogeneity. Thus, we estimate an IV probit model focusing on our dependent variable of interest: self-selection due to low perceived creditworthiness.

5. Results and Discussion

5.1. Baseline Estimates of Self-Selection

The results from our baseline specification are reported in Tables 3 and 4 for the whole sample of Africa and the North Africa region, respectively. As shown in Table 3, compared with men, women managers in Africa are more likely to not apply for new loans or new lines of credit because they "*did not think it would be approved.*" Specifically, having a female rather than a male manager is significantly associated with a 1.202 increase in the relative log odds of reporting low perceived creditworthiness as the reason for not applying versus the "no need for a loan" reason. By exponentiating the coefficient, we find that the relative probability of self-selection due to low perceived creditworthiness for female managers is more than triple the corresponding relative probability for male managers with the same firm characteristics.[8]

The difference between male and female managers' self-selection behavior is stronger for firms in North Africa than in Africa in general. Table 3 shows that female managers have 1.583 higher relative log odds of selecting themselves out of the credit market. In other words, the relative probability of reporting low perceived creditworthiness for not applying rather than the

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[8] The coefficients obtained from the logistic regression are the raw regression coefficients. The coefficient of the variable "Female Top Manager" is the log of odds ratio between the female managers group and the male managers group. So, we obtain the odds ratio— the odds for female managers versus male managers for a specific outcome (reason for not applying)—by exponentiating the reported regression coefficient of the variable "Female Top Manager."

"*no need for a loan*" reason for female managers in North Africa is more than four times the corresponding relative probability for male managers with the same firm characteristics. Interestingly, low perception is the only reason for which we find significant gender differences between female- and male-managed firms in both Africa and North Africa. We find no statistically significant differences between female- and male-managed firms for any of the remaining reported reasons: "*complexity of application procedures,*" "*unfavorable loan/credit terms,*" and "*other reasons.*"

There is also a significant negative relationship between log sales per worker, which is a good proxy for profitability and true creditworthiness of firms, and self-selection out of the credit market. A one-unit increase in log sales per worker, denoting an increase in the true creditworthiness of the firm, is associated with an 0.128 decrease in the relative log odds of reporting self-selection as the reason for not applying versus the "*no need for a loan*" reason (Table 3). This result affirms that low perception of creditworthiness is also determined by firm's performance.

Similarly, women managers in North Africa are more likely to self-select due to their lower perception of the creditworthiness of their firms, and not by their true creditworthiness (Table 4). We should expect high-productivity firms to have high perceived creditworthiness and low self-selection. To our surprise, however, we find no statistically significant relationship between productivity and perceived creditworthiness as a reason for firms in North Africa to self-select. This implies that managers' perceived creditworthiness in North Africa can, in fact, be vastly different from their true creditworthiness.

Table 3: Multinomial Logit Estimates of Reasons for Self-Selection
(by Gender of Manager in Africa)

Outcome Variable: What Is the Main Reason for Not Applying for New Loans/New Lines of Credit?	Reason			
	(1) Complex Application	(2) Unfavorable Terms	(3) Low Perception	(4) Other Reasons
Female Top Manager Y:1 N:0	0.424	0.348	1.202***	0.000
	(0.313)	(0.233)	(0.432)	(0.305)
Sector (Ref: Manufacturing)				
Services	-0.261	-0.300*	-0.064	-0.160
	(0.202)	(0.154)	(0.307)	(0.263)
Firm Size (Ref: Small)				
Medium	-0.412*	-0.451**	0.067	-0.178
	(0.227)	(0.186)	(0.331)	(0.323)
Large	-0.421	-1.215***	-0.625*	-0.245
	(0.350)	(0.253)	(0.354)	(0.407)
Locality Size (Ref: Main Business City)				
Over 1 million	-0.393	0.391	0.917**	1.171**
	(0.333)	(0.273)	(0.439)	(0.505)
250,000–1 million	-0.001	0.682**	0.894**	1.154**
	(0.391)	(0.315)	(0.428)	(0.480)
50,000–250,000	0.066	0.932***	2.126***	1.267**
	(0.424)	(0.323)	(0.531)	(0.516)
Less than 50,000	0.087	0.995***	0.448	0.190
	(0.474)	(0.354)	(0.482)	(0.644)
Official Capital City Y:1 N:0	-0.401	0.211	0.088	-0.169
	(0.298)	(0.191)	(0.289)	(0.297)
Firm Legal Status (Ref: Shareholding Company with Shares Traded in the Stock Market)				
Shareholding Company with Non-Traded/Privately Traded Shares	-0.750	0.047	-0.113	-1.359**
	(0.463)	(0.395)	(0.946)	(0.549)
Sole Proprietorship	-0.211	0.098	-0.026	-0.091
	(0.427)	(0.337)	(0.861)	(0.475)
Partnership	-0.030	0.518	-0.279	-0.853*
	(0.443)	(0.367)	(0.948)	(0.514)
Limited Partnership	0.212	0.322	0.847	-0.677
	(0.465)	(0.366)	(0.936)	(0.574)
Other	-1.214	-1.509**	1.627	-1.343*
	(0.777)	(0.673)	(1.347)	(0.791)
Share Foreign Ownership	-0.007*	0.004	0.001	-0.011***
	(0.004)	(0.003)	(0.005)	(0.003)
Firm Age	-0.002	-0.001	-0.062***	-0.040***
	(0.006)	(0.006)	(0.016)	(0.013)
Number of Employees	0.000	0.000	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Top Manager Experience Years	-0.009	0.005	0.006	0.019*
	(0.011)	(0.008)	(0.013)	(0.011)
Quality Certification Y:1 N:0	-0.070	-0.106	-1.300***	-0.474
	(0.341)	(0.213)	(0.382)	(0.355)
Sales Per Worker	-0.035	-0.080	-0.128*	0.079
	(0.057)	(0.049)	(0.072)	(0.091)
Direct Exports Share of Sales	-0.005	-0.010*	-0.013**	-0.017***
	(0.005)	(0.006)	(0.006)	(0.005)
External Audit Y:1 N:0	-0.435**	-0.158	0.743**	0.643**
	(0.205)	(0.152)	(0.319)	(0.252)
Constant	-1.264	0.288	-4.176***	-2.129*
	(0.915)	(0.798)	(1.570)	(1.284)
Number of Observations	11,603	11,603	11,603	11,603

Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent level, respectively. All coefficients are estimated using survey-weighted data (Stata's svy prefix). Country dummies are included in all estimations. Reference category: No need for a loan.

Table 4: Multinomial Logit Estimates of Reasons for Self-Selection
(by Gender of Manager in North Africa)

Outcome Variable: What Is the Main Reason for Not Applying for New Loan /New Lines of Credit?	Reason			
	(1) Complex Application	(2) Unfavorable Terms	(3) Low Perception	(4) Other Reasons
Female Top Manager Y:1 N:0	0.619	0.659	1.583***	-0.761
	(0.414)	(0.433)	(0.550)	(0.883)
Sector (Ref: Manufacturing)				
Services	-0.190	-0.356	-0.009	-0.092
	(0.247)	(0.228)	(0.375)	(0.403)
Firm Size (Ref: Small)				
Medium	-0.511*	-0.284	0.073	-0.394
	(0.277)	(0.258)	(0.411)	(0.510)
Large	-0.676	-1.297***	-0.336	0.248
	(0.413)	(0.430)	(0.505)	(0.723)
Locality Size (Ref: Main Business City)				
Over 1 million	-0.685*	0.482	1.146*	2.185**
	(0.411)	(0.459)	(0.689)	(1.015)
250,000 - 1 million	-0.107	0.879**	0.975	2.072**
	(0.415)	(0.441)	(0.671)	(0.988)
50,000 - 250,000	0.036	1.220***	2.578***	2.380**
	(0.457)	(0.441)	(0.690)	(1.017)
Less than 50,000	-0.013	1.192**	0.799	1.150
	(0.495)	(0.464)	(0.686)	(1.108)
Official Capital City Y:1 N:0	-0.630*	0.382	0.561	1.203
	(0.380)	(0.407)	(0.624)	(1.034)
Firm Legal Status (Ref: Shareholding Company with Shares Traded in the Stock Market)				
Shareholding Company with Non-Traded/Privately Traded Shares	-0.869	0.173	-0.470	-2.577***
	(0.540)	(0.561)	(1.358)	(0.848)
Sole Proprietorship	-0.174	0.059	-0.322	-0.601
	(0.490)	(0.504)	(1.255)	(0.618)
Partnership	-0.010	0.632	-0.568	-1.759**
	(0.500)	(0.506)	(1.353)	(0.685)
Limited partnership	0.141	0.274	0.515	-1.428*
	(0.545)	(0.551)	(1.321)	(0.787)
Other	-2.759**	-0.348	-14.981***	-2.114*
	(1.355)	(0.933)	(1.378)	(1.131)
Share Foreign Ownership	-0.009	0.007	0.004	-0.017**
	(0.005)	(0.005)	(0.006)	(0.008)
Firm Age	-0.002	0.003	-0.094***	-0.076***
	(0.007)	(0.008)	(0.027)	(0.028)
Number of Employees	0.000	0.000	0.001***	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
Top Manager Experience Years	-0.007	0.008	0.011	0.031*
	(0.013)	(0.011)	(0.018)	(0.017)
Quality Certification Y:1 N:0	0.057	-0.311	-1.567***	-0.573
	(0.429)	(0.349)	(0.521)	(0.710)
Sales Per Worker	-0.015	0.020	-0.105	0.074
	(0.081)	(0.095)	(0.112)	(0.206)
Direct Exports Share of Sales	-0.007	-0.006	-0.017**	-0.019**
	(0.007)	(0.006)	(0.008)	(0.010)
External Audit Y:1 N:0	-0.409*	-0.225	1.097**	1.048**
	(0.241)	(0.229)	(0.500)	(0.436)
Country (Ref: Egypt)				
Mauritania	0.357	1.786***	0.541	0.859
	(0.813)	(0.634)	(1.234)	(1.196)
Morocco	-1.096**	-0.480	-0.693	-0.388
	(0.500)	(0.398)	(0.908)	(0.525)
Tunisia	0.819**	0.670*	1.702***	0.944
	(0.386)	(0.367)	(0.565)	(0.708)
Constant	-0.670	-3.023***	-2.828	-4.796**
	(1.091)	(1.173)	(2.036)	(2.282)
Number of Observations	3,946	3,946	3,946	3,946

Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5 and 1 level, respectively. All coefficients are estimated using survey-weighted data (Stata's svy prefix). Reference category: No need for a loan.

Similarly, the results show that managers of older firms, firms holding an internationally recognized quality certification, and firms with higher exports share of sales are more confident and significantly less likely to engage in a self-selection behavior in general, in both Africa and North Africa. Also, managers of firms located in larger cities are less confident because they face fiercer competition in the credit market and thus are significantly more likely to engage in a self-selection behavior. Unexpectedly, we observe that firms whose financial statements are checked and certified by an external auditor, supposedly reducing information asymmetries (between firms and banks) that increase risk to lenders and constrain the supply of finance, tend to adopt a self-selection behavior in both Africa and North Africa (Tables 3 and 4).

5.2. Instrumental Variable Estimates

Although the results from our baseline specification show strong self-selection of female managers out of the credit market, the estimates are suspected to be biased due to endogeneity. We use an IV probit specification to correct for the potential endogeneity. Tables 5 and 6 depict the results for the whole Africa sample and the North Africa region subsample, respectively. We report the results for all firms and the subsamples of micro firms (less than 5 employees) and small firms (5–19 employees)[9]. From the first-stage F-statistic for the instrument's significance and statistically significant coefficient of the proportion of female employees, we confirm the statistical plausibility of our instrument[10] (see Tables 5 and 6; columns 2, 4, and 6). The J-test of overidentifying restrictions further supports the validity of our instrument, as the statistically insignificant J-test statistic implies that we do not reject the null hypothesis of instrument exogeneity (see Tables 5 and 6; columns 1, 3, and 5).

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[9] We could not report the results of medium-sized (20–99 employees) and large (100+ employees) firms due to small sample sizes.

[10] As a rule of thumb, the F-statistic for (joint) significance of the instrument(s) in the first stage should exceed 10.

Table 5: IV Estimates of Self-Selection Due to Low Perceived Creditworthiness

(by Gender of Top Manager in Africa and Firm Size)

Variables	All Firms		Small Firms		Micro Firms	
	(1) Low Perception	(2) First-Stage	(3) Low Perception	(4) First-Stage	(5) Low Perception	(6) First-Stage
Female Top Manager Y:1 N:0	1.449		1.750**		1.547*	
	(1.052)		(0.840)		(0.916)	
Sales Per Worker	-0.051*		-0.037		-0.040	
	(0.032)		(0.035)		(0.052)	
Proportion of Female Employees		0.236***		0.333***		0.363***
		(0.056)		(0.064)		(0.082)
Proportion of Female Employees (Missing)		-0.019		-0.025		-0.001
		(0.019)		(0.028)		(0.039)
Constant	-2.818***	0.310***	-3.406***	0.384***	-1.290	0.241*
	(0.703)	(0.105)	(0.735)	(0.136)	(0.856)	(0.130)
F-Stat (IVs Joint Significance)		18.22		27.15		20.53
J-Stat (Overidentification)	1.01		1.32		0.79	
Number of Observations	11,603	11,603	6,457	6,457	3,641	3,641
With Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors are reported in parentheses. *, ** and *** denote statistical significance at the 10, 5 and 1 levels, respectively. All coefficients are estimated using survey-weighted data (Stata's svy prefix). Country dummies are included in all estimations.

Table 6: IV Estimates of Self-Selection Due to Low Perceived Creditworthiness

(by Gender of Top Manager in North Africa and Firm Size)

	All Firms		Small Firms		Micro Firms	
	(1) Low Perception	(2) First-Stage	(3) Low Perception	(4) First-Stage	(5) Low Perception	(6) First-Stage
Female Top Manager Y:1 N:0	2.844***		3.006***		2.832**	
	(0.994)		(0.965)		(1.151)	
Sales Per Worker	-0.045		-0.038		-0.072	
	(0.045)		(0.052)		(0.080)	
Proportion of Female Employees		0.179**		0.258***		0.356**
		(0.074)		(0.096)		(0.141)
Proportion of Female Employees (Missing)		-0.023		-0.034		-0.018
		(0.022)		(0.034)		(0.050)
Constant	-1.851**	0.212**	-1.353*	0.090	-0.243	0.083
	(0.773)	(0.092)	(0.695)	(0.087)	(1.004)	(0.137)
J-Stat (Overidentification)	0.51		0.13		0.31	
Number of Observations	3,916	3,916	1,628	1,628	843	843
With Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors are reported in parentheses. *, ** and *** denote statistical significance at the 10, 5 and 1 levels, respectively. All coefficients are estimated using survey weighted data (Stata's svy prefix). Country dummies are included in all estimations.

As shown in Table 5 (column 1), after correcting for potential endogeneity, the coefficient on female top manager for the whole sample of firms in Africa becomes insignificant. However, when we restrict our sample to micro and small firms (see columns 3 and 5, respectively), we find evidence that women managers significantly self-select out of the credit market because of their low perception of their creditworthiness compared with that of men.

This finding can be explained by the fact that, in light of asymmetric and imperfect information in the credit market, smaller firms tend to have less information about their true creditworthiness, as they usually lack the expertise to assess their creditworthiness through reliable financial reports and, importantly, to obtain information on the creditworthiness of the pool of applicants in the credit market, leading to a perception bias. This combined with the fact that women are more risk averse than men in financial decision-making,[11] probably leads women managers of smaller firms to generate even lower perception of their creditworthiness. Besides the gender of top manager, self-selection out of the credit market in Africa is significantly determined by factors such as the age of the firm, holding an internationally recognized quality certification, and the firm's export orientation.

Women's self-selection due to low perceived creditworthiness is far stronger for firms in North Africa regardless of the sample size and firm true creditworthiness (Table 6). One possible explanation is the lower marketing and financial literacy of women entrepreneurs in the region compared with men, making it harder for women to assess their true creditworthiness. According to S&P Global FinLit Survey, the gender gap in financial literacy ranges from 5 percent in Egypt to 9 percent in Mauritania, 10 percent in Algeria, and 13 percent in Tunisia. Another explanation is the difficulties faced by women entrepreneurs in the region in presenting their investment projects to bankers or investors.

Moreover, women may lack confidence when interacting with financial institutions and therefore be unable to effectively present their business proposals (OECD, 2011). In addition to the gender of top manager, we find significant evidence that self-selection out of the credit

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[11] There is abundant evidence that women are more risk averse than men in financial decision-making (see, for example, Parrotta and Smith, 2013; Charness and Gneezy, 2012; Borghans et al., 2009).

market in North Africa is determined by other factors such as size of locality and age of firm (Table 6).

5.3. Discrimination in the Credit Market

Belief formation about own creditworthiness could be driven by present discriminatory lending practices against women by the banks. To rule out discrimination by banks as a possible driver of women's belief formation, we estimate whether firms with a female manager face higher rejection rate on their applications for new loans or new lines of credit compared with their male-led counterparts.

Table 7 presents the results for Africa and North Africa. After controlling for confounding factors, the results show no statistically significant evidence that female-managed firms in Africa and North Africa have a higher probability of rejection than male-managed firms. That is, we find no statistical evidence of credit market discrimination against female entrepreneurs in Africa or North Africa. This strengthens our argument that female entrepreneurs self-select out of the credit market due to their own low perceived creditworthiness.

Overall, application rejection rates are significantly driven by systematic characteristics such as firm size, locality size, whether the firm is in a capital city, firm age, and whether the firm's financial statements are checked and certified by an external auditor. Also, as expected, we observe a significant negative association between productivity and the probability of a firm's application being rejected. This result suggests that firms' productivity is an important indicator used by banks to assess the creditworthiness of firms, supporting our simplifying assumption in the conceptual framework that banks' predictions of creditworthiness are unbiased and coalesce toward the objective creditworthiness of applicants.

Table 7: Logit Estimates of Loan/Credit Line Application Outcomes
(by Gender of Top Manager)

Outcome Variable: What Was the Outcome of the Most Recent Application for Loan/Credit Line? Rejected:1 Approved:0	Logistic Regression	
	(1) Africa	(2) North Africa
Female Top Manager Y:1 N:0	-0.948	-0.986
	(0.631)	(1.111)
Sector (Ref: Manufacturing)		
Services	0.091	0.218
	(0.382)	(0.593)
Firm Size (Ref: Small)		
Medium	0.175	0.774
	(0.398)	(0.676)
Large	-1.082**	-0.653
	(0.480)	(0.710)
Locality Size (Ref: Main Business City)		
Over 1 million	0.741	2.119*
	(0.684)	(1.238)
250,000–1 million	-0.124	0.838
	(0.651)	(1.195)
50,000–250,000	1.661*	3.759***
	(0.862)	(1.346)
Less than 50,000	1.488*	3.053**
	(0.811)	(1.279)
Official Capital City Y:1 N:0	1.079**	2.797**
	(0.477)	(1.115)
Firm Legal Status (Ref: Shareholding Company with Shares Traded in the Stock Market)		
Shareholding Company with Non-Traded/Privately Traded Shares	0.099	-0.138
	(0.567)	(0.754)
Sole Proprietorship	-0.582	-0.626
	(0.525)	(0.765)
Partnership	-1.098	-0.869
	(0.822)	(1.177)
Limited partnership	-0.033	0.030
	(0.610)	(0.881)
Other	-0.191	0.685
	(0.891)	(1.447)
Share Foreign Ownership	0.009*	0.010
	(0.004)	(0.007)
Firm Age	-0.041***	-0.077***
	(0.015)	(0.023)
Number of Employees	-0.000	0.000
	(0.000)	(0.000)
Top Manager Experience Years	0.010	0.025
	(0.016)	(0.025)
Quality Certification Y:1 N:0	-0.135	-0.100
	(0.514)	(0.789)
Sales Per Worker	-0.576***	-0.530***
	(0.126)	(0.192)
Direct Exports Share of Sales	0.004	0.002
	(0.006)	(0.008)
External Audit Y:1 N:0	-1.149***	-0.954*
	(0.368)	(0.521)
Constant	6.542***	4.363
	(1.918)	(2.832)
Number of Observations	2,253	577

Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5 and 1 level, respectively. All coefficients are estimated using survey-weighted data (Stata's svy prefix). Country dummies are included in all estimations.

6. Conclusion

Access to finance is a key constraint for entrepreneurs in Africa, and empirical evidence shows that women entrepreneurs are at a particular disadvantage. Although supply-side factors that limit women's access to finance have been extensively addressed in the literature, little has been documented about demand-side factors, in particular, self-selectivity based on perceived creditworthiness. Within a parsimonious theoretical model of credit market with an imperfect information regime, we provide fresh evidence that, compared with men, women entrepreneurs are more likely to self-select themselves out of the formal credit market based on their perceived creditworthiness. We found that women managers of micro-size and small firms in Africa are more likely to self-select out of the credit market compared with men. Regardless of firm size, we also find stronger self-selectivity behavior in North Africa.

Moreover, we show that there is no systematic bias in loan rejection rates against women entrepreneurs and establish that the observed self-exclusion behavior from the part of women loan applicants is mainly due to their low self-perception of creditworthiness. This holds even if the results show that banks assess them favorably. Thus, we rule out the possibility that the observed low perceived creditworthiness is driven by current discriminatory lending practices by financial institutions. However, perception could be driven by other behavioral factors such as lower levels of risk tolerance and low financial literacy.

The findings of this paper have substantial policy implications in terms of addressing the gender gap in access to finance. Besides supply-side factors, there is a need to address demand-side factors such as the financial literacy of women entrepreneurs. Financially literate entrepreneurs make more informed financial decisions and assess their creditworthiness more objectively. This is especially important as the complexity of credit markets increases. Thus,

enabling women entrepreneurs with the appropriate financial knowledge and skills will ensure their effective engagement in the credit market.

Our study raises several opportunities for future research, especially regarding the causal pathways that underlie the observed gender differential in perceived creditworthiness that drives women's self-selection behavior. As we control for differences between men and women entrepreneurs in terms of talents, and between their respective firms in terms of characteristics, and as we rule out the idea that the observed self-selection behavior is driven by discrimination on the supply side of the credit market, or more generally by institutional barriers, we are left with an interesting causal pathway that requires further investigation: men and women tend to behave differently. These behavioral differences can be based, for instance, on differences in risk, social, and competitive preferences, all of which warrant further investigation.

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Appendix A: Descriptive Statistics and Estimation Results by Gender of Firm's Owner

Table A.1: Reasons for Not Applying for New Loans/Lines of Credit in the Last Fiscal Year

(by Gender of Principal/Majority Owner*)

Reason	Africa			North Africa		
	Male	Female	Pooled	Male	Female	Pooled
No need for a loan**	67.2	51.5	62.8	75.4	75.6	75.3
Application procedures were complex	9.9	10.2	10.4	9.0	6.3	8.8
Interest rates were not favorable	8.2	13.1	10.9	6.0	11.0	6.4
Collateral requirements were too high	5.4	9.6	5.8	2.1	0.8	2.1
Size of loan and maturity were insufficient	1.0	3.0	1.2	0.7	0.0	0.7
Did not think it would be approved (low perceived creditworthiness)	**3.7**	**3.0**	**4.1**	**3.6**	**2.8**	**3.6**
Other reasons	4.6	9.7	4.7	3.1	3.6	3.1
Number of Observations			37,699			6,097

* Each firm is categorized as men-owned, majority men-owned, majority women-owned, women-owned, and equally owned. Equally men- and women-owned firms report 50 percent male ownership and 50 percent female ownership; these firms represent less than 5 percent of our sample and are excluded from all ownership calculations. Survey-weighted data are used (Stata's svy prefix). ** indicates that the establishment had sufficient capital.

Table A.2: Differences in Firm Baseline Characteristics
(by Gender of Principal/Majority Owner)

Characteristic	Africa			North Africa		
	Male	Female	Pooled	Male	Female	Pooled
Sector						
Manufacturing	48.2	39.4	47.3	64.2	65.2	64.2
Services	51.8	60.6	52.7	35.8	34.8	35.8
Firm Size						
Small	55.1	72.8	56.8	41.3	52.8	41.6
Medium	30.4	21.7	29.5	35.2	33.2	35.2
Large	14.6	5.6	13.7	23.5	14.0	23.2
Locality Size						
Main Business City	19.6	12.4	18.8	34.5	31.5	34.4
Over 1 million	39.5	47.9	40.3	17.1	12.9	17.0
250,000 – 1 million	25.9	26.0	25.9	20.3	22.5	20.4
50,000 – 250,000	10.7	10.8	10.7	15.7	20.8	15.9
Less than 50,000	4.5	2.9	4.3	12.4	12.4	12.4
Official Capital City Y:1	40.8	45.0	41.2	26.5	23.0	26.3
Firm Legal Status						
Shareholding Company with Shares Traded in the Stock Market	5.8	1.7	5.3	7.0	5.1	7.0
Shareholding Company with Non-Traded/Privately Traded Shares	17.2	6.9	16.1	28.5	20.8	28.3
Sole Proprietorship	52.0	77.5	54.5	33.4	51.1	34.0
Partnership	12.1	5.7	11.4	19.3	15.2	19.2
Limited partnership	10.9	6.9	10.5	10.5	6.2	10.3
Other	2.2	1.3	2.1	1.3	1.7	1.3
Share Foreign Ownership	11.791	6.047	11.594	6.252	5.423	6.492
Firm Age	16.894	14.373	15.875	20.900	18.565	20.645
Number of Employees	72.796	57.763	65.506	128.771	71.723	132.212
Top Manager Experience Years	16.716	13.888	15.197	21.899	19.080	21.425
Quality Certification Y:1	16.1	8.9	15.4	22.9	14.4	22.6
Sales Per Worker	10.323	9.677	10.490	10.890	10.530	10.887
Direct Exports Share of Sales	5.784	4.739	4.823	8.911	12.126	8.999
External Audit Y:1	55.2	41.9	53.9	77.2	72.2	77.0
Number of Observations			37,699			6,097

For continuous variables (share foreign ownership, firm age, number of employees, top manager experience years, log sales per worker and direct exports share of sales), we report means instead of proportions.

Table A.3: Multinomial Logit Estimates of Self-Selection out of the Credit Market
(by Gender of Principal/Majority Owner in Africa)

Outcome Variable: What Is the Main Reason for Not Applying for New Loans/New Lines of Credit?	Reason			
	(1) Complex Application	(2) Unfavorable Terms	(3) Low Perception	(4) Other Reasons
Female Principal/Majority Owner Y:1 N:0	-0.393	0.101	-0.200	-0.137
	(0.431)	(0.259)	(0.459)	(0.364)
Sector (Ref: Manufacturing)				
Services	-0.217	-0.260	-0.041	-0.145
	(0.208)	(0.161)	(0.320)	(0.273)
Firm Size (Ref: Small)				
Medium	-0.418*	-0.473**	0.001	-0.175
	(0.235)	(0.196)	(0.366)	(0.338)
Large	-0.330	-1.260***	-0.437	-0.085
	(0.364)	(0.298)	(0.382)	(0.435)
Locality Size (Ref: Main Business City)				
Over 1 million	-0.449	0.414	1.041**	1.172**
	(0.346)	(0.278)	(0.500)	(0.504)
250,000 - 1 million	-0.004	0.774**	0.993**	1.144**
	(0.396)	(0.316)	(0.453)	(0.485)
50,000 - 250,000	0.059	0.918***	2.141***	1.251**
	(0.431)	(0.321)	(0.547)	(0.523)
Less than 50,000	0.076	1.053***	0.474	0.164
	(0.479)	(0.361)	(0.504)	(0.648)
Official Capital City Y:1 N:0	-0.437	0.268	0.013	-0.154
	(0.310)	(0.192)	(0.322)	(0.308)
Firm Legal Status (Ref: Shareholding Company with Shares Traded in the Stock Market)				
Shareholding Company with Non-Traded/Privately Traded Shares	-0.801	0.140	-0.192	-1.155*
	(0.495)	(0.402)	(1.051)	(0.610)
Sole Proprietorship	-0.254	0.246	0.005	0.268
	(0.448)	(0.340)	(0.956)	(0.536)
Partnership	-0.057	0.732**	-0.403	-0.493
	(0.465)	(0.371)	(1.039)	(0.575)
Limited partnership	0.116	0.414	0.819	-0.345
	(0.497)	(0.366)	(1.045)	(0.649)
Other	-1.960**	-1.468**	-2.797**	-1.254
	(0.802)	(0.694)	(1.187)	(0.848)
Share Foreign Ownership	-0.009**	0.003	0.000	-0.011***
	(0.004)	(0.004)	(0.005)	(0.003)
Firm Age	-0.004	-0.003	-0.082***	-0.044***
	(0.006)	(0.007)	(0.018)	(0.015)
Number of Employees	0.000	0.000	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Top Manager Experience Years	-0.008	0.008	0.008	0.021*
	(0.011)	(0.009)	(0.015)	(0.012)
Quality Certification Y:1 N:0	-0.094	-0.098	-1.319***	-0.451
	(0.363)	(0.229)	(0.409)	(0.381)
Sales Per Worker	-0.038	-0.079	-0.146**	0.039
	(0.058)	(0.050)	(0.066)	(0.084)
Direct Exports Share of Sales	-0.005	-0.010*	-0.014**	-0.017***
	(0.005)	(0.006)	(0.006)	(0.006)
External Audit Y:1 N:0	-0.434**	-0.162	0.658**	0.744***
	(0.208)	(0.158)	(0.322)	(0.257)
Constant	-0.937	0.159	-3.173**	-2.083
	(0.923)	(0.841)	(1.487)	(1.359)
Number of Observations	10,603	10,603	10,603	10,603

Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5 and 1 level, respectively. All coefficients are estimated using survey-weighted data (Stata's svy prefix). Country dummies are included in all estimations. Reference category: No need for a loan.

Table A.4: Multinomial Logit Estimates of Self-Selection
(by Gender of Principal/Majority Owner in North Africa)

Outcome Variable: What Is the Main Reason for Not Applying for New Loans/New Lines of Credit?	Reason			
	(1) Complex Application	(2) Unfavorable Terms	(3) Low Perception	(4) Other Reasons
Female Principal/Majority Owner Y:1 N:0	-0.418	0.460	-0.018	-3.830***
	(0.791)	(0.628)	(0.868)	(0.755)
Sector (Ref: Manufacturing)				
Services	-0.157	-0.328	0.033	-0.040
	(0.249)	(0.233)	(0.387)	(0.408)
Firm Size (Ref: Small)				
Medium	-0.492*	-0.339	0.122	-0.399
	(0.277)	(0.269)	(0.436)	(0.502)
Large	-0.578	-1.259***	-0.062	0.384
	(0.422)	(0.454)	(0.533)	(0.731)
Locality Size (Ref: Main Business City)				
Over 1 million	-0.748*	0.682	1.128	2.074**
	(0.427)	(0.474)	(0.694)	(1.008)
250,000 - 1 million	-0.120	1.110**	0.860	2.016**
	(0.414)	(0.460)	(0.664)	(0.993)
50,000 - 250,000	-0.002	1.254***	2.370***	2.362**
	(0.459)	(0.468)	(0.662)	(1.017)
Less than 50,000	-0.042	1.364***	0.566	1.028
	(0.496)	(0.497)	(0.659)	(1.112)
Official Capital City Y:1 N:0	-0.680*	0.603	0.212	1.139
	(0.384)	(0.425)	(0.635)	(1.032)
Firm Legal Status (Ref: Shareholding Company with Shares Traded in the Stock Market)				
Shareholding Company with Non-Traded/Privately Traded Shares	-0.964*	0.297	-0.957	-2.159**
	(0.581)	(0.573)	(1.213)	(0.938)
Sole Proprietorship	-0.256	0.297	-0.590	-0.205
	(0.513)	(0.529)	(1.098)	(0.753)
Partnership	-0.095	0.906*	-1.083	-1.351*
	(0.525)	(0.529)	(1.206)	(0.788)
Limited partnership	0.024	0.361	0.069	-1.078
	(0.567)	(0.570)	(1.173)	(0.886)
Other	-2.942**	-0.260	-14.752***	-1.811
	(1.386)	(0.971)	(1.269)	(1.223)
Share Foreign Ownership	-0.010*	0.006	0.003	-0.016**
	(0.006)	(0.005)	(0.007)	(0.008)
Firm Age	-0.003	0.001	-0.118***	-0.083***
	(0.007)	(0.008)	(0.026)	(0.030)
Number of Employees	0.000	0.000	0.001***	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
Top Manager Experience Years	-0.006	0.010	0.012	0.037**
	(0.013)	(0.012)	(0.019)	(0.017)
Quality Certification Y:1 N:0	-0.002	-0.230	-1.579***	-0.464
	(0.452)	(0.351)	(0.530)	(0.735)
Sales Per Worker	-0.015	0.030	-0.179*	-0.071
	(0.084)	(0.101)	(0.102)	(0.164)
Direct Exports Share of Sales	-0.006	-0.005	-0.018**	-0.019*
	(0.007)	(0.007)	(0.008)	(0.010)
External Audit Y:1 N:0	-0.408*	-0.264	1.110**	1.190***
	(0.241)	(0.232)	(0.501)	(0.447)
Country (Ref: Egypt)				
Mauritania	0.365	1.669**	0.654	1.156
	(0.813)	(0.661)	(1.253)	(1.190)
Morocco	-1.025**	-0.536	-0.710	-0.496
	(0.496)	(0.414)	(0.916)	(0.624)
Tunisia	0.784**	0.706*	1.960***	1.043
	(0.396)	(0.382)	(0.584)	(0.705)
Constant	-0.495	-3.507***	-1.253	-3.723*
	(1.121)	(1.273)	(1.743)	(2.081)
Number of Observations	3,775	3,775	3,775	3,775

Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5 and 1 percent level, respectively. All coefficients are estimated using survey-weighted data (Stata's svy prefix). Reference category: No need for a loan.

Table A.5: IV Estimates of Self-Selection Due to Low Perceived Creditworthiness

(by Gender of Principal/Majority Owner in Africa and Firm Size)

Variables	All Firms		Small Firms		Micro Firms	
	(1)	(2)	(3)	(4)	(5)	(6)
	Low Perception	First-Stage	Low Perception	First-Stage	Low Perception	First-Stage
Female Principal/Majority Owner Y:1 N:0	2.485*		2.866***		2.444**	
	(1.518)		(1.026)		(1.170)	
Sales per Worker	-0.040		-0.043		-0.062	
	(0.030)		(0.028)		(0.041)	
Proportion of Female Employees		0.117***		0.167***		0.206***
		(0.036)		(0.046)		(0.056)
Proportion of Female Employees (Missing)		0.009		-0.006		-0.022
		(0.013)		(0.014)		(0.019)
Constant	-2.609***	0.287***	-2.880***	0.286**	-1.626**	0.277**
	(0.573)	(0.094)	(0.617)	(0.126)	(0.666)	(0.111)
F-Stat (IVs Joint Significance)		10.53		13.66		15.09
Number of Observations	10,603	10,603	6,009	6,009	3,421	3,421
With Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5 and 1 level, respectively. All coefficients are estimated using survey-weighted data (Stata's svy prefix). Country dummies are included in all estimations.

Table A.6: IV Estimates of Self-Selection Due to Low Perceived Creditworthiness

(by Gender of Principal/Majority Owner in North Africa and Firm Size)

Variables	All Firms		Small Firms		Micro Firms	
	(1)	(2)	(3)	(4)	(5)	(6)
	Low Perception	First-Stage	Low Perception	First-Stage	Low Perception	First-Stage
Female Principal/Majority Owner Y:1 N:0	4.573***		4.200***		4.604***	
	(1.773)		(1.554)		(1.364)	
Proportion of Female Employees		0.074		0.139*		0.161*
		(0.050)		(0.072)		(0.096)
Proportion of Female Employees (Missing)		0.004		-0.007		-0.029*
		(0.011)		(0.017)		(0.016)
Constant	-1.803***	0.118**	-1.398***	0.055	-0.328	0.057
	(0.500)	(0.048)	(0.485)	(0.037)	(0.462)	(0.052)
Number of Observations	4,267	4,267	1,816	1,816	943	943
With Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5 and 1 percent level, respectively. All coefficients are estimated using survey-weighted data (Stata's svy prefix). Country dummies are included in all estimations. The p-value associated with the "Proportion of Female Employees" in the "All Firms" estimation equals 0.141. The removal of "Sales per Worker" corresponded to a significant increase in the validity of the instrumental variable "Proportion of Female Employees."

Table A.7: Logit Estimates of Loan/Credit Line Application Outcomes

(by Gender of Principal/Majority Owner)

Outcome Variable: What Was the Outcome of the Most Recent Application for Loan / Credit Line? Rejected:1 Approved:0	Logistic Regression	
	(1) Africa	(2) North Africa
Principal/Majority Owner Y:1 N:0	-0.986*	-1.889
	(0.527)	(1.375)
Sector (Ref: Manufacturing)		
Services	-0.064	-0.120
	(0.391)	(0.595)
Firm Size (Ref: Small)		
Medium	0.238	0.709
	(0.445)	(0.733)
Large	-0.844*	-0.405
	(0.471)	(0.706)
Locality Size (Ref: Main Business City)		
Over 1 million	1.312*	2.641**
	(0.720)	(1.168)
250,000 - 1 million	0.453	1.463
	(0.712)	(1.197)
50,000 - 250,000	2.860***	4.840***
	(0.935)	(1.421)
Less than 50,000	2.164**	3.654***
	(0.891)	(1.390)
Official Capital City Y:1 N:0	1.370**	2.750**
	(0.573)	(1.176)
Firm Legal Status (Ref: Shareholding Company with Shares Traded in the Stock Market)		
Shareholding Company with Non-Traded/Privately Traded Shares	-0.282	-0.366
	(0.639)	(0.780)
Sole Proprietorship	-0.804	-1.189
	(0.576)	(0.854)
Partnership	-0.524	-0.360
	(0.746)	(1.050)
Limited partnership	-0.222	-0.291
	(0.642)	(0.848)
Other	-0.306	0.346
	(0.975)	(1.575)
Share Foreign Ownership	0.007	0.009
	(0.005)	(0.007)
Firm Age	-0.012	-0.032
	(0.015)	(0.020)
Number of Employees	-0.000	0.000
	(0.000)	(0.001)
Top Manager Experience Years	-0.007	-0.002
	(0.019)	(0.029)
Quality Certification Y:1 N:0	-0.665	-0.946
	(0.585)	(0.903)
Sales Per Worker	-0.511***	-0.420**
	(0.125)	(0.173)
Direct Exports Share of Sales	0.005	0.002
	(0.006)	(0.008)
External Audit Y:1 N:0	-1.084***	-0.824
	(0.409)	(0.561)
Constant	4.741**	3.182
	(2.100)	(2.782)
Number of Observations	1,982	546

Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10, 5 and 1 percent level, respectively. All coefficients are estimated using survey-weighted data (Stata's svy prefix). Country dummies are included in all estimations.