Gender and Firm Performance in Africa: Does the Business Environment Play a Moderating Role?

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Bringing Rigour and Evidence to Economic Policy Making in Africa

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Abstract

This paper examines the moderating role of the business environment in the relationship between the gender of the top manager and firm performance (measured as sales per employee), and whether female-managed firms perform better the higher the proportion of female employees in the firm. The paper uses World Bank Enterprise Survey data of 14,561 firms from 29 African countries collected between 2010 and 2016. The descriptive analysis reveals significant variation in the performance and experience of business environment constraints that disadvantage female-managed firms. Controlling for potential endogeneity and country fixed effects, we show that female-managed firms are associated with lower performance compared to male-managed firms. Electricity outages, informal competition and corruption account for the performance gap between female- and male-managed firms. However, we show that *large* female-managed firms perform better than large male-managed firms. Overall, the results imply that strengthening Africa's business environment is central to closing the performance gap between male and female managers.

***Key words*:** Africa, firms, performance, gender, business environment

1. Introduction

There is increasing interest in the role that the gender of top managers (hereinafter referred to as gender of manager) plays in firm performance. Although there have been interventions to increase the proportion of women in top management positions, recent evidence shows that gender parity has not been achieved, with the proportion of women reaching top positions remaining low in most countries (Amin and Islam, 2014). Furthermore, the literature on the relationship between the gender of managers and firm performance is inconclusive.

Some evidence suggests that male-managed firms are associated with increased firm performance (Khan and Vieito, 2013; Concetta et al, 2014), but a more common finding is that female managers are associated with lower firm performance (Brush et al, 2006; Amin, 2011; Bardasi et al, 2011; Hallward-Driemeier, 2013; Gui-Diby et al, 2017; Okumu and Mawejje, 2020; Islam et al, 2020). Other studies find no significant difference, including Du Rietz and Henrekson (2000) for Swedish firms, Depalo and Lotti (2014) for Italy, and Niringiye (2014) for Ugandan firms.[1]

Using World Bank Enterprise Survey (ES) data, this paper contributes to the empirical literature by investigating the relationship between the gender of a manager and firm performance as measured by sales per employee for 14,561 firms from 29 African countries. Specifically, this study seeks to understand whether the nature of the business environment proxied by electricity outages (Asongu and Odhiambo, 2019; Islam et al, 2020; Okumu and Mawejje, 2020), corruption (Dal Bo and Rossi, 2007; Bbaale and Okumu, 2018; Okumu and Mawejje, 2020), credit access (Islam et al, 2020; Okumu and Mawejje, 2020) and informal competition (Okumu and Mawejje, 2020), moderates the relationship between the gender of the manager and firm-level performance. In doing so, this paper is most closely related to Flabbi et al (2019) who attempt to understand the moderating effect of the fraction of female workers employed in the relationship between gender of the manager and performance. The unique contribution of this paper is the consideration of the business environment as a moderating factor in the relationship between gender of the manager and firm performance.

The specific focus of this paper is to identify any moderating effect of the business environment on the relationship between gender of the manager and firm performance. The available literature suggests that the inverse relationship between female managers and firm performance is attributed to a high level of risk aversion

among women that influences their investment decisions, and that women may self-select employment in sectors with lower performance (Baliamoune-Lutz and Lutz, 2017). However, no study has attempted to analyse whether there is a difference in the way different types of managers (by gender) react to constraints in the business environment, which could in turn induce differences in performance. This study seeks to fill this gap by exploring the moderating role of the business environment in the relationship between gender and firm performance.

Female-managed firms are defined as firms where the top manager is a woman while male-managed firms are those where the top manager is a man. An exploration of the data indicates that there is a significant performance gap between male- and female-managed firms, especially in manufacturing firms. Furthermore, there is a significant wedge between female-managed and male-managed firms in terms of their experience with the business environment. Losses due to electricity outages and informal competition disproportionately hurt female-managed firms in comparison to male-managed firms, irrespective of the sector, while bribe payments more significantly affect male-managed firms in comparison to female-managed firms, irrespective of the sector. With regards to firm size, while informal competition decreases with firm size across both male- and female-managed firms, female-managed firms experience more informal competition compared to male-managed medium-sized and large firms. Furthermore, across all sizes of firms, male-managed firms have a higher likelihood of paying a higher proportion of their sales in the form of bribes in comparison to female-managed firms. With respect to losses due to electricity outages, generally female-managed firms experience higher losses due to electricity outages in comparison to male-managed firms, especially in medium-sized firms. In addition, female-managed firms experience higher losses due to electricity outages in larger firms.

Owing to the existence of a gender performance gap and variations in experiences of business environment constraints between female- and male-managed firms, we further undertook an econometric analysis to explore whether the gender of the manager significantly affects firm performance and whether the business environment moderates the relationship between gender and firm performance. The results indicate that female-managed firms are associated with lower performance compared to male-managed firms. Furthermore, a weak business environment, characterized by electricity outages, informal competition and corruption ,exacerbates the performance gap between male- and female-managed firms.

The rest of the paper is organized as follows: Section 2 captures the literature review, Section 3 analyses the data characteristics and includes the descriptive analysis, while Section 4 describes the empirical strategy, Section 5 presents the econometric results and discussion of findings, and Section 6 concludes.

2. Literature review

There is no consensus on the relationship between the gender of the manager and firm performance, with various authors finding positive, negative or neutral outcomes. Among the empirical literature showing the positive effects of female leadership, Khan and Vieito (2013) show that female CEOs are associated with higher return on assets in a panel of US firms. Furthermore, Concetta et al (2014) find that female-managed Italian manufacturing firms are associated with higher performance compared to male-managed firms, perhaps because investment in tangible assets (buildings, installations and machinery) is associated with performance gains compared to investment in intangible assets (such as investments in research and development, patents and advertising) and that female participation in management increases the elasticity of tangible rather than intangible assets. Interestingly, Concetta et al (2014) find that mixed-managed firms are more productive than female or male-only managed firms, suggesting that complementarities between female and male managers improve performance.

A large strand of the empirical literature supports the underperformance hypothesis. Islam et al (2020) used a large data set of 128 mostly developing countries to show that female-managed firms are less productive in comparison to male-managed firms. The results reveal a sizeable unconditional gap, with labour productivity being approximately 11% lower among female than male-managed firms. The findings were attributed to the fact that fewer female than male-managed firms protect themselves from crime and electricity outages, have their own websites, and are (co-)owned by foreigners. In addition, within the manufacturing sector, female-managed firms are less capitalized and have lower labour costs than male-managed firms. Furthermore, using USA firm-level data, Brush et al (2006) show that the average revenue of female-owned firms is about 26% of the average for male-owned firms. Using Argentinian and Peruvian data from unregistered firms, Amin (2011) argues that a typical worker in a female-owned business produces only 76% of the output of a worker in a male-owned business. More support for the hypothesis was found by Bardasi et al (2011) for Europe, Central Asia and Latin America; Rijkers and Costa (2012) for Bangladesh, Ethiopia and Sri Lanka; Hallward-Driemeier (2013) for sub-Saharan Africa; and Gui-Diby et al (2017) for Asia.

The neutrality hypothesis suggests that performance differences do not exist between female- and male-managed firms. Du Rietz and Henrekson (2000) use Swedish firm-level data to show that there are no gender differences in terms of profitability among male- and female-managed firms. Similarly, using Chinese firm-level data Lam et al (2013) find no gender differences in return on assets between male- and female-managed firms. Considering firms operating in sectors other than agriculture and services, and using different indicators of performance, Depalo and Lotti (2014) also find no significant difference between male- and female-managed firms. Looking at firm efficiency as measured by the average productivity of labour, Amin (2010) finds no significant difference between male- and female-owned firms. Similar results were obtained by Niringiye (2014) for Uganda.

The recent literature suggests that the relationship between female-managed firms and performance is conditioned on the number of female workers employed. For example, using a matched employer-employee panel data set of Italian firms, Flabbi et al (2019) show that before taking into account the share of female workers, female CEOs do not appear to have a significant impact on firm performance. The positive impact is only realized after interacting female leadership with the share of female workers employed by the firm, which suggests that the positive relationship between female managers and performance is conditioned on having more female workers. Similarly, Lindstädt et al (2011) use a sample of German firms to show that the positive relationship between female supervisory board members and firm performance is conditioned on having a high proportion of women in the workforce. Similar results were obtained by Wolfers (2006) and Albanesi et al (2015). The main justification for these results is that female executives improve the allocation of female talent within the firm by counteracting pre-existing statistical gender discrimination, which has implications on firm productivity (Flabbi et al, 2019).

The reviewed empirical literature suggests that the debate on the relationship between gender of the manager and firm performance is not conclusive. Moreover, there is limited evidence from Africa. Following the empirical literature on the moderating factors in the relationship between firm performance and gender of the manager, this paper contributes to the empirical literature by investigating whether the business environment plays an instrumental role in the relationship between gender of the manager and firm performance.

3. Data source and description

This study uses the World Bank Enterprise Surveys (WBES) data set for manufacturing and services firms. The WBES are nationally representative surveys of formal (registered) firms with at least five employees and cover manufacturing and services firms, excluding extractive industries and the agriculture sector. They use standardized survey instruments and a uniform sampling methodology to minimize measurement error and to yield data that are comparable across countries. To ensure a representative sample, the surveys are implemented using stratified random sampling. Stratification is conducted using three criteria: sector of activity, firm size and geographical location. Stratification by sector of activity is done using a two-digit ISIC (revision 3.1), which categorizes firms into manufacturing, retail and other services. Stratification by firm size divides the population of firms into three strata: small firms (5–19 employees), medium firms (20–99 employees) and large firms (100 or more employees). In the survey, geographical distribution is defined to reflect the distribution of the non-agricultural economic activity of the country, which in essence leads to the inclusion of main urban centres as non-agricultural activities concentrated in urban centres.

This study includes 29 African countries covering a cross-section of firms surveyed between 2010 and 2017, giving a sample of 15,000 firms, of which 54% are engaged in the services and about 46% in the manufacturing sector (see Table 1a). The analysis is restricted to the most recent wave of surveys conducted after 2010 (listed in Appendix Table A2). The questionnaires are completed by business owners and/or top managers, although respondents may have sought the guidance of company accountants and human resource managers during the interview, to answer questions regarding the sales and labour sections of the survey.

Table 1a: Descriptive statistics

Variable	Observations	Mean	Median	Minimum	Maximum
Sales per worker (constant US$)	15,000	29,619	6,129	0.907	753,717
Gender (1=Female)	14,888	0.122	0	0	1
Share of female employees	14,976	0.244	0.179	0	1
Losses due to power outages	14,457	8.745	3	0	100

Line of credit (1=Yes)	14,202	0.229	0	0	1
Informal payment (% of sales)	15,000	1.437	0	0	100
Formal training (1=Yes)	14,780	0.277	0	0	1
Manager's experience	15,000	16.660	15	0	72
Firm size (1=Small)	15,000	0.569	1	0	1
Firm size (2=Medium)	15,000	0.296	0	0	1
Firm size (3=Large)	15,000	0.135	0	0	1
Exportation (1=Yes)	15,000	0.259	0	0	1
Certification (1=Yes)	14,138	0.154	0	0	1
Age of the firm	15,000	17.150	14	1	211
R&D (1=Yes)	14,050	0.179	0	0	1
Informal competition (1=Yes)	14,147	0.591	1	0	1
Sector (1=Services)	15,000	0.543	1	0	1
Sector (2=Manufacturing)	15,000	0.457	0	0	1

Notes: (i) Descriptive statistics were computed by the authors using WBES data; (ii) Summary statistics were calculated for 29 countries (see list of countries in Table A2).

Given that the surveys are conducted using the same methodology across all countries, a cross-country comparison is possible. Potential differences are captured in business environment aspects across countries. However, it is important to note that WBES has a number of self-reported responses that are sometimes subjective. Nonetheless, the data set is widely used in empirical research and produces robust results.

Given the likelihood of outliers in performance data, we employed blocked adaptive computationally efficient outlier nominators as suggested by Billor, Hadi and Velleman (2000) at the 15th percentile to exclude outliers. To further enable comparability of data across countries, all values in local currency units are converted to constant 2010 United States dollars using annual average exchange rates obtained from the World Bank (2019).

Performance is proxied by sales per worker, measured as a firm's total annual sales in the fiscal year prior to the survey, divided by the number of permanent full-time employees at the firm in the fiscal year prior to the survey. The average sales per worker at constant 2010 US$ in the sample is US$29,619, with a maximum value of US$753,717 (Table 1a). Considering firm size: 56.9% of firms in the sample are small, 29.6% are medium-sized and only 13.5% are large. Average sales per worker across firm sizes are US$22,396, US$34,072, and US$50,268, respectively. Unsurprisingly, sales values increase with a larger firm size.

Regarding the gender of the manager, 12.2% of firms are managed by female managers. Lesotho has the highest share of female-managed firms, estimated at 32.5%, while Sudan has the lowest at 3.5% (Table A2). Relatedly, 24.4% of employees across all firms are female. There are significant differences in the share of female employees when taking into account the gender of the manager, with female-managed

firms employing 24% more women compared to male-managed firms (Table 1b). While female-managed firms have a higher share of female employees across all firm sizes, the difference in the share of female employees between male-managed and female-managed firms reduces with firm size. Across sectors, the difference in the share of female employees is highest among manufacturing firms (Table 1b).

There are apparent gender differences across male- and female-managed firms that are attributed to gender bias. For example, there is a 12.7% mean performance difference between female- and male-managed firms, which reflects a gender bias in favour of male-managed firms (see Table 1b). Sectoral disaggregation shows that while there is a positive mean difference between female- and male-managed services firms, the difference is marginally significant (at 10%). However, among manufacturing firms there is a 21% mean difference between female- and male-managed firms in favour of male-managed firms (see Table 1b). Among small, medium-sized and large firms there are no significant differences in performance by gender (see Table 1b).

Regarding the business environment indicators of interest for the study, losses due to electricity outages (a proxy for the quality of public physical infrastructural services) is measured as annual losses as a percentage of sales due to power outages in the last fiscal year. On average, firms lose about 8.7% of their sales as a result of power outages. Bribe payments are measured as the percentage of a firm's sales that respondents state are paid informally to government officials, which are unaudited and unreported. On average, 1.4% of firms' sales annually are paid as bribes to government bureaucrats. Informal competition measures whether a firm competes against unregistered or informal establishments. About six in every 10 registered firms (59.1%) in Africa reportedly experience competition from the informal sector. Credit access measures whether a firm has a line of credit or a loan from a financial institution. From the data, only 23% of the surveyed firms have lines of credit.

The descriptive analysis (see Table 1b) also suggests that a firm's self-reported experience of the business environment exhibits gender differences. For example, female-managed firms experience more informal competition and losses due to power outages compared to male-managed firms, by a magnitude 4.2% and 0.83%, respectively (see Table 1b). A sectoral decomposition shows that across both services and manufacturing firms female-managed firms experience more informal competition and losses due to power outages compared to male-managed firms. Regarding bribe payments, male-managed firms pay more bribes than female-managed firms, comprising 0.37% of their sales. A disaggregation across services and manufacturing firms shows that these gender differences are not sector specific.

Concerning firm size, there are no significant differences between male- and female-managed firms in terms of informal competition and access to credit. However, medium-sized female-managed firms incur higher losses due to power outages compared to male-managed firms of the same size. Conversely, male-managed medium-sized firms pay a slightly higher percentage of their sales in bribes compared to female-managed firms of the same size.

Table 1b: Test of mean difference for key variables of interest by gender of top manager

Variables	Male managed	Female managed	Mean diff
Overall			
Sales per worker (US$)	30,678	26,794	3,884**
Losses due to power outages (% of sales)	8.655	9.480	-0.825**
Bribe payments (% of sales)	1.482	1.113	0.368**
Informal competition (1=Yes)	0.586	0.629	-0.042***
Line of credit (1=Yes)	0.231	0.220	0.011
Share of female employees	0.215	0.455	-0.240***
Services sector			
Log of sales per worker	34,135	30,099	4,036*
Losses due to power outages (% of sales)	6.880	8.150	-1.27***
Bribe payments (% of sales)	1.350	1.020	0.326
Informal competition (1=Yes)	0.605	0.645	-.0396**
Line of credit (1=Yes)	0.224	0.213	0.011
Share of female employees	0.253	0.476	-0.223***
Manufacturing sector			
Log of sales per worker	26,793	21,128	5,665**
Losses due to power outages (% of sales)	10.70	11.80	-1.17*
Bribe payments (% of sales)	1.630	1.270	0.362
Informal competition (1=Yes)	0.565	0.600	-.0354*
Line of credit (1=Yes)	0.238	0.231	0.007
Share of female employees	0.172	0.420	-0.248***
Small firms			
Log of sales per worker	23,441	22,096	1,345
Losses due to power outages (% of sales)	9.370	9.620	-0.246
Bribe payments (% of sales)	1.480	1.220	0.264
Informal competition (1=Yes)	0.653	0.656	-0.003
Line of credit (1=Yes)	0.155	0.173	-0.018
Share of female employees	0.212	0.504	-0.292***
Medium-sized firms			
Log of sales per worker	34,388	33,122	1,266
Losses due to power outages (% of sales)	8.380	10.20	-1.79**
Bribe payments (% of sales)	1.650	0.983	0.664*
Informal competition (1=Yes)	0.548	0.590	-0.042
Line of credit (1=Yes)	0.275	0.302	-0.027
Share of female employees	0.222	0.350	-0.128***

Large firms			
Log of sales per worker	50,326	55,042	-4,715
Losses due to power outages (% of sales)	6.410	5.660	0.748
Bribe payments (% of sales)	1.120	0.429	0.693
Informal competition (1=Yes)	0.419	0.479	-0.061
Line of credit (1=Yes)	0.421	0.413	0.008
Share of female employees	0.209	0.283	-0.074***

* significance at 10%; ** significance at 5%, *** significance at 1%

Source: Authors' own construction using ES data.

Further descriptive analysis shows that the likelihood of facing informal competition decreases with firm size, regardless of the gender of the manager. That is, both male- and female-managed small firms experience a higher probability of facing informal competition compared to medium-sized and large firms (see Figure A1, panel a). In both medium-sized and large firms, female-managed firms experience a high probability of facing informal competition (but the difference is insignificant).

Male-managed firms pay a higher proportion of their sales as bribes across small, medium-sized and large firms compared to female-managed firms (see Figure A1, panel c). Figure A1, panel c, also shows that the movement from small to medium-sized is associated with an increase in bribe payments for both male-managed and female-managed firms, with the latter paying a higher share. Moving from a medium-sized to a large firm size is associated with declining bribe payment behaviour. Whereas bribes paid by male-managed firms continues to fall in large firms, female-managed firms exhibit an increasing trend to the extent of convergence, whereafter female-managed firms are more likely to pay more bribes than male-managed firms.

Considering the losses due to power outages, generally female-managed firms experience higher losses due to power outages in comparison to male-managed firms (Figure A1, panel d). This is especially true among medium-sized firms with losses increasing along with firm size.

Firm characteristics used in the study include: size, measured by the number of (permanent full-time) employees; age, the difference between the year of the survey and the year the firm commenced operations in logarithms (to abate the risk of extreme values biasing regression results); and managerial experience, the number of years a firm's manager has spent in that line of operation. Formal training is a dummy variable taking a value of 1 if a firm conducted formal training programmes, otherwise 0. Export status is informed by a firm's response to the question: What percentage of sales was exported? The variable *Export* takes a value of 1 if the percentage of sales exported (both directly and indirectly) is greater than zero, otherwise 0. Research and development (R&D) is a binary variable and equals 1 if a firm had spent money on formal research and development activities, excluding market research surveys, otherwise 0.

The descriptive statistics for the control variables are presented in Table A1. Notably, there are significant gender differences in the control variables. Male managers are likely to have more experience compared to female managers. Male-managed firms are, on average, older than female-managed firms, are more likely to engage in exportation and are more likely to have international certification. Female-managed firms are more likely to invest in R&D compared to male-managed firms (Table A1). There is also visible self-selection behaviour with a high concentration of female-managed small firms operating in the services sector.

The preceding descriptive statistics allude to two things: (i) the existence of a gender performance gap, and (ii) variations in the experiences of business environment constraints between female- and male-managed firms, especially related to bribe payments and losses due to power outages. This raises the empirical question whether the gender of the manager significantly affects firm performance, and whether the experience of the business environment moderates or exacerbates gender differences in firm performance. Accordingly, the subsequent subsections of the paper are devoted to exploring these empirical questions.

4. Empirical strategy

To achieve our study objectives, we regress measures of firm performance on gender of the firm manager and a set of controls including business environment indicators (as highlighted earlier) and the share of female workers (to capture the effect of gender composition of the workforce). Based on the literature and the need to control for firm heterogeneity we include firm characteristics as additional control variables. Accordingly, the baseline model is given by:

$$lny_{icj} = \beta_0 + \beta_1 Gender_{icj} + \beta_2 Fem_{icj} + \theta' BE_{icj} + \psi' X_{icj} + \eta_j + \mu_c + \varepsilon_{icj} \quad (1)$$

Where i, c and j are index firm, country and sector, respectively, and lny is the log of sales per worker (as the performance measure). The gender of the manager is a dummy variable, with $Gender$=1 if the manager is female, and 0 otherwise. Fem is the share of female employees in a firm. BE is a vector of business environment indicators: losses due to power outages, dummy for access to credit, bribe payments and dummy for informal competition. X is a vector of firm-specific characteristics: firm size, firm age, managerial experience, formal training, ownership, export status, quality certification and R&D. ε_{ijc} is the error term. β_1 measures by how much performance changes when a manager is female compared to when manager is a male. β_2 measures by how much performance changes when the share of female employees changes. η_j represents unobserved sector heterogeneity, μ_c represents unobserved country heterogeneity, ε_{ijc} is an idiosyncratic error term that may vary between firms, sectors and countries, and is assumed to be independently distributed with $E(\varepsilon_{icj}) = 0$.

To explore the effect of business environment (BE) indicators in the relationship between gender of manager and performance, we also estimate the following equation:

$$= \beta_0 + \beta_1 Gender_{icj} + \beta_2 Fem_{icj} + \theta' BE_{icj} + \varphi'(Gender * BE)_{icj} + \psi' X_{icj} + \eta_j + \mu_c + \varepsilon_{icj} \quad (2)$$

where φ is a vector of coefficients that indicates the moderating effect of the BE in the relationship between the gender of the top manager and firm performance, and ψ is a vector of coefficients for firm-specific characteristics (variables defined previously, see Table 1a). We also explore whether the share of female workers (Fem) affects the relationship between gender of manager and firm performance by including an interaction term:

$$lny_{icj} = \beta_0 + \beta_1 Gender_{icj} + \beta_2 Fem_{icj} + \theta' BE_{icj} + \phi' (Gender * Fem)_{icj} + \psi' X_{icj} + \eta_j + \mu_c + \varepsilon_{icj} \quad (3)$$

where Φ is a vector of coefficients that indicates the effect of the proportion of female workers in the relationship between gender of the manager and firm performance. All other variables are as defined before.

Following studies such as those by Du Rietz and Henrekson (2000), Gui-Diby et al (2017) and Islam et al (2020), we employ the pooled ordinary least squares (OLS) technique to estimate the models in Equations 1, 2 and 3. To account for heterogeneity, we check if the interactive effect of gender and business environment on performance varies by firm size and sector.

Estimating the above models using pooled OLS may suffer from endogeneity and selection bias issues. For example, among the business environment indicators, informal payment is most likely to be endogenous as highly productive firms are more likely to be able to afford bribe payments to overcome bureaucratic hurdles compared to less productive firms (Mawejje and Okumu, 2016; Bbaale and Okumu, 2018). Therefore, bribe payments become a consequence of performance rather than a cause. Similarly, more productive firms are more likely to access a line of credit and perhaps are likely to face limited informal competition compared to less productive firms. To the extent that women are broadly disadvantaged in Africa, there may also be selection bias if only exceptional women get leadership roles. Unfortunately, data are not available to control for gender selection into management. Consequently, pooled OLS estimators are likely to be biased and inconsistent. Moreover, the bias and the inconsistency are not confined to the coefficients on the endogenous variables.

Although we acknowledge endogeneity concerns, it is not feasible using the available data to identify good instruments for gender, informal competition and access to credit. As such we proceed to explore the data in a more coherent manner while addressing endogeneity arising from bribe payments by re-estimating using an instrumental variable two-stage least squares approach (IV-2SLS). This approach requires the identification of instruments that satisfy two assumptions: 1) the instrument is correlated with the endogenous covariate; and 2) the instrument is uncorrelated with the error term, implying that the instrument only affects the dependent variable through its influence on the endogenous covariates. Country-sector-size averages of the endogenous variables (excluding the firm's own response,

"leave out" means) have been argued to satisfy the above assumptions by, for example, Aterido et al (2011), Mawejje and Okumu (2016), Mawejje and Okumu (2018) and Okumu and Mawejje (2020). Accordingly, we construct instruments using sector-country-size "leave out" means for bribe payments (informal payments). Under this set-up, the firm's response for bribe payments is instrumented by the country-sector-size averages of the percentage of sales paid as bribes, excluding by comparator firms.

Constructing the instrument in this manner implies that the percentage of sales paid as a bribe by firm i can be decomposed into the portion that depends on firm $i's$ characteristics (B_i) and the proportion that depends on country-sector-size bribe payment behaviour (B_{-ijcs}) so $B_{ijcs} = B_i + B_{-ijcs}$. The component B_{-ijcs} is assumed to be exogenous as the performance of firm ii has no impact on B_{-ijcs} but country-sector-size average (B_{-ijcs}) is thought to influence the bribe payment behaviours of firm i, thus making B_{-ijcs} a better instrument.[2]

However, the use of country-sector-size "leave out" means is limited when there are many small cell sizes (so the "leave out" mean is not the true population value). In our sample, using the 2-digit ISIC level, the smallest cell size is 1 and the largest is 939. Consequently, following Aterido et al (2011) and Okumu and Mawejje (2020), we restrict the minimum number of firms in a cell to 4 (we acknowledge that this is very small, but adopting more reasonable sizes of 30 or above leaves too few usable cells). For cells less than four (11.5% of the firms in the sample), we used country-size averages of percentage of sales paid as a bribe, excluding firm $i's$ own response. Given that there are only a few firms in this category, we believe that this wouldn't bias our results. This type of instrumenting, therefore, enables us to deal with the reverse causality and measurement errors that are common in firm-level responses. However, the strengths of the IV method depends on whether the variable thought to be endogenous is indeed endogenous, and the strength and validity of the instruments. Durbin and Wu-Hausman tests are used to test whether a bribe payment is indeed endogenous, while the Cragg-Donald test is used to ascertain the strength of the instruments. We acknowledge the low power of these tests, especially with small cells, and are cautious in our interpretation.

Another form of selection bias arises if women are more likely to be active in specific sectors or industries (Marlow and McAdam, 2013). We allow for this by estimating two sub-samples based on sector (manufacturing and services) using the ISIC code provided in the WBES.[3]

5. Econometric results

We first present the results highlighting the relationship between firm performance and gender of the manager while controlling for the business environment and other controls. The results are estimated using a pooled OLS technique and are then compared with IV-2SLS estimators. Second, we present the results for the moderating role of the share of female workers and the business environment. To examine the moderating role of the business environment, all four business environment indicators were interacted with the gender of the top manager, and the relationships were examined across firm size and sectors, while controlling for country fixed effects and firm-specific characteristics.

Gender, business environment and firm performance

In Tables 2 and A3 we present the impact of gender on firm performance while controlling for several firm-specific characteristics and country fixed effects. Note that results of the instrumental variable technique (Table A3) for this estimation suggests the absence of endogeneity in all models (except the services sector model) as the p-values for the Durbin and Wu-Hausman tests are greater than 0.05. Accordingly, the discussion for the baseline model is centred on the results in Table 2. We present the results of the IV-2SLS in the Appendix (Table A3).

The results provide some evidence that sales per worker are lower in female-managed firms overall, more so among small and medium-sized firms. Notably, sales per worker are significantly higher among female-managed large firms compared to male-managed firms of the same size (Table 2). Overall, female-managed firms have 10% lower sales per worker than male-managed firms, which is in line with the descriptive statistics in Table 1a.[4] A disaggregation across size shows that female-managed firms are less productive than male-managed firms by 17% in small firms and 15% in medium-sized firms, but are 43% more productive than male-managed large firms. Our results therefore suggests that switching management from female to male increases firm performance only to the extent that the firm is small or medium-sized, but it's likely to undermine firm performance in large firms. This suggests that the female underperformance hypothesis is conditional on firm size. Such results could be attributed to the ability of large firms in Africa to attract top quality female

managers compared to small and medium-sized firms. Our results also suggest that the gender performance gap is not conditional on the sector of operation as these coefficients are all insignificant.

Table 2: Gender and firm-level performance (sales per worker), OLS

	(1) Overall	(2) Small	(3) Medium	(4) Large	(5) Services	(6) Manufacturing
Gender (1=Female)	-0.110**	-0.191***	-0.167*	0.357**	-0.104	-0.110
	(0.049)	(0.059)	(0.096)	(0.168)	(0.064)	(0.074)
Share of female employees	-0.072	0.195**	-0.230*	-0.966***	0.208**	-0.375***
	(0.066)	(0.084)	(0.121)	(0.195)	(0.092)	(0.098)
Loss due to power outages	-0.006***	-0.005***	-0.007***	-0.007	-0.005***	-0.005***
	(0.001)	(0.001)	(0.002)	(0.005)	(0.002)	(0.002)
Line of credit (1=Yes)	0.357***	0.211***	0.482***	0.224**	0.405***	0.278***
	(0.037)	(0.051)	(0.063)	(0.090)	(0.050)	(0.053)
Informal payment (% of sales)	-0.006**	-0.004	-0.009**	0.003	-0.003	-0.008**
	(0.003)	(0.003)	(0.004)	(0.008)	(0.004)	(0.003)
Manager's experience	0.004**	0.002	0.006**	0.003	0.008***	0.000
	(0.002)	(0.002)	(0.003)	(0.004)	(0.002)	(0.002)
Formal training (1=Yes)	0.082**	0.124**	0.018	0.127	0.033	0.120**
	(0.036)	(0.049)	(0.062)	(0.096)	(0.051)	(0.052)
Exportation (1=Yes)	-0.018	-0.108**	-0.044	-0.080	-0.035	-0.032
	(0.039)	(0.054)	(0.064)	(0.100)	(0.057)	(0.053)
Certification (1=Yes)	0.407***	0.236***	0.499***	0.406***	0.316***	0.443***
	(0.048)	(0.081)	(0.077)	(0.097)	(0.076)	(0.062)
Log of firm age	0.123***	0.098***	0.095**	0.191***	0.108***	0.094***
	(0.023)	(0.029)	(0.040)	(0.061)	(0.032)	(0.032)
R&D (1=Yes)	0.320***	0.315***	0.324***	0.309***	0.261***	0.380***
	(0.043)	(0.059)	(0.073)	(0.109)	(0.059)	(0.062)
Informal competitors (1=Yes)	-0.138***	-0.114***	-0.103*	-0.152*	-0.149***	-0.110**
	(0.032)	(0.042)	(0.056)	(0.091)	(0.046)	(0.044)

Sector (1=Manufacturing)	-0.335***	-0.464***	-0.277***	0.170		
	(0.032)	(0.041)	(0.057)	(0.105)		
Size (Ref: Small)						
Medium	0.135***				0.017	0.321***
	(0.035)				(0.047)	(0.052)
Large	0.267***				-0.028	0.549***
	(0.058)				(0.093)	(0.075)
Constant	9.949***	10.597***	9.362***	8.183***	9.867***	9.866***
	(0.129)	(0.149)	(0.214)	(0.414)	(0.152)	(0.260)
Country dummies	YES	YES	YES	YES	YES	YES
Observations	11,636	6,685	3,424	1,527	6,185	5,451
R-squared	0.363	0.329	0.451	0.331	0.335	0.408

Notes: (i) All models are estimated with robust standard errors; (ii) standard errors in parentheses; (iii) * significance at 10%; ** significance at 5% and *** significance at 1%.

Source: Authors' own construction using WBES data.

Furthermore, we show that firm performance is neutral to the proportion of female workers in the workforce (Table 2, column 1). However, a disaggregation across firm size and sector indicates mixed results. On the one hand, an increase in the share of female workers in the workforce is associated with an increase in firm performance among small firms, and more so in the services sector (Table 2, columns 2 and 5). On the other hand, an increase in the share of female workers is associated with a reduction in firm performance among medium-sized and large firms, especially those in the manufacturing sector (Table 2, columns 3, 4 and 6). This suggests that the impact of the gender composition of the workforce is conditional on the size and sector of operation, with those in the services sector able to leverage a higher share of female workers.

With regard to business environment variables, firm performance is inversely associated with power outages, especially among small and medium-sized firms, regardless of the sector of operation. The results show that a percentage loss in sales due to power outages is associated with a 0.6% reduction in performance in the overall model (Table 2, column 1). Specifically, electricity outages result in a 0.5% and 0.7% reduction in performance among small and medium-sized firms, respectively, with a mute effect among large firms (Table 2, columns 2, 3 and 4). Sector disaggregation indicates that electricity outages have an equal impact on services and manufacturing sector firms (Table 2, column 6). One possible reason for such findings is that power outages induce resource misallocation as firms resort to alternative sources of power such as generators, which are expensive to maintain and run. Furthermore, power outages imply a loss of production time as firms without a standby generator would have to wait for electricity to be reinstated for production to proceed.

Informal payments (measure of corruption) are also found to undermine performance.[5] The results in Table 2 (column 1) suggest that for every 1% of sales paid to government bureaucrats by firms, performance reduces by 0.6%. However, the effect of corruption is size and sector specific. While small and medium-sized firms lose 0.5% and 0.7% of their sales per worker, respectively, for every 1% of sales paid in bribes, there is no significant impact on large firms (Table 2). Sector wise, the negative impact of corruption is mainly felt in the manufacturing sector as opposed to the services sector. The negative relationship between bribe payments and performance could be attributed to the former inducing resource diversion from productive activities of the firm (Bbaale and Okumu, 2018). For example, rather than investing in new machinery or even offering better remuneration to attract more talented human resources, a firm's finances are diverted to bribe payments (Bbaale and Okumu, 2018). Furthermore, bribe payments can induce longer delays in public services provision as bureaucrats tend to increase red tape in order to extort more bribes (Hanousek and Kochanova, 2016).

However, as previously indicated, informal payments are associated with endogeneity concerns as the most productive firms are the ones likely to pay bribes. Accordingly, we re-examined the relationship between corruption and performance using the IV 2SLS technique (the results are presented in Tables 3 of the Appendix). The results of the Durbin and Wu-Hausman tests suggest that bribe payments are only endogenous in the services sector (Table A3, column 5). For this model, the p-value for the F-statistic for the first stage and the Cragg-Donald statistic confirm the validity of the instruments. Notably, the results of the services model suggest that bribe payments seem to grease the wheels of performance among services sector firms, increasing performance by 3% for every 1% of sales paid (Table A3, column 5).

Consistent with the literature, informal competition is found to undermine performance among all categories of firms with the biggest impact among small firms and those engaged in the services sector. Overall, firms that are faced with informal competition are approximately 13% less productive compared to those that don't. This suggests that informal sector firms incur lower costs of production while at the same time evading tax payment, which enables them to charge lower prices, unlike formal firms. While the impact of informal competition is marginally significant among medium-sized and large firms, it is highly significant among small firms. The strong relationship among small firms as opposed to medium-sized and large firms could be attributed to small firms' inability to invest in high-end technology to leverage economies of scale, which could potentially make them more competitive in the midst of informal competition, unlike medium-sized and large firms. This could also suggest that when firms are still small the entry costs for informal competitors could be low, especially in terms of mimicking the products of the latter (Gonzalez and Lamanna, 2007). Our results also support the argument that informal competition is more harmful to firms whose technology can easily be mimicked by informal sector firms by virtue of low entry costs, as is the case for small firms (Gonzalez and Lamanna, 2007). Sectoral disaggregation shows that informal competition is negatively associated with performance among both services and manufacturing firms, with a higher impact among services sector firms (Table 2, columns 5 and 6).

Access to credit is found to have a complementary effect on firm performance. Overall, firms that have a line of credit are 43% more productive than their counterparts that do not have a line of credit (Table 2, column 1). Alleviating credit constraints improves the performance of all categories of firms. This might be because credit from formal financial institutions is relatively cheap compared to other, informal sources of credit. Moreover, formal financial institutions can provide a substantial amount of credit that enables firms to employ more efficient and highly productive technology, which leads to higher performance. The marginal effect of credit is highest among medium-sized firms. Sector wise, the marginal impact is highest among services sector firms (Table 2).

Among the other control variables, consistent with Islam et al (2020) we show that formal training is associated with performance gains. Also consistent with Bbaale and Okumu (2018) we find that quality certification is associated with much higher performance gains. Similar to Gui-Diby et al (2017), we find that firm age has a positive impact on firm performance, which is statistically significant at the 1% level in all the models. Furthermore, consistent with Lallemand et al (2005) and Gui-Diby et al (2017), we show that larger firms are much more productive than both small and medium-sized firms. Finally, we show that firm performance increases with years of managerial experience and engagement in research and development.

Moderating role of female share of employees and business environment

Following Flabbi et al (2019), we first explore the moderating role of the proportion of female workers in the workforce in the relationship between gender of the manager and firm performance. We find mixed results that vary depending on the sector and size of the firm, suggesting that the moderating role of gender composition is conditional on these factors. Overall, the results show that an increase in the share of female workers reduces firm performance among female-managed firms while the same change has no significant impact on male-managed firms (Table 3, column 1). The disaggregated results indicate that an increase in the share of female workers in the workforce is associated with an increase in firm performance among male-managed small firms and those in the services sector, while the effect is negligible for female-managed firms in the same category. This suggests that in the first best equilibrium, male managers are able to get the best out of female workers in small firms and in the services sector.

Among large firms and those engaged in the manufacturing sector, an increase in the share of female employees significantly undermines firm performance, regardless of the gender of the manager. However, the negative impact is much more severe among female-managed firms compared to male-managed firms in this category (Table 3, columns 4 and 6). This suggests that male managers are more able to ameliorate the negative effect of an increase in the share of women in the workforce on

firm performance, and even leverage higher shares of women in the workforce among small firms and services sector firms compared to female managers. This indicates that the share of female workers may not bridge the gender performance gap but instead worsen the gap, which negates the argument that female managers are better placed to allocate female talent compared to male managers. This suggests that in the second-best environment, male managers can better allocate female workers to optimize firm performance than female managers in large firms, and more so in the manufacturing sector.

Table 3: Moderating role of share of female employees (OLS)

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Overall	Small	Medium	Large	Services	Manufacturing
Male # share of female workers	0.024	0.350***	-0.199	-0.908***	0.288***	-0.256**
	(0.073)	(0.095)	(0.127)	(0.203)	(0.099)	(0.112)
Female # share of female workers	-0.466***	-0.323*	-0.423	-1.656***	-0.136	-0.797***
	(0.149)	(0.171)	(0.345)	(0.587)	(0.221)	(0.189)
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,636	6,685	3,424	1,527	6,185	5,451
R-squared	0.364	0.330	0.451	0.331	0.335	0.409

Notes: (i) All models are estimated with robust standard errors; (ii) standard errors in parentheses.

* p < 0.10, ** p < 0.05, *** p < 0.01.

Source: Authors' own construction using WBES data.

Turning to the moderating role of business environment indicators, our results suggest that power outages do indeed moderate the gender performance gap to the extent that the performance of female-managed firms falls by almost twice as much as the fall in the performance of male-managed firms owing to power outages (Table 4, column 1). This disproportionate negative impact is much higher among medium-sized firms and firms engaged in the manufacturing sector. The results indicate that while the performance of both male-managed and female-managed firms is negatively affected by power outages and related losses, the impact is much more severe among female-managed firms.[6] This is in line with the evidence from the descriptive statistics suggesting that female-managed firms experience higher losses due to power outages compared to male-managed firms. A firm size and sector disaggregation shows that power outages negatively affect female-managed small, medium-sized, and manufacturing firms most compared to male-managed firms in the same categories. Specifically, a percentage increase in the share of sales lost due to power outages among female-managed small, medium-sized, and manufacturing firms is associated with a 0.9%, 1.8% and 1.2% reduction in performance, respectively.

A similar shock reduces the performance of male-managed firms in the same category by only 0.4%, 0.7% and 0.5%, respectively (Table 4; columns 2, 3 and 6). However, the relationships are insignificant for large firms. This could be explained by the fact that large firms are able to hire more competent female managers and therefore are not very different from their male counterparts in terms of decision making. The moderating effect of power outages could perhaps suggest that female managers are less likely to invest in alternative sources of power, such as purchasing/hiring a generator, compared to male managers.

With regard to the moderating effect of access to credit, the results in Table 4 suggest that the moderating role of access to credit is size and sector specific. On the one hand, access to credit mitigates the gender performance gap among small and services sector firms. On the other hand, male-managed firms are better able to leverage access to credit among medium-sized, large and manufacturing firms. In brief, our results show access to credit enhances a firm's sales per worker among female-managed small firms by 15.7% more than it does among male-managed firms in the same category (Table 4, column 2). Similarly, access to credit enhances a firm's sales per worker among female-managed services firms by 4.3% more than it does among male-managed firms in the same category (Table 4, column 5). The results in favour of male managers in medium-sized, large and manufacturing firms could be attributed to the under-representation of female managers in these categories of firms.

Table 4: Gender and firm performance: Moderating role of businesses environment (OLS)

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Overall	Small	Medium	Large	Services	Manufacturing
Male # power outage	-0.006***	-0.004***	-0.007***	-0.007	-0.005**	-0.005***
	(0.001)	(0.002)	(0.003)	(0.005)	(0.002)	(0.002)
Female # power outage	-0.011***	-0.009**	-0.018***	-0.014	-0.008	-0.012***
	(0.004)	(0.004)	(0.007)	(0.022)	(0.006)	(0.004)
Credit						
Male # has line of credit	0.368***	0.192***	0.486***	0.255***	0.403***	0.283***
	(0.039)	(0.055)	(0.065)	(0.093)	(0.054)	(0.056)
Female # has line of credit	0.344***	0.314**	0.443**	-0.259	0.431***	0.223
	(0.099)	(0.126)	(0.206)	(0.297)	(0.134)	(0.153)
Informal payments						
Male # informal payments	-0.005**	-0.003	-0.009**	0.003	-0.003	-0.007**
	(0.003)	(0.004)	(0.004)	(0.008)	(0.004)	(0.004)

Female # informal payments	-0.007	-0.008	-0.024	-0.007	-0.003	-0.018*
	(0.009)	(0.009)	(0.016)	(0.046)	(0.012)	(0.010)
Informal competition						
Male # informal competition	-0.128***	-0.102**	-0.090	-0.139	-0.127***	-0.104**
	(0.033)	(0.045)	(0.058)	(0.095)	(0.049)	(0.046)
Female # informal competition	-0.248***	-0.177	-0.226	-0.347	-0.294**	-0.183
	(0.089)	(0.109)	(0.186)	(0.324)	(0.124)	(0.130)
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	9.955***	10.588***	9.337***	8.157***	9.846***	9.850***
	(0.129)	(0.150)	(0.214)	(0.420)	(0.154)	(0.260)
Observations	12,084	6,685	3,424	1,527	6,185	5,451
R-squared	0.358	0.329	0.452	0.332	0.335	0.408

Notes: (i) All models are estimated with robust standard errors; (ii) standard errors in parentheses; (iii) *signifies significance at 10%; ** signifies significance at 5% and *** signifies significance at 1%.

Source: Authors' own construction using WBES data.

Regarding informal competition, our results suggest that informal competition leads to a gender performance gap of 10%. Whereas informal competition undermines sales per worker among both female- and male-managed firms, the negative impact is much more severe among female-managed firms (22%) compared to male-managed firms (12%) (Table 4, column 1). The performance gap due to informal competition is more prevalent in the services sector and is estimated at 13%. This suggests that informal competition exacerbates the gender performance gap, especially among services sector firms. However, in the presence of informal competition there is no significant difference in performance between male- and female-managed medium-sized and large firms.

Finally, with respect to bribe payments (informal payments), our results suggest that bribe payments undermine firm performance among male-managed, medium-sized and manufacturing firms. Among female-managed firms, bribe payments undermine firm performance among manufacturing firms only.

As can be seen in Table 4, model 6, female-managed manufacturing firms are 1.1% less productive than male-managed manufacturing firms.

6. Conclusion

The study looked at whether the gender performance gap is mediated by business environment indicators. We investigated whether a higher proportion of female workers in the workforce would induce higher performance in female-managed firms than male-managed firms. First, we re-estimated the relationship between gender, business environment and firm performance. Our preliminary analysis highlighted significant variations in performance and the experience of business environment constraints that disfavoured female-managed firms. The baseline regression also confirms the female underperformance hypothesis from other studies such as Okumu and Mawejje (2020). However, our findings indicate that the female underperformance hypothesis is conditional on the firm size, holding only to the extent that firms are small and medium sized. Our results show that female-managed large firms outperform male-managed large firms. We also show that small firms and those in the services sector are able to leverage higher shares of female workers, while an increase in the share of female workers undermines performance among medium-sized and large firms.

Regarding business environment, we find evidence that corruption undermines firm performance; that is, the "sanding effect." In line with Bbaale and Okumu (2018), our results suggest bribe payments undermine firm performance, especially among small and medium-sized firms, and those engaged in the manufacturing sector. However, after controlling for endogeneity in the services sector, we find evidence in support of performance being positively related with corruption in the service sector. Informal competition is found to undermine performance among all categories of firms with the biggest impact being among small firms and those engaged in the services sector. However, our results disagree with Ali and Najaman (2015), whose findings indicate that the higher the intensity of informal competition, the higher the firm's performance. Unfortunately, because of data limitations, we are not in a position to establish the relationship between the degree of informal competition and performance. In line with Bbaale and Okumu (2018), access to credit is found to enhance firm performance across all categories. Finally, power outages are found to undermine firm performance, especially among small and medium-sized firms, regardless of the sector of operation.

We find mixed results regarding the moderating role of the share of female employees in the workforce. Contrary to Flabbi et al (2019), our findings suggest that male managers are more able to ameliorate the negative effect of an increase in the share of women in the workforce on firm performance, and can even leverage higher shares of women in the workforce among small firms and services sector firms compared to female managers. This suggests that having more female workers in the workforce does not mitigate the gender performance gap. Regarding the business environment, our results indicate that the presence of a poor business environment in the form of electricity outages, informal competition, credit constraints and corruption exacerbate the performance gap between male- and female-managed firms in favour of male-managed firms.

The business environment-induced female-male managed firm performance gap is firm size specific especially among small and medium-sized firms, and is sector specific. For example, power outages widen the gender performance gap mainly among small, medium-sized and manufacturing firms. Access to credit mitigates the gender performance gap mainly among small and services sector firms while informal competition exacerbates the gender performance gap mainly in the services sector; and informal payments exacerbate the gender performance gap among manufacturing firms. Notably, the business environment plays a limited role in moderating the gender performance gap among large firms. This is in line with our finding that female managers in large firms are as good as their male counterparts in the same categories of firm, thus limiting the gender performance gap.

Based on our analysis, we conclude that the apparent performance gap between male and female managers is partly perpetuated by a weak business environment to which male managers are able to adjust better compared to female managers. Such performance differences may, therefore, have implications for the choice of managers in African firms with a preference for male as opposed to female managers. Therefore, attaining gender parity in firm management in Africa is contingent upon closing the gender firm performance gap. Our results indicate that this performance gap is perpetuated by a less-than-desirable business environment as opposed to managerial attributes of male and female managers. Consequently, closing the gender performance gap is partly contingent upon improving Africa's business environment.

Notes

1 These studies use sales per worker, total revenue, sales and employment growth, and value added per worker as measures of firm performance.

2 $-i-i$ indicates that firm ii is not included.

3 We restrict ourselves to the manufacturing and services sectors because the disaggregation into manufacturing, retail and other services results in too small a sub-sample for retail, and eventually the models for retail do not converge.

4 As the dependent variable is log transformed, coefficients of the variables are converted to elasticities using the formula $[exp^{cofficient} - 1] * 100$. We use this transformation in all subsequent discussions.

5 Except for services models, this analysis is based on OLS results as there is no systematic difference between OLS results and IV-2SLS results, given the absence of endogeneity in the models, as suggested by the Durbin and Wu-Hausman tests.

6 Except for large and services models, this analysis is based on OLS results, as there is no systematic difference between OLS results and IV-2SLS results, given the absence of endogeneity in the models, as suggested by the Durbin and Wu-Hausman tests.

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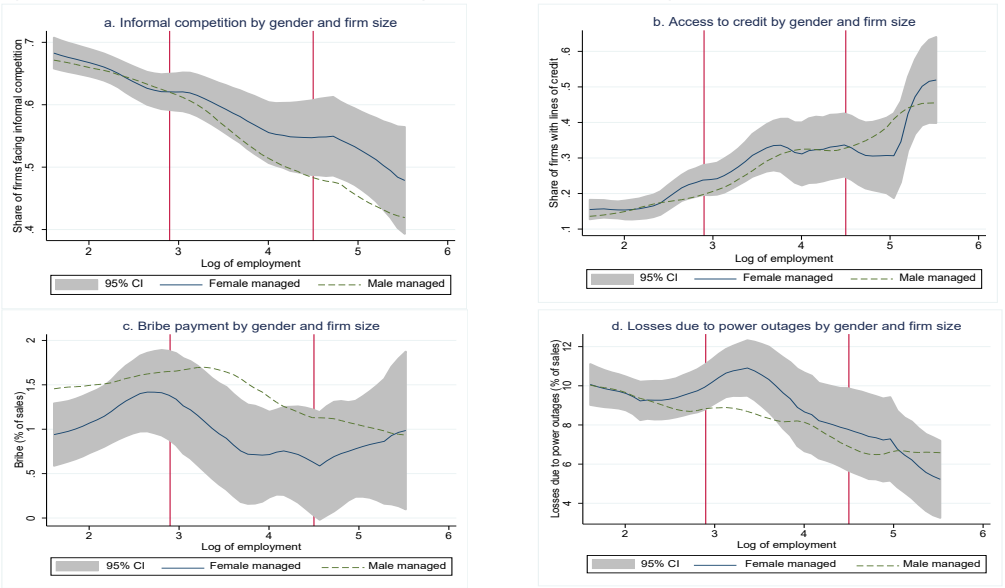
Appendix

Figure A1: Business environment, gender of the manager and firm size



Note: The first reference (vertical) line is the boundary for small firms, the second line is the boundary for medium-sized firms.

Source: Authors' construction using WBES data.

Table A1: Test of mean difference for control variables by gender of top manager

Variables	Male managed	Female managed	Mean difference
Formal training	0.279	0.259	0.020*
Manager's experience	17.10	14.00	3.1***
Certification	0.160	0.108	0.053***
Firm age	17.40	15.30	2.16***
Investment in R&D	0.177	0.196	-0.018*
Engaged in export	0.258	0.234	0.024**
Sector			
Services	0.529	0.632	-0.102***
Manufacturing	0.471	0.368	0.102***

Firm size			
Small	0.549	0.711	-0.162***
Medium	0.306	0.220	0.086***
Large	0.145	0.069	0.076***

Table A2: Sample and proportion of female-managed firms

Country	Frequency	Share of female managed
Djibouti 2013	257	0.139
Morocco 2013	388	0.052
Sudan 2014	565	0.035
Tunisia 2013	570	0.078
Angola 2010	279	0.146
Benin 2016	141	0.153
Botswana 2010	256	0.168
Burundi 2014	150	0.173
Cameroon 2016	350	0.156
Côte d'Ivoire 2016	344	0.122
DRC 2013	512	0.121
Egypt 2016	1,808	0.050
Ethiopia 2015	842	0.089
Ghana 2013	695	0.149
Guinea 2016	131	0.060
Kenya 2013	755	0.102
Lesotho 2016	143	0.329
Madagascar 2013	211	0.233
Malawi 2014	506	0.160
Mali 2016	163	0.072
Mauritania 2014	139	0.053
Namibia 2014	553	0.358
Niger 2017	140	0.087
Nigeria 2014	2,618	0.118
Rwanda 2011	229	0.199
Senegal 2014	583	0.114
Tanzania 2013	790	0.128
Togo 2016	147	0.113
Uganda 2013	735	0.167
Total	15,000	0.122

Table A3: Gender and firm-level performance (sales per worker) IV-2SLS

	(1) Overall	(2) Small	(3) Medium	(4) Large	(5) Services	(6) Manufacturing
Gender (1=Female)	-0.109**	-0.191***	-0.159*	0.349**	-0.102	-0.114
	(0.049)	(0.059)	(0.095)	(0.166)	(0.065)	(0.073)
Share of female employees	-0.072	0.197**	-0.224*	-0.967***	0.225**	-0.373***
	(0.066)	(0.084)	(0.121)	(0.193)	(0.093)	(0.097)
Loss due to power outage	-0.006***	-0.005***	-0.008***	-0.007	-0.007***	-0.005***
	(0.001)	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)
Line of credit (1=Yes)	0.356***	0.205***	0.480***	0.224**	0.378***	0.280***
	(0.037)	(0.052)	(0.062)	(0.089)	(0.052)	(0.053)
Informal payment (% of sales)	-0.004	0.002	0.001	-0.012	0.029**	-0.015*
	(0.007)	(0.012)	(0.008)	(0.029)	(0.014)	(0.008)
Manager's experience	0.004**	0.002	0.006**	0.003	0.009***	0.000
	(0.002)	(0.002)	(0.003)	(0.004)	(0.003)	(0.002)
Formal training (1=Yes)	0.083**	0.125**	0.020	0.125	0.038	0.118**
	(0.036)	(0.049)	(0.061)	(0.095)	(0.051)	(0.052)
Exportation (1 =Yes)	-0.019	-0.112**	-0.050	-0.076	-0.058	-0.029
	(0.039)	(0.055)	(0.064)	(0.099)	(0.058)	(0.053)
Certification (1=Yes)	0.407***	0.236***	0.498***	0.391***	0.325***	0.442***
	(0.048)	(0.081)	(0.076)	(0.099)	(0.076)	(0.062)
Log of firm age	0.123***	0.097***	0.095**	0.189***	0.103***	0.093***
	(0.023)	(0.029)	(0.040)	(0.061)	(0.032)	(0.032)
R and D (1=Yes)	0.318***	0.308***	0.316***	0.310***	0.236***	0.386***
	(0.043)	(0.060)	(0.073)	(0.108)	(0.061)	(0.062)
Informal competitors (1=Yes)	-0.138***	-0.111***	-0.098*	-0.156*	-0.142***	-0.115***
	(0.032)	(0.042)	(0.056)	(0.090)	(0.046)	(0.044)
Sector (1 = Manufacturing)	-0.334***	-0.464***	-0.275***	0.166		
	(0.032)	(0.041)	(0.057)	(0.103)		
Size (Ref: Small)						
Medium	0.134***				0.012	0.322***
	(0.034)				(0.047)	(0.052)
Large	0.267***				-0.018	0.545***
	(0.057)				(0.094)	(0.074)
Constant	9.949***	10.600***	9.362***	8.211***	9.884***	9.869***
	(0.129)	(0.149)	(0.213)	(0.412)	(0.153)	(0.260)
N	11,636	6,685	3,424	1,527	6,185	5,451
R-squared	0.363	0.329	0.450	0.329	0.323	0.407
Durbin (p-value)	0.787	0.587	0.205	0.624	0.004	0.353

Wu-Hausman (p-value)	0.7880	0.588	0.207	0.629	0.005	0.355
Prob > F(first stage)	0.794	0.621	0.166	0.571	0.009	0.356
Cragg-Donald	1331.13	449.509	717.839	119.492	453.546	834.774

Note: (i) The instrument for corruption is country-sector-size averages of informal payments; (ii) all models are estimated with robust standard errors; (iii) standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Authors' own construction using WBES data.

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