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Female managers and firm performance

Evidence from the Caribbean countries

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Abstract: This paper investigates whether firm performance differs significantly when comparing firms with female and male top managers in the Caribbean region. We use survey data with detailed information on gender for firms in 13 Caribbean countries. Our methodology is based on Blinder–Oaxaca decomposition and propensity score matching econometric techniques. These allow us to ascertain whether there is a gender gap in labour productivity in these countries and the extent to which the characteristics of the management team, the firm, and/or environmental constraints hamper the normal development of production or service activities. The results from the regression analysis indicate that female-managed firms are, on average, 16 per cent less productive than male-managed firms. This difference is reduced to 8 per cent when using propensity score matching and when comparing firms and management teams with similar characteristics. Moreover, having some gender diversity in the management team contributes to increasing labour productivity.

Key words: Caribbean region, firm performance, gender gap, propensity score matching

JEL classification: C21, J16, O54, P42

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1 Introduction

The gender gap persists in many aspects of the economy. One such aspect is the low number of women in management positions in the private sector. While, on average, only 18 per cent of formal sector firms in developing countries have a woman as a top manager (Islam et al. 2020), women's representation in managerial positions also appears problematic in high-income countries. For instance, among the 26.2 per cent of female workers in Italian manufacturing firms, only 3.3 per cent hold executive positions and only 2.1 per cent are Chief Executive Officers (CEOs) (Flabbi et al. 2019).

In the context of our study—the Latin American and Caribbean region—females run only a quarter of the firms according to our dataset, and female-run firms are around three times smaller than male-run firms (Cuberes and Teignier 2017).

A controversial question is whether firms managed by females are less productive than those managed by males. Firms run by female managers are generally more concentrated in labour-intensive industries, pay lower wages, are on average smaller in terms of revenue and number of employees, and have lower potential to grow, when compared to their male counterparts (Flabbi et al. 2019). Indeed, some studies argue that females select themselves into small firms that require less dedication and that are generally less productive than big firms, while others state that women are discriminated against by the fact that the management world is male dominated.

In this paper, we investigate whether firm performance differs significantly when comparing firms with female and male top managers in the Caribbean region. We also consider how the gender composition of the management team affects firm performance. For this purpose, we use survey data for firms in 13 Caribbean countries for which responses to a questionnaire with very detailed questions on gender are available. The main methodology applied is based on regression analysis, Blinder–Oaxaca decomposition, and propensity score matching (PSM) econometric techniques. These techniques allow us to ascertain whether there is a gender gap in labour productivity in these countries and the extent to which the characteristics of the management team, those of the firm, and/or the environmental constraints hamper the normal development of the production or service activities.

Previous research on the gender gap and firm performance typically measured female entrepreneurship by female ownership. However, an emerging literature has started to question the role that female ownership might play in firm performance and suggests that management rather than ownership better relates to decision-making power. While management and ownership generally overlap in the case of informal sector firms, the distinction is relevant for formal sector enterprises. Indeed, especially in developing countries, female owners tend to have a merely formal role and have little or no involvement in the enterprise's key activities and decisions.

The main novelties of this paper are threefold. First, we focus on the Caribbean region, where, in most countries, service activities are more prevalent than manufacturing activities and for which there are no similar studies. Moreover, focusing on a context with a higher prevalence of the service sector will help to shed more light on the effects that the constraints to women's empowerment may have on the economic growth of countries moving towards tertiarization of the economy. As recently shown in Ostry et al. (2018), if, during the process of structural transformation, too few women are reallocated to the growing sector, the process of economic development will slow down, reducing output and welfare. Second, we depart from simple regression analysis by using PSM techniques as an identification strategy which allows us to infer

whether the differences in firm performance found in previous studies are due to the fact that the studies were not able to use a valid counterfactual. Third, in addition to what previous studies on developing countries have investigated, i.e. whether having women in the management team (or female ownership) matters for a firm's performance, we apply different thresholds in the gender composition of the management team. We also allow for heterogeneous effects depending on the gender composition of workers, testing whether there are positive complementarities between female leadership and female workers and whether these lead to enhanced firm performance (i.e. whether the performance of firms led by female managers increases with the share of female workers).

The main results show that, although the regression analysis indicates that firms managed by females are, on average, 16 per cent less productive than male-managed firms, the difference is reduced to 8 per cent when using PSM and when comparing firms and management teams with very similar characteristics, and this difference is no longer statistically significant. Moreover, some level of gender diversity in the management team contributes to increasing labour productivity. Finally, having a more gender-diverse management team seems to increase the share of female employees and, through this, to increase firm performance.

The rest of the paper is organized as follows. Section 2 outlines the theoretical framework on which the empirical models are based and presents the literature review, paying particular attention to research focused on developing countries. Section 3 describes the data and presents the empirical methodology. The main results are given in Section 4. Section 5 presents additional results using alternative gender variables. Section 6 concludes.

2 Gender gap in entrepreneurship and firm performance: theoretical framework and empirics

According to the literature on the gender gap in firm performance (Bardasi et al. 2011; Klapper and Parker 2011), there are two main explanations why female-owned firms tend to perform worse than male-owned firms. On the one hand, the constraints-driven gap view suggests that females face more constraints than males in the business environment in developing countries. For instance, it may be that access to credit is more restricted for women than for men, that legal treatment is gender biased, or that corruption and crime affect more female than male entrepreneurs.[1] These gender barriers are related to gender discrimination and gender-based social norms. This is in line with the argument of the liberal feminist approach which defends the equal capacity of men and women when controlling for all potential discrimination factors.

On the other hand, the preference-driven gap view states that females may show a preference for activities in services and trade and that they tend to operate at a lower scale. According to this view, socio-cultural norms such as stigmatization of entrepreneurship and pressure from society

[1] According to the Ernst & Young Global (2014) report, limited access to financing and capital is the main constraint on female entrepreneurs, followed by limited contact networks. Women entrepreneurs are less informed about alternative funding sources. In developing countries, women with limited access to formal financing have to rely on informal financial support services, such as savings clubs, non-governmental organizations (NGOs), and credit unions (Lashley and Smith 2015). Moreover, female-managed enterprises have less representation on media platforms. Compared to male-managed enterprises, they are less able to protect themselves against crime and corruption, reflecting legal discrimination by gender, and less likely to own a website, which accounts for a firm–labour productivity gap of around 8 per cent (Islam et al. 2020).

and family shape women's preferences and strategic decisions for doing business.[2] Moreover, as suggested by Cuberes et al. (2019), some women may also choose not to participate in the labour market if this decision increases their own welfare.

In these cases, individual choices will be responsible for the lower rates of female participation and female success in entrepreneurship (Bardasi et al. 2011). This view overlaps with the social feminist approach according to which males and females socialize differently and this influences their managerial approaches. Klapper and Parker (2011) identify the existence of barriers to accessing finance and the business regulatory environment as potential explanations for the concentration of female entrepreneurs in low-capital intensive sectors with lower potential to grow. However, Aterido et al. (2013), Bruhn (2009), and Hansen and Rand (2014a, 2014b) find no evidence that access to finance or regulatory burdens cause a difference in the performance of female- and male-owned firms in Africa (the two first studies) and Latin America (Bruhn 2009).

Early research on the gender gap and firm performance in a developing country context typically measured female entrepreneurship by female ownership. According to these studies, women's ownership leads to lower labour productivity (Bardasi et al. 2011; Chaudhuri et al. 2020; Hallward-Driemeier 2013; Nagler and Naudé 2014), lower profits (Hardy and Kagy 2018), and lower turnover and net revenue per worker (Munyegera and Precious 2018). Although comparison of the findings across these studies is hampered by differences in the underlying estimation methodology, the focus of the analysis (e.g. formal or informal sector), the data used (e.g., firm-level data, census, or enterprise modules of household level datasets), and the significance and magnitude of the coefficient on female ownership weakens in many instances when controlling for firm characteristics.

Moreover, recent studies have found that firm performance—particularly firm productivity—is more related to the presence of females in management positions than to female ownership (Aterido and Hallward-Driemeier 2011; Flabbi et al. 2019; Islam et al. 2020).

Aterido and Hallward-Driemeier (2011) find that, while female participation in ownership is not linked to any firm performance gaps by gender, having women as the main decision makers in the firm is associated with a significant productivity gap of 12 per cent for firms in Africa. Similarly, Islam et al. (2020) find that, globally, female-managed firms in the formal private sector are about 11 per cent less productive than male-managed enterprises in terms of labour productivity. However, in line with Aterido and Hallward-Driemeier (2011), they do not find a significant gender gap in labour productivity when female ownership is used as the female leadership variable.[3]

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[2] As the empirical literature suggests, women generally tend to take lower risks and choose to operate in low-growth, less-innovative sectors due to lack of self-confidence and fear of failure (Lashley and Smith 2015).

[3] Other findings from studies which focus on high-income countries support the hypothesis that female management matters more than female ownership. Christiansen et al. (2016) find that, in a sample of 2 million companies in Europe, the share of women in senior positions significantly contributes to increasing the return to assets. This relationship appears particularly strong in sectors where women form a larger share of the labour force and where complementarities in skills and critical thinking are in high demand. Similarly, Martín-Ugedo and Minguez-Vera (2014) find a positive effect of the presence of women board members on the performance of different types of small and medium-sized enterprises (SMEs), including firms with corporate ownership, where family connections play less of a role in the election of board members, and in firms in the secondary and tertiary sectors. Flabbi et al. (2019) find that the productivity of firms with female CEOs increases with the share of female workers in Italian manufacturing firms. For instance, employing a female CEO is associated with an increase of around 3.2 per cent in sales per employee, conditional on 25 per cent of the workers in the firm being female. This effect is explained by the improved allocation

In the regional context of Latin America, Noland et al. (2016) find no significant effect on firm performance from having female CEOs. However, they suggest that a positive effect of female leadership on firm performance may occur, driven by higher functional diversity in firms' leadership teams.

3 Empirical strategy

In this section, we first describe the data sources and variables used in the empirical estimation (subsection 3.1). Then, we outline the identification strategy and the model specification in subsection 3.2, the decomposition analysis in subsection 3.3, and the PSM procedure in subsection 3.4.

3.1 Data and variables

The data are taken from the Caribbean PROTEqIN Survey (2014). As part of its Latin American and Caribbean Enterprise Surveys (LACES), the World Bank funded the Compete Caribbean programme to collect survey data with local partners which included detailed information on manufacturing and services enterprises. The Compete Caribbean programme generated firm-level, internationally comparable data to measure enterprise performance, including indicators of the business environment in which firms operate and of their ownership and management structures. The sampling methodology is stratified random sampling. It is representative of the non-agricultural private sector and can therefore be used to generate statistically robust analysis. Firms are stratified based on size, business sector, and the geographical region within countries in which they are located. Businesses are classified according to the International Standard Industrial Classification (ISIC 3.1), including three strata: the manufacturing, the retail, and the other services strata. Size is divided into small (between 5 and 19 employees), medium (between 20 and 99 employees), and large (more than 99 employees).

In 2014, a new round of data was generated with additional variables linked to productivity, technology innovation, and gender. As the main interest of our paper is in the gender dimension, we focus, in particular, on the questions that specifically refer to the involvement of women in decision-making and management.[4]

The Caribbean countries surveyed are Antigua-Barbuda, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Saint Lucia, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Suriname, The Bahamas, and Trinidad and Tobago. The firms—1,966 in total—were asked a broad set of questions related to gender, including the gender composition of the owners and of the management team. Additional questions asked about the gender of the largest shareholder, her relationship with the owners and percentage of ownership, whether she was involved in the

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of female employers within the firm by female CEOs. However, female leadership does not have any significant effect on firm performance per se.

[4] Until 2008, the LACES questionnaires only asked whether 'any of the owners are female'. As there are many firms where women are owners but have no involvement in the management of the business, the question was somewhat imprecise. In addition to information on the gender of the main decision maker, it is important to know the extent to which the largest owners are involved in running the business, that is, whether the largest owners are among the most important decision makers. It is also relevant to have information on the gender composition of the broader management team. In the early questionnaires, the information on the background of entrepreneurs was generally limited to their level of education. Meanwhile, the 2014 Compete Caribbean programme questionnaires incorporated more specific gender questions.

management and her years of experience in the firm. Information on the gender of the person responsible for dealing with tax inspectors and for dealing with banks was also collected. Two further questions asked about the prior experience of the managers, in particular, how many years they had worked in the business and whether they had previously worked in other enterprises. These more specific questions are absent from the World Bank's standardized questionnaires for all countries.

In the countries covered by the Caribbean questionnaire, in some cases the primary decision maker is also one of the owners of the firm, but the converse is not necessarily the case. It is common that there are multiple owners, all of whom are not necessarily involved in taking major decisions about the firm.[5] For instance, the majority of these partial owners who are not lead decision makers are women. For partnerships with more than 50 per cent female ownership, the decision makers are male in 39 per cent of the enterprises.[6]

With respect to the structure of economic activity in Caribbean countries, it is worth noting the importance of the services sector in those economies to which 66 per cent of the firms surveyed belong, making manufacturing activities less important (Table 1).

Table 1: Sectoral structure

Manufactures	Freq.	%
Food	196	9.97
Other manufacturing	174	8.85
Chemicals	51	2.59
Non-metallic mineral products	49	2.49
Machinery and equipment	45	2.29
Garments	41	2.09
Fabricated metal products	35	1.78
Basic metals	27	1.37
Electronics	18	0.92
Plastics and rubber	18	0.92
Textiles	6	0.31
Total manufactures	660	33.58
Services	Freq.	%
Retail	466	23.7
Hotel and restaurants	339	17.24
Transport	154	7.83
Construction	136	6.92
Wholesale	95	4.83
Motor vehicle services	78	3.97
Information technology	38	1.93
Total services	1,306	66.42
Total	1,966	100

Source: authors' computation based on Caribbean PROTEqIN Survey (2014).

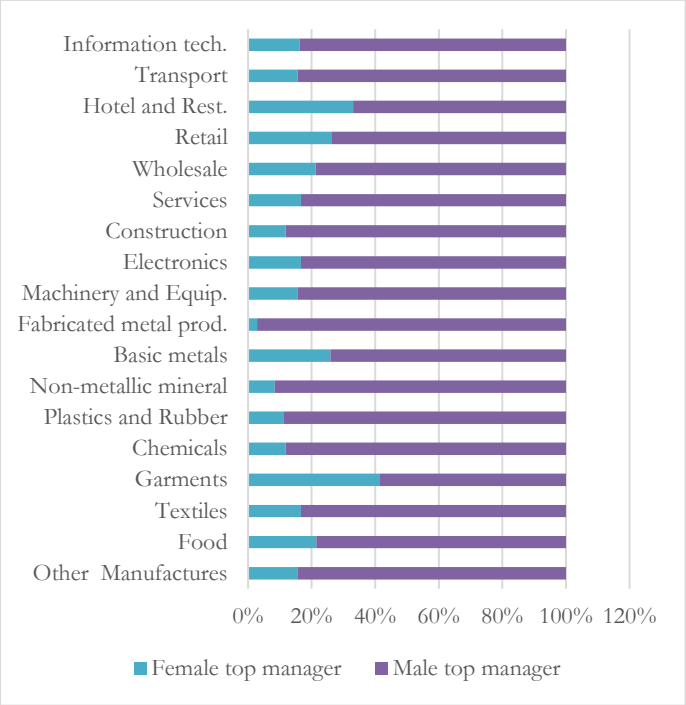
[5] Note that firms that are majority owned by the government or by foreigners were excluded, as were publicly traded firms.

[6] The distinction does not matter for sole proprietorships (750 in the whole sample), but it does for limited partnerships (271) and limited liability companies (254).

Figures 1 and 2 provide the percentage of women-managed firms by sector and by country, respectively, in the sample. With regard to sectors, garments (41 per cent) within manufacturing and hotels and restaurants (33 per cent) within services activities have the highest percentage of female top managers, whereas the corresponding lowest percentages are for fabricated metal products (3 per cent) and construction (12 per cent).

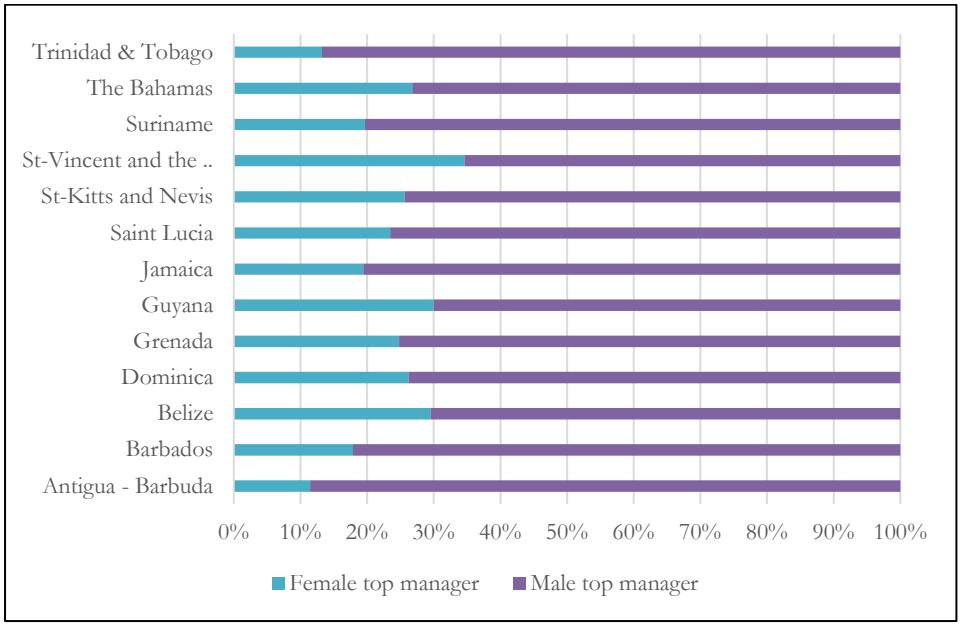
The country with the highest percentages of female top managers is Saint Vincent (35 per cent), followed by Belize and Guyana (30 per cent), whereas the country with lowest is Antigua and Barbuda (11 per cent), followed by Trinidad and Tobago (13 per cent). The overall average for the Caribbean is 22 per cent, which is slightly above the 18 per cent average for all developing countries (Islam et al. 2020). The Caribbean PROTEqIN Survey (2014) has the advantage over the World Bank Enterprise Survey for all countries in that it also includes the percentage of females in the management team and in the ownership for most firms.

Figure 1: Firms with female top managers, by sector



Source: authors' computation based on Caribbean PROTEqIN Survey (2014).

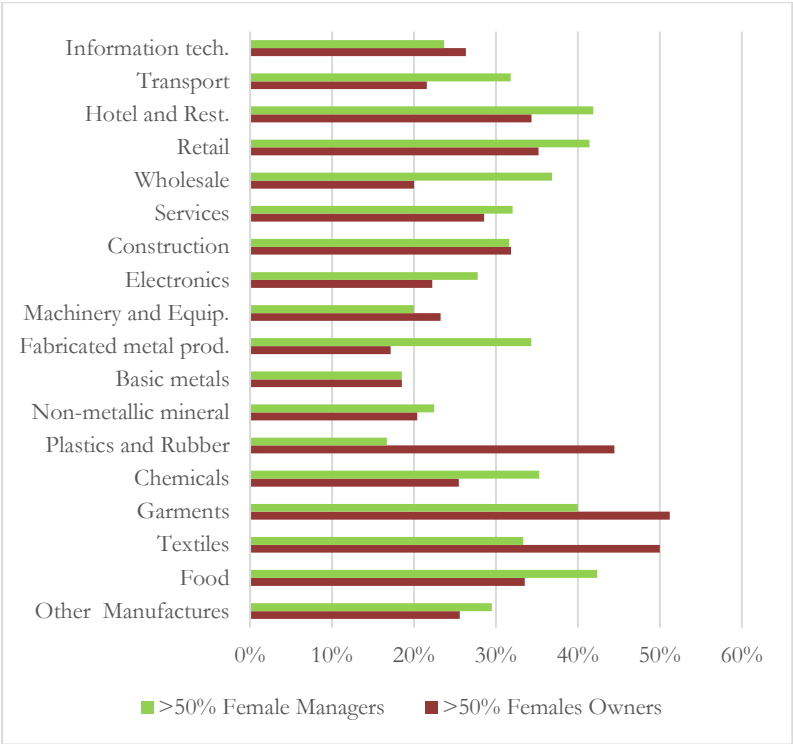
Figure 2: Firms with female top managers, by country



Source: authors' computation based on Caribbean PROTEqIN Survey (2014).

Figure 3 shows that the sectors in which females are well represented in the management team are mostly the hotel and restaurant and retail sectors within services activities and food and garments in manufacturing.

Figure 3: Women in management and ownership, by sector

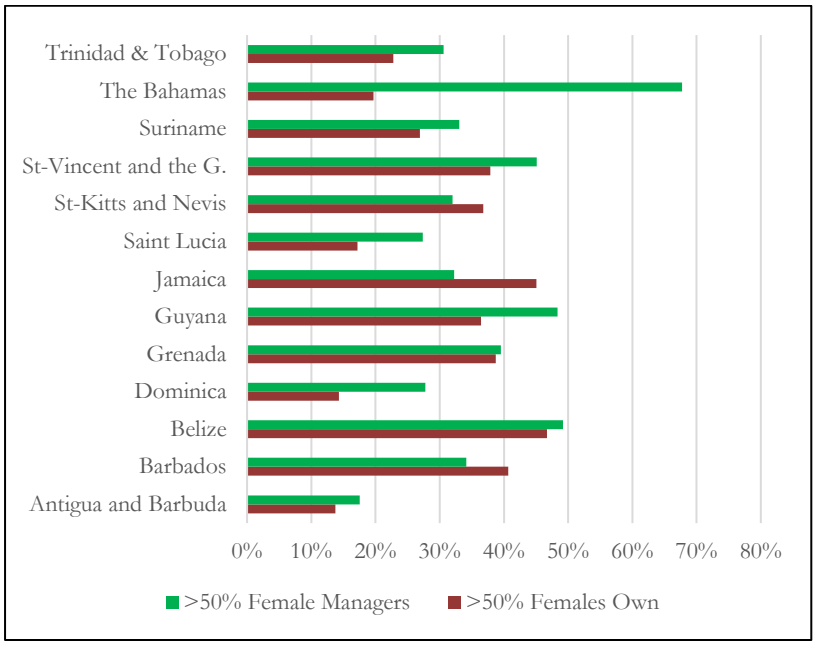


Source: authors' computation based on Caribbean PROTEqIN Survey (2014).

However, women are also well represented in ownership in the textiles and plastic and rubber sectors, in which women are less present in the management teams. The Bahamas is the country

where women are over-represented in the management teams—almost 70 per cent of the firms have management teams in which more than 50 per cent are women—followed by Belize and Guyana. Antigua and Barbuda is at the other extreme of the spectrum, with only 14 per cent of the firms having at least parity in their management teams (Figure 4).

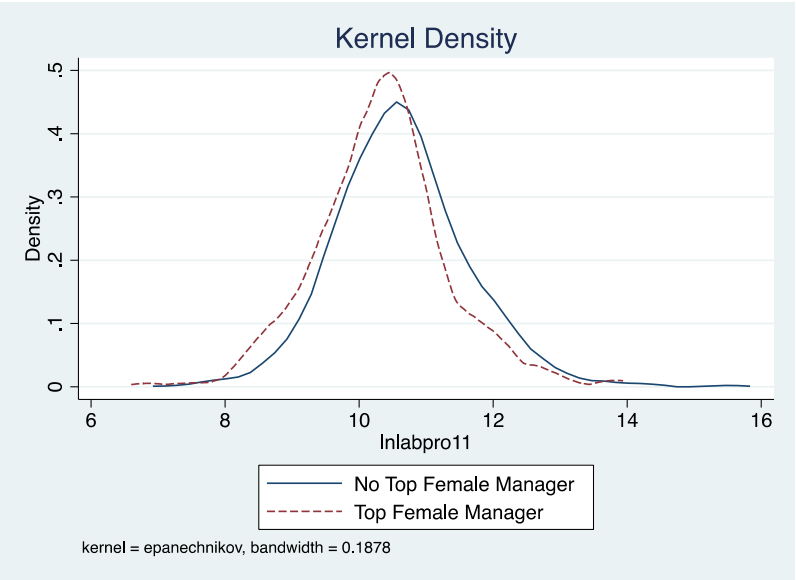
Figure 4: Women in management and ownership, by country



Source: authors' computation based on Caribbean PROTEqIN Survey (2014).

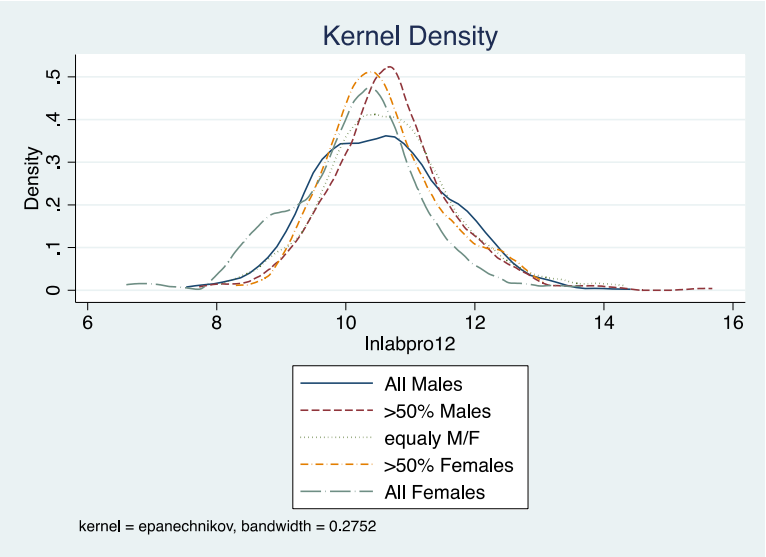
Comparing the average labour productivity of firms with top managers of different sexes, Figure 5 shows that firms with top female managers tend to have lower labour productivity, measured as total sales per worker. However, the labour productivity gap is less evident when considering the composition of the management team, as seen in Figure 6, where the kernel density curves indicate that the average labour productivity of firms with only males in the management team is, on average, lower than in others and the productivity has a higher variance. Otherwise, firms with management teams with more than 50 per cent males show a distribution more to the right and with a higher average, and those with more than 50 per cent females are doing well in terms of average labour productivity (Figure 6). In terms of gender diversity in ownership, there are less obvious differences in labour productivity, as indicated by the curves shown in Figure 7.

Figure 5: Differences in labour productivity, by gender of the top manager



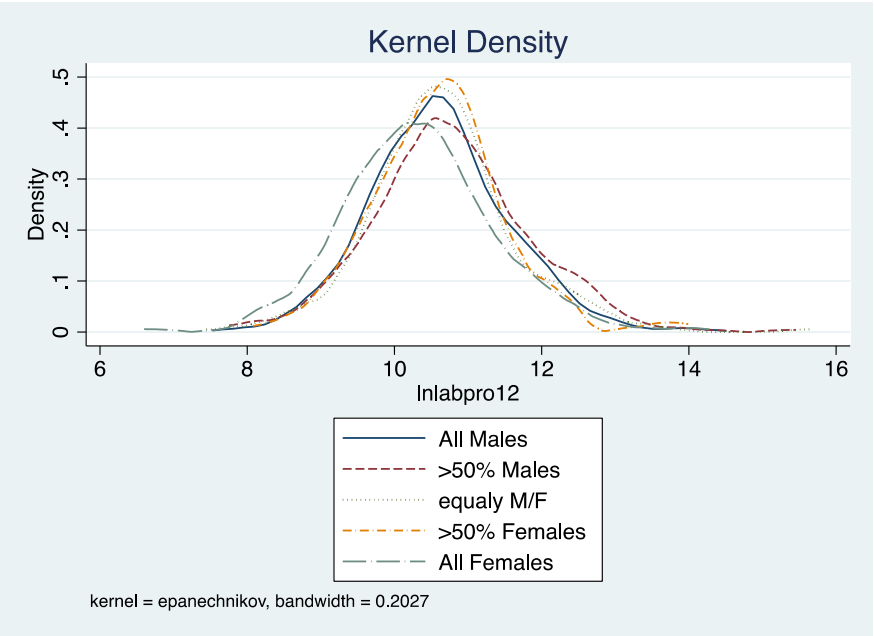
Source: authors' computation based on Caribbean PROTEqIN Survey (2014).

Figure 6: Differences in labour productivity, by gender diversity in management



Source: authors' computation based on Caribbean PROTEqIN Survey (2014).

Figure 7: Differences in labour productivity, by gender diversity in ownership



Source: authors' computation based on Caribbean PROTEqIN Survey (2014).

With respect to the variables used in the empirical analysis, the main outcome variable is labour productivity. We construct this variable as total sales in constant USD at the end of the year divided by total number of employees. We consider three sets of variables that correlate with firm performance: management team characteristics, firm characteristics, and the business environment obstacles which may hamper firms' activities. Summary statistics and variable definitions can be found in Table A1 in the Appendix.

Table 2 shows the differences in means by gender of the top managers. There is a significant unconditional labour productivity gap for firms managed by males compared to those with top female managers. There are also significant differences in the average educational attainment of the manager and in the average experience in the sector as well as in firm size, measured by the number of workers.

Table 2: Descriptive statistics and T-test of mean difference, by gender of the top manager

Variable	Male top manager	Female top manager	mean-diff	t
Ln total sales per worker in 2012 (USD, deflated)	10.635	10.367	0.268***	4.810
Average manager wages in 2012 (USD, deflated)	9.592	9.556	0.035	1.045
Minimum education level of the manager, 1–8	6.753	6.684	0.069	1.319
Average education level of the manager, 1–8	6.339	6.170	0.168**	2.420
Years of experience in the same sector	19.303	16.346	2.957***	4.738
Ln age of the firm	3.000	2.863	0.138***	3.461
Ln number of employees	3.287	2.826	0.461***	7.181
The firm purchases fixed assets	0.344	0.356	-0.012	-0.453
Shareholding company	0.383	0.273	0.110***	4.060
Partnership including limited liability	0.130	0.118	0.012	0.660
Limited partnership	0.130	0.155	-0.026	-1.332
The establishment part of a larger firm	0.174	0.135	0.039*	1.834
Percentage of the firm owned by foreigners	0.165	0.125	0.039*	1.920

The firm exports	0.259	0.268	-0.009	-0.362
Manufacturing activities	0.345	0.276	0.069***	2.608
Retail activities	0.228	0.276	-0.048**	-1.969
The firm uses its own website	0.470	0.456	0.014	0.505
The firm benefits from any technical assistance programmes	0.170	0.155	0.014	0.678
Innovation department	0.102	0.078	0.024	1.458
Innovation introduced	0.222	0.163	0.059**	2.561
Inadequately educated workforce	1.870	1.812	0.058	0.861
Business licensing and permits	1.108	0.990	0.118*	1.846
Access to finance	1.829	1.895	-0.066	-1.002
Macroeconomic environment	1.611	1.694	-0.084	-1.166
Corruption	1.427	1.526	-0.100	-1.476
Crime, theft, and disorder	1.681	1.709	-0.028	-0.427
Telecommunications	1.251	1.266	-0.015	-0.219
Electricity	1.603	1.581	0.021	0.291
Transportation	1.188	1.173	0.015	0.223
Access to land	1.046	0.927	0.119*	1.852
Political environment	1.378	1.566	-0.188***	-2.690
Tax rates	1.689	1.644	0.045	0.670
Tax administration	1.518	1.454	0.065	0.988
Customs and trade regulations	1.512	1.474	0.038	0.617
Labour regulations	1.383	1.273	0.110	1.637

Note: N obs=1,420 (399) firms with male (female) top managers.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

3.2 Model specification for the regression analysis

We specify labour productivity, LABP, as a function of three different sets of covariates, controlling in addition for sector (ϕ_s) and country (λ_c) fixed effects:

$$\ln LABP_i = \alpha + \beta_0 FETM_i + TM'_i\beta + FIRM'_i\gamma + CONS'_i\delta + \phi_s + \lambda_c + \varepsilon_i \qquad (1)$$

where FETM denotes that a female is the top manager. Alternatively, it is a dummy which is equal to one when the proportion of women in the management team is equal to or higher than 50 per cent or when there is at least one woman in the top management team. TM is a vector of characteristics that define the top manager/management team, including years of experience, education and average salary; FIRM is a vector of observable firm characteristics including size, dummies for exporting status, foreign ownership, etc.; and CONS is a vector of business environmental constraints, which includes categorical variables at the firm level that indicate the extent to which a given constraint is perceived by the firm as an obstacle for the development of its activities.

3.3 Decomposition analysis

Following the related literature, we perform a Blinder–Oaxaca decomposition of the mean outcome differential between female and male top managers. The methodology is based on Blinder (1973) and Oaxaca (1973), extended by Daymont and Andrisani (1984) and Bauer and Sinning (2008). The traditional decomposition is based on two linear regression models that are fitted separately for two groups, in our case for firms with female and male top managers. Then, the main outcome difference is decomposed into two components. The first component is the fraction

of the difference that is explained by observable characteristics, and the second component shows the fraction of the differential that is due to differences in coefficient estimates. Daymont and Andrisani (1984) extended the Blinder–Oaxaca decomposition to add a third factor representing the part of the differential that can be explained by the interaction of the two above-mentioned components.

3.4 Propensity score matching

An alternative to regression-based methods is the use of non-parametric matching techniques. These techniques contrast the productivity of comparable firms with female and male top managers, that is, those firms with similar observable characteristics:

$$LABPGap = E(lnLABP_1|D = 1) - E(lnLABP_0|D = 0) \quad (2)$$

where ln LABP is the natural logarithm of labour productivity. The treatment group is composed of firms with a female top manager (D=1), whereas the control group contains firms managed by males (D=0). The matching technique intends to estimate the missing counterfactual, that is, what the productivity of the firm would be if she were a man. The outcome is given by the productivity of firms with male top managers and with the same set of observable characteristics. In order to estimate the missing counterfactual, several matching algorithms are available to match comparable firms. As matching exactly on the whole vector of observable characteristics will lead to the curse of dimensionality, Rosenbaum and Rubin (1985) showed that, to avoid this issue, the matching can be done on the conditional probability of the treatment, in our case firms having a female as top manager, which is known as the propensity score. We apply three matching algorithms: exact, kernel, and Mahalanobis matching with replacement.[7] Whereas exact matching compares firms with the same values of the observed variables, kernel matching is based on the estimated propensity scores and takes local averages of the untreated observations that are in the neighbourhood of each treated one. In the case of Mahalanobis, a subset of variables assumed to be particularly important in our context (the characteristics of the managers) are used for the matching in addition to the propensity score.

To assess the quality of the procedure, we use a two-sample t-test comparison as proposed by Rosenbaum and Rubin (1985), the results of which are shown in Table A2 in the Appendix. We also check whether the common support is satisfied, i.e. whether there are enough comparable observations in the treated and the untreated groups (Figure A1 in the Appendix). Both requirements, i.e. that the bias is substantially reduced after matching and that there are enough observations in the common support, are satisfied in our context.

4 Main results

The results obtained from the ordinary least squares (OLS) estimation of equation (1) are presented in Table 3. The first and second columns present the results obtained from the whole sample with country and sector fixed effects (FEs) and with the interaction sector*country FEs, respectively. Columns 3 and 4 present separated results for the services and the manufacturing sectors.

[7] Matching was performed in Stata 16 using the *psmatch2* command developed by Leuven and Sianesi (2003). We used matching with replacement as the size of the treatment group is considerably smaller than the size of the control group.

Conditional on country and sectoral unobserved characteristics and on the observable characteristics of firms and their managers, female-managed firms are about 16 per cent less productive than male-managed firms. Interestingly, this gap is similar in magnitude (about 3 percentage points higher) to the conditional productivity gap estimated by Islam et al. (2020) in their sample of 48,867 firms from 126 developing countries. On the other hand, Caribbean countries appear to have more constraints to female entrepreneurship with respect to the broader Latin America region where Islam et al. (2020) find no statistically significant difference in labour productivity between female- and male-managed firms. The productivity gap in Caribbean countries appears, moreover, to be confined mainly to the services sector as our results point to a non-statistically significant difference between female- and male-managed firms in the manufacturing sector.

Table 3: Regression analysis results

Dependent VARIABLE:	(1)	(2)	(3)	(4)
Ln total sales per worker in 2012 (USD, deflated)	All	All	Services	Manufac-turing
Independent VARIABLES:				
Female top manager	-0.167***	-0.156***	-0.176**	-0.106
	(0.054)	(0.057)	(0.070)	(0.100)
Average manager wages in 2012 (USD, deflated)	0.591***	0.603***	0.555***	0.624***
	(0.065)	(0.070)	(0.078)	(0.132)
Minimum education level of the manager, 1–8	-0.018	-0.001	0.015	-0.037
	(0.034)	(0.036)	(0.042)	(0.071)
Average education level of the manager, 1–8	0.021	0.015	0.030	-0.002
	(0.019)	(0.019)	(0.024)	(0.034)
Years of experience in the same sector	-0.000	0.002	-0.001	0.005
	(0.002)	(0.002)	(0.003)	(0.004)
Ln age of the firm	0.051	0.039	0.084*	-0.033
	(0.036)	(0.038)	(0.047)	(0.063)
Ln number of employees	0.009	-0.003	-0.044	0.055
	(0.024)	(0.025)	(0.030)	(0.047)
The firm purchases fixed assets	0.063	0.097**	0.109*	0.080
	(0.045)	(0.047)	(0.057)	(0.084)
Shareholding company	0.125**	0.112**	0.149**	0.036
	(0.055)	(0.056)	(0.067)	(0.107)
Partnership including limited liability	-0.049	-0.054	0.011	-0.168
	(0.062)	(0.063)	(0.079)	(0.110)
Limited partnership	0.098	0.068	0.117	-0.034
	(0.066)	(0.068)	(0.083)	(0.123)
The establishment part of a larger firm	-0.015	0.007	-0.016	0.043
	(0.063)	(0.065)	(0.075)	(0.131)
Percentage of the firm owned by foreigners	0.067	0.084	0.014	0.240*
	(0.066)	(0.068)	(0.078)	(0.125)
The firm exports	0.067	0.112*	0.073	0.172*
	(0.055)	(0.057)	(0.073)	(0.096)
The firm uses its own website	0.085*	0.085*	0.142**	-0.013
	(0.046)	(0.048)	(0.057)	(0.086)
The firm benefits from technical assistance programmes	0.027	0.036	0.003	0.121
	(0.056)	(0.058)	(0.064)	(0.127)

Innovation department	0.287***	0.289***	0.587***	0.198
	(0.090)	(0.097)	(0.214)	(0.124)
Innovation introduced	-0.098*	-0.074	-0.059	-0.083
	(0.058)	(0.063)	(0.079)	(0.108)
Inadequately educated workforce	0.018	0.011	0.050**	-0.071**
	(0.018)	(0.019)	(0.022)	(0.035)
Business licensing and permits	0.016	0.024	0.031	0.019
	(0.022)	(0.022)	(0.027)	(0.044)
Access to finance	-0.042**	-0.041**	-0.031	-0.070*
	(0.019)	(0.020)	(0.023)	(0.039)
Macroeconomic environment	-0.006	-0.009	-0.034	0.037
	(0.017)	(0.018)	(0.021)	(0.033)
Corruption	-0.012	-0.005	-0.005	0.011
	(0.021)	(0.022)	(0.028)	(0.039)
Crime, theft, and disorder	-0.011	-0.019	-0.005	-0.039
	(0.019)	(0.021)	(0.025)	(0.039)
Telecommunications	0.035	0.047**	0.052*	0.030
	(0.022)	(0.022)	(0.027)	(0.040)
Electricity	-0.021	-0.036*	-0.040	-0.024
	(0.020)	(0.020)	(0.024)	(0.036)
Transportation	0.008	0.015	0.017	0.012
	(0.019)	(0.020)	(0.023)	(0.037)
Access to land	0.002	0.004	-0.019	0.036
	(0.019)	(0.019)	(0.023)	(0.039)
Political environment	-0.018	-0.017	-0.040*	0.020
	(0.019)	(0.020)	(0.023)	(0.039)
Tax rates	-0.001	0.000	-0.001	-0.007
	(0.020)	(0.021)	(0.026)	(0.038)
Tax administration	-0.046**	-0.055**	-0.074***	-0.006
	(0.021)	(0.022)	(0.026)	(0.043)
Customs and trade regulations	0.011	-0.003	0.001	0.003
	(0.021)	(0.022)	(0.026)	(0.040)
Labour regulations	0.025	0.028	0.025	0.027
Constant	4.966***	4.288***	5.118***	5.021***
	(0.640)	(0.744)	(0.835)	(1.298)
Observations	1,819	1,819	1,219	600
R-squared	0.252	0.352	0.327	0.447
Country FE	Yes	-	-	-
Sector FE	Yes	-	-	-
Country-sector FE		Yes	Yes	Yes

Notes: robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

The results for the Blinder–Oaxaca decomposition are presented in Table 4. Four specifications, labelled models A to D, each of which includes additional sets of variables, are considered. The decomposition begins with Model A, which only includes country and sector FEs. Model B adds to the previous model a set of characteristics of the management team and replicates the analysis. Model C includes the covariates in Model B and characteristics of the firm and, in addition, Model

D controls for environmental constraints. The set of variables can be found in Table A1 in the Appendix.

The results indicate that, regardless of the model, the productivity gap between male- and female-managed firms equals a penalty of around 27 per cent for firms with female top managers. The managerial characteristics, average salary, and education attainment explain 8.8 per cent of the difference, as indicated in column 4, whereas adding firm characteristics only helps to explain an additional 1.8 per cent of the gap (Model C), and including environmental constraints adds another 0.4 per cent to the explained part of the difference. With respect to the structural part of the gap, which is due to the differences in the estimated coefficients of the given covariates for the female- and male-only regressions, Model A yields the largest unexplained component (24 per cent), whereas this unexplained part is reduced to 18 per cent when the characteristics of the managers are considered in Model B. Adding firm characteristics contributes to a further reduction of the unexplained part of 2.3 per cent, resulting in 0.162 per cent, and adding environmental constraints only marginally increases the unexplained component, which remains at similar levels as in Model C (16.3 per cent). It is worth noting that in the full specification (Model D) endowments and coefficients—the structural part of the differential—still only account for 26.8 per cent of the gap, meaning that around 73 per cent remains unaccounted for for the two terms in the decomposition; that is, the unexplained residual could include unobservables such as personality, attitudes, motivation, and ambition, to name a few.

Table 4: Blinder–Oaxaca decomposition results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Diff.	Decomp.	Diff.	Decomp.	Diff.	Decomp.	Diff.	Decomp.
Models:	A: Country and Sector FE		B: A+MANAGER CHARACTERISTICS		C: B+FIRM CHARACTERISTICS		D: C+ ENVIRONMEN. CONSTRAINTS	
Prediction_1	10.635***		10.638***		10.634***		10.635***	
	(0.026)		(0.026)		(0.027)		(0.027)	
Prediction_2	10.364***		10.367***		10.367***		10.367***	
	(0.049)		(0.049)		(0.050)		(0.051)	
Gap	0.271***		0.270***		0.266***		0.268***	
	(0.055)		(0.055)		(0.057)		(0.058)	
Endowments		0.043		0.088**		0.096*		0.104*
		(0.040)		(0.044)		(0.051)		(0.054)
Coefficients		0.241***		0.185***		0.162***		0.163***
		(0.055)		(0.054)		(0.056)		(0.057)
Interaction		-0.013		-0.002		0.009		0.000
		(0.040)		(0.043)		(0.051)		(0.054)
Observations	1,888	1,888	1,855	1,855	1,820	1,820	1,819	1,819
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

Table 5 presents the results from the matching analysis. The first row shows the average treatment on the treated (ATT) obtained by applying exact matching, kernel, and Mahalanobis procedures. The propensity score is estimated using a logit model[8] controlling for the same set of covariates used in the OLS regressions presented in Table 3. The estimated ATTs indicate that the labour productivity conditional gaps between female-managed firms and male-managed firms are smaller than the OLS-based gaps and are not statistically significant. These results hold across the three types of matching, indicating that when only comparable observations are considered there are no differences in firm labour productivity.

Table 5: Propensity score matching results for top female managers

Outcome:	Unexplained	Exact	Propensity score	
ln LABP	Difference[a]	Matching	Kernel	Mahalanobis
	(1)	(2)	(3)	(4)
ATT[b]	-.267	-.0820	-.0831	-0.108
		(.0885)	(-0.088)	(0.067)
N Treated	399	396	396	396
N Control	1,422	1,382	1,422	1,422
Total Obs.	1,821	1,782	1,818	1,818

Notes: [a]Oaxaca–Blinder decomposition from Table 4 (column 7). [b]Average treatment on the treated over the common support. Heteroskedasticity-consistent analytical standard errors in brackets. PSM with all controls, country, and sector FEs. ATT denotes average treatment on the treated.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

We performed a series of robustness checks to validate our main results. First, we replaced our outcome variable measuring firm performance and used value added per worker instead of sales per worker. Value added was computed as total sales minus the total costs of raw materials and intermediate goods used in production. The results hold both for the regression and decomposition analysis. The unconditional productivity gap increases by one percentage point, which is explained by the endowments in the Blinder–Oaxaca decomposition, whereas the differential due to differences in the coefficients—structural part—remains unchanged.

Second, we used whether the main owner is female as a gender variable. In this case, there are no significant differences in productivity even in the regression analysis.[9]

5 Additional results: gender diversity in management and complementarities across female managers with female workers

In this section, we estimate the regression model, and apply the Blinder–Oaxaca decomposition and PSM using alternative variables for female representation in the top managerial team. First, the target variable is defined as a dummy variable equal to one when at least half of the managers in the management team are females. The results in Table A4 in the Appendix show that there are no significant differences in productivity between firms with an equal or higher share of females

[8] The results of the estimations are shown in Table A3 in the Appendix.

[9] The results are available on request from the authors.

than males in the management team when all firms are considered. This result holds for manufacturing firms. However, for services labour productivity it is around 12.5 per cent higher for firms with a majority of males in the management team. When moving to the Blinder–Oaxaca decomposition, we can observe from Table A5 in the Appendix that the differences in productivity are small (5–6 per cent) and not statistically significant when the three sets of control variables, namely manager team characteristics, firm characteristics, and business environment constraints, are included as regressors. Likewise, when using PSM (Table A6), we do not find significant differences in the productivity of firms with an equal or higher share of females than males in the management team.

Second, we consider gender diversity as the target variable using a dummy variable that takes the value of one when there are both males and females in the management team. The results of the regression analysis, shown in the second panel of Table A4, indicate that, although the estimated coefficients in columns 1 and 2 for the whole sample are positively signed, they are not statistically significant. Therefore, we cannot confirm that gender diversity favours firm performance. Also when using the Blinder–Oaxaca decomposition and the PSM method, gender diversity does not explain the differences in firm productivity.[10]

Third, we use the percentage of females in the management team as the target variable. Although the linear specification did not show any statistical relationship between this variable and labour productivity, when adding a squared term to the model of the target variable the results indicate that there is an inverted-U-shaped relationship, i.e. it is positive for low shares of females in the management team (up to 37 per cent, which is the turning point) and negative for higher shares. However, the statistical significance is weaker when adding interactions between the sectoral and country FEs, as can be seen in Table A7.

Next, we were also interested in assessing whether there are positive complementarities between female leaderships and female workers and whether these lead to enhanced firm performance. The underlying hypothesis is that female managers are better at processing information about female workers' skills and productivity and so are better at improving the allocation of female workers across tasks (Flabbi et al. 2019). Moreover, for the same reasons, female managers discriminate less across gender compared to male managers when hiring workers for their firms. Hence, there are two main channels through which the productivity of firms with female top managers increases with the share of female workers. First, the gender composition of workers will be more equalized if female and male labour are complementary in the production (as empirically demonstrated in Ostry et al. (2018) and Bargain and Lo Bue (2021)) and female workers are initially in short supply relative to men. In this case, the effect on the firm's productivity from increasing female employment will be larger than the effect of an equivalent increase in male workers (as long as female productivity is not substantially lower than male productivity). Second, as shown in Flabbi et al. (2019), female managers are more able to improve the allocation of female workers across tasks, which enhances firm productivity.[11]

To test this hypothesis, we first check whether female-managed firms employ more females. In Figure A3, we show the density plots for the percentage of female employees in firms with a female top manager (solid line) and with a male top manager (dotted line). The former plot is located

[10] The results are available on request from the authors.

[11] Another type of complementarity—leading to opposite implications—would be theoretically possible. This is the so-called 'Queen Bees' effect, according to which women who have managed to reach top positions in male-dominated environments intentionally damage other women's career prospects and so underinvest in female labour. However, as also argued in Flabbi et al. (2019), this hypothesis has found weak support in the empirical literature.

towards the right of the figure, indicating that female-managed firms tend to have more females among their workers. When running regressions using female employment shares as dependent variable and a broad set of controls, including firm characteristics and environmental constraints, we obtain a coefficient for the female top manager variable of 9.53, indicating that female-managed firms employ, on average, almost 10 per cent more females than male-managed firms.[12]

Second, we replicate our main analysis and add an interaction between the share of females in the work force and the top female manager dummy to our main model. The results shown in Table A8 in the Appendix indicate that this is the case, but only when considering the share of unskilled workers.

6 Conclusions

This paper analysed whether firm performance significantly differs when comparing firms with female and male top managers in the Caribbean region. Using country and sector fixed effect regressions analysis, the main results show that firms managed by females are, on average, 16 per cent less productive than male-managed firms. However, the difference is reduced to 8 per cent when using PSM and when comparing firms and management teams with similar characteristics. Moreover, the difference is not statistically significant in this latter case.

Second, we expanded our analysis by considering alternative definitions of female-managed firms. Contrary to the one used in the main results—based on the question about the top manager only being a woman—alternative definitions rely entirely on the gender composition of the management team. As we observed in the kernel density curve reported in Figure 6, the average labour productivity of firms with only males in the management team is smaller compared to firms where there is heterogeneity in the gender composition of the management team but women account for at least 50 per cent of the management team. In the robustness analysis, we replicated our analysis by using different thresholds of women's representation in the management team. This allowed us to ascertain whether—and under which conditions in a developing country context such as the Caribbean countries—gender diversity in managerial positions can boost firms' performance. The results indicate that labour productivity increases with female participation in management positions for lower shares of female managers in the management team but decreases again after some threshold. We also find that firms which employ more unskilled female workers and have a female top manager favour increases in labour productivity. Future research empirically exploring the mechanisms through which these complementarities between female workers and female managers take place would provide important insights.

References

Aterido, R., T. Beck, and L. Iacovone (2013). 'Access to Finance in Sub-Saharan Africa: Is There a Gender Gap?'. *World Development*, 47: 102–20. https://doi.org/10.1016/j.worlddev.2013.02.013

Aterido, R., and M. Hallward-Driemeier (2011). 'Whose Business is it Anyway?'. *Small Business Economics*, 37(4): 443–64. https://doi.org/10.1007/s11187-011-9375-y

Bardasi, E., S. Sabarwal, and K. Terrell (2011). 'How Do Female Entrepreneurs Perform? Evidence from Three Developing Regions'. *Small Business Economics*, 37: 417–41.

[12] The results are available on request from the authors.

https://doi.org/10.1007/s11187-011-9374-z

Bargain O., and M. Lo Bue (2021). 'The Economic Gains of Closing the Employment Gender Gap: Evidence from Morocco'. WIDER Working Paper, *forthcoming*. Helsinki: UNU-WIDER.

Bauer, T.K., and M. Sinning (2008). 'An Extension of the Blinder–Oaxaca Decomposition to Nonlinear Models'. *Advances in Statistical Analysis*, 92: 197–206. https://doi.org/10.1007/s10182-008-0056-3

Blinder, A.S. (1973). 'Wage Discrimination: Reduced Form and Structural Estimates'. *Journal of Human Resources*, 8(4): 436–55. https://doi.org/10.2307/144855

Bruhn, M. (2009). 'Female-Owned Firms in Latin America: Characteristics, Performance, and Obstacles to Growth'. World Bank Policy Research Paper 5122. Washington, DC: World Bank. https://doi.org/10.1596/1813-9450-5122

Chaudhuri, K., S. Sasidharan, S., and R.S.N. Raj (2020). 'Gender, Small Firm Ownership, and Credit Access: Some Insights from India'. *Small Business Economics*, 54(4): 1165–81. https://doi.org/10.1007/s11187-018-0124-3

Christiansen, L., H. Lin., J. Pereira, P. Topalova, and R. Turk (2016). 'Gender Diversity in Senior Positions and Firm Performance: Evidence from Europe'. IMF WP/16/50. Washington, DC: International Monetary Fund. https://doi.org/10.5089/9781513553283.001

Cuberes, D., S. Priyanka, and M. Teignier (2019). 'The Determinants of Entrepreneurship Gender Gaps: A Cross-Country Analysis'. *Review of Development Economics*, 23(1): 72–101. https://doi.org/10.1111/rode.12537

Cuberes, D., and M. Teignier (2017). 'Gender Gaps in Entrepreneurship and their Macroeconomic Effects in Latin America'. IDB Working Paper Series 848. Washington, DC Inter-American Development Bank. https://doi.org/10.18235/0000931

Daymont, T.N., and P.J. Andrisani (1984). 'Job Preferences, College Major, and the Gender Gap in Earnings'. *Journal of Human Resources*, 19(3): 408–28. https://doi.org/10.2307/145880

Ernst & Young Global (2014) 'We Grow: Unlocking the Growth Potential of Women Entrepreneurs in Latin America and the Caribbean'. Washington DC: Multilateral Investment Fund, Inter- American Development Bank, 2014. Available at: http://www.ey.com/Publication/vwLUAssets/EY-MIF- reporte-en/$FILE/EY-WeGrow-MIF-Report-en.pdf (accessed 15 February 2021).

Flabbi, L., M. Macis, A. Moro, and F. Schivardi (2019). 'Do Female Executives Make a Difference? The Impact of Female Leadership on Gender Gaps and Firm Performance'. *The Economic Journal*, 129(622): 2390–423. https://doi.org/10.1093/ej/uez012

Hallward-Driemeier, M. (2013). *Enterprising Women. Expanding Economic Opportunities in Africa*. Washington, DC: Agence Française de Développement and the World Bank. https://doi.org/10.1596/978-0-8213-9703-9

Hansen, H., and J. Rand (2014a). 'Estimates of Gender Differences in Firm's Access to Credit in sub-Saharan Africa'. *Economics Letters*, 123(3): 374–77. https://doi.org/10.1016/j.econlet.2014.04.001

Hansen, H., and J. Rand (2014b). 'The Myth of Female Credit Discrimination in African Manufacturing'. *Journal of Development Studies*, 50(1): 81–96. https://doi.org/10.1080/00220388.2013.849337

Hardy, M., and G. Kagy (2018). 'Mind the (Profit) Gap: Why Are Female Enterprise Owners Earning Less Than Men?'. *American Economic Association Papers and Proceedings*, 108: 252–55. https://doi.org/10.1257/pandp.20181025

Islam, A.M., I. Gaddis, A. Palacios-Lopez, and M. Amin (2020). 'The Labor Productivity Gap Between Female and Male-managed Firms in the Formal Private Sector'. *Feminist Economics*, 26(4): 228–58. https://doi.org/10.1080/13545701.2020.1797139

Klapper, L., and S.C. Parker (2011). 'Gender and the Business Environment for New Firm Creation'. *World Bank Research Observer*, 26(2): 237–57. https://doi.org/10.1093/wbro/lkp032

Lashley, J.G., and K.V. Smith (2015). *Profiling Caribbean Women Entrepreneurs: Business Environment, Sectoral Constraints, and Programming Lessons*. Washington, DC: World Bank. Available at: http://documents.worldbank.org/curated/en/240461562141037955/Profiling-Caribbean-Women-Entrepreneurs-Business-Environment-Sectoral-Constraints-and-Programming-Lessons (accessed 27 July 2020).

Leuven E., and B. Sianesi (2003). 'PSMATCH2: Stata Module to Perform Full Mahalanobis and Propensity Score Matching, Common Support Graphing, and Covariate Imbalance Testing'. Available at : http://ideas.repec.org/c/boc/bocode/s432001.html (accessed 25 February 2021).

Martín-Ugedo J.F. and A. Minguez-Vera (2014). 'Firm Performance and Women on the Board: Evidence from Spanish Small and Medium-Sized Enterprises'. *Feminist Economics*, 20(3): 136–62. https://doi.org/10.1080/13545701.2014.895404

Munyegera, G.K., and A. Precious (2018). 'The Gender Gap in Firm Productivity in Rwanda: Evidence from Establishment and Household Enterprise Data'. UNU-WIDER Working Paper 2018/100. Helsinki: UNU-WIDER. https://doi.org/10.35188/UNU-WIDER/2018/542-8

Nagler, P., and W. Naudé (2014). 'Non-Farm Enterprises in Rural Africa. New Empirical Evidence.' Policy Research Working Paper 7066. Washington, DC: World Bank. https://doi.org/10.1596/1813-9450-7066

Noland, M., T. Moran, and B.R. Kotschwar (2016). 'Is Gender Diversity Profitable? Evidence from a Global Survey'. PIIE Working Paper 16-3. Washington, DC: Peterson Institute for International Economics. https://doi.org/10.2139/ssrn.2729348

Ostry, J.D., J. Alvalrez, R. Espinoza, and C. Papageorgiou (2018). 'Economic Gains from Gender Inclusion: New Mechanisms, New Evidence'. IMF Staff Discussion Note SDN/18/06. Washington, DC: International Monetary Fund. https://doi.org/10.5089/9781484337127.006

Oaxaca, R. (1973). 'Male–Female Wage Differentials in Urban Labour Markets'. *International Economic Review*, 14(3): 693–709. https://doi.org/10.2307/2525981

Caribbean PROTEqIN Survey (2014). 'Productivity, Technology and Innovation in the Caribbean 2014 Survey'. Bridgetown, Barbados: Compete Caribbean, Caribbean Development Bank.

Rosenbaum, P.R., and D.B. Rubin (1985). 'Constructing a Control Group Using Multivariate Matched Sampling Methods that Incorporate the Propensity Score'. *The American Statistician*, 39(1): 33–38. https://doi.org/10.1080/00031305.1985.10479383

Appendix

Table A1: Summary statistics

Variable definition	Name	N	Mean	SD	Min	Max
Ln total sales per worker in 2012 (USD, deflated)	Lnlabpro12	1,891	10.58	0.99	7.42	15.61
Female top manager	Tfem	1,963	0.22	0.41	0	1
The main owner is a female	Ofem	1,966	0.20	0.40	0	1
Percentage of the firm owned by females	Pcofem	1,938	21.19	31.15	0	100
At least 50% of the owners are females	Femmore	1,950	0.30	0.46	0	1
At least 50% of managers are females	Tfemmore	1,964	0.36	0.48	0	1
There are males and females in management team	Gendivm	1,966	0.71	0.46	0	1
There are males and females among owners	Gendivo	1,966	0.35	0.48	0	1
Ln average manager wages in 2012 (USD, deflated)	Lnwagem12d	1,932	9.59	0.61	7.64	11.35
Minimum education level of the manager, 1–8	Edumanmin	1,959	6.69	0.95	1	8
Average education level of the manager, 1–8	Edumanav	1,957	6.27	1.24	1	8
Years of experience in the same sector	Expsec	1,947	18.86	11.12	1	58
Ln age of the firm	Lnage	1,922	2.97	0.72	-0.69	5.84
Ln number of employees	Lnnworkers	1,966	3.20	1.16	0	7.49
The firm purchases fixed assets	Fixas	1,966	0.35	0.48	0	1
Shareholding company	Shareh	1,966	0.36	0.48	0	1
Partnership including limited liability	Partner	1,966	0.13	0.34	0	1
Limited partnership	Limpartner	1,966	0.14	0.34	0	1
The establishment part of a larger firm	Multi	1,966	0.17	0.38	0	1
Percentage of the firm owned by foreigners	Foreign	1,966	0.16	0.37	0	1
The firm exports	Exporter	1,966	0.26	0.44	0	1
Manufacturing activities	Manuf	1,966	0.34	0.47	0	1
Retail activities	Retail	1,966	0.24	0.43	0	1
The firm uses its own website	Web	1,966	0.47	0.50	0	1
Benefits from any technical assistance programmes	Techas	1,966	0.17	0.37	0	1
Innovation department	Innovd	1,966	0.10	0.30	0	1
Innovation introduced	Innovp	1,966	0.21	0.41	0	1
Inadequately educated workforce	Skills	1,965	1.85	1.20	0	4
Business licensing and permits	Permits	1,964	1.09	1.14	0	4
Access to finance	Accesfinance	1,964	1.83	1.18	0	4
Macroeconomic environment	Macroenv	1,965	1.62	1.26	0	4
Corruption	Corruption	1,964	1.46	1.20	0	4
Crime, theft, and disorder	Crime	1,965	1.70	1.19	0	4
Telecommunications	Tel	1,965	1.25	1.20	0	4
Electricity	Elec	1,965	1.62	1.30	0	4
Transportation	Trans	1,965	1.19	1.20	0	4
Access to land	Land	1,965	1.03	1.14	0	4
Political environment	Policy	1,964	1.41	1.24	0	4
Tax rates	Taxrates	1,965	1.70	1.20	0	4
Tax administration	Taxadmin	1,965	1.50	1.16	0	4
Customs and trade regulations	Customs	1,962	1.48	1.10	0	4
Labour regulations	Labour	1,965	1.34	1.18	0	4

Source: variables generated from Caribbean PROTEqIN Survey (2014).

Table A2: Mean comparison and bias reduction after exact matching

Variable	Mean Treated	Mean Control	Matched % bias	t-test t	t-test p>|t|	% reduction bias
Lnwagem11d	9.604	9.614	-1.500	-0.200	0.845	82.50
Edumanav	6.182	6.247	-5.200	-0.730	0.463	55.70
Edumanmin	6.697	6.705	-0.800	-0.120	0.908	81.80
Expsec	16.37	16.08	2.700	0.420	0.677	90.10
Femempl	13.12	14.18	-2.400	-0.350	0.727	85.30
Lnage	2.868	2.926	-8	-1.130	0.258	66.30
Lnnworkers	2.841	2.802	3.400	0.500	0.618	92.40
Fixas	0.354	0.328	5.300	0.750	0.454	-45.40
Shareh	0.275	0.270	1.100	0.160	0.873	94.80
Partner	0.119	0.126	-2.300	-0.320	0.745	55.80
Limpartner	0.154	0.182	-8	-1.050	0.296	-137.3
Multi	0.136	0.129	2.100	0.310	0.754	79.70
Foreign	0.126	0.134	-2.100	-0.320	0.752	80.80
Exporter	0.268	0.253	3.500	0.490	0.627	-421.9
Manuf	0.270	0.232	8.200	1.230	0.220	54
Retail	0.278	0.265	2.900	0.400	0.690	79.50
Web	0.457	0.442	3	0.430	0.669	9.900
Techas	0.157	0.159	-0.700	-0.100	0.922	90.10
Innovd	0.0783	0.0783	0	0	1	100
Innovp	0.164	0.144	5.100	0.790	0.432	62.50
Skills	1.813	1.813	0	0	1	100
Permits	0.995	0.927	6	0.860	0.391	34.50
Accesfinance	1.886	1.874	1.100	0.150	0.884	87.50
Macroenv	1.687	1.687	0	0	1	100
Corruption	1.525	1.530	-0.400	-0.0600	0.953	96.90
Crime	1.712	1.664	4	0.570	0.568	21.10
Tel	1.265	1.306	-3.400	-0.470	0.639	-18.10
Elec	1.581	1.581	0	0	1	100
Trans	1.174	1.093	6.700	0.960	0.337	-374.5
Land	0.934	0.977	-3.700	-0.530	0.598	62
Policy	1.568	1.490	6.200	0.870	0.385	50.40
Taxrates	1.641	1.614	2.300	0.330	0.745	48
Taxadmin	1.454	1.457	-0.200	-0.0300	0.975	96.60
Customs	1.470	1.404	6	0.850	0.396	-222.5
Labour	1.275	1.364	-7.600	-1.060	0.288	26.70
Mean Bias:	Unmatched=9	Matched=3	Median Bias:	Unmatched=7.3	Matched=3.3	PR^2=0.03

Notes: * if variance ratio outside [0.82; 1.22]. Unmatched Pseudo R^2=0.118. The covariate balancing tests for the PSM are shown. Treated firms are in the common support if their propensity score is lower than the maximum and higher than the minimum score of the control units. In the last row we display the mean and median bias across all the covariates included in the probit estimation before and after the matching.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

Table A3: Logit results for the propensity score estimation with exact matching

	(1)
VARIABLES	Probit coeff.
Lnwagem	-0.210
	(0.176)
Edumanav	-0.0827
	(0.0545)
Edumanmin	0.111
	(0.0898)
Expsec	-0.0284***
	(0.00668)
Femempl	0.00309*
	(0.00171)
Lnage	-0.0121
	(0.102)
Lnnworkers	-0.361***
	(0.0787)
Fixas	0.132
	(0.131)
Shareh	-0.302*
	(0.156)
Partner	-0.236
	(0.198)
Limpartner	0.197
	(0.193)
Multi	-0.0915
	(0.182)
Foreign	-0.284
	(0.186)
Exporter	0.301**
	(0.150)
Manuf	0.0611
	(0.536)
Retail	0.818*
	(0.488)
Web	0.123
	(0.135)
Techas	-0.159
	(0.171)
Innovd	0.214
	(0.283)
Innovp	-0.253
	(0.200)
Skills	0.00333
	(0.0533)
Permits	-0.0994
	(0.0647)
Accesfinance	-0.0190

	(0.0546)
Macroenv	0.0164
	(0.0500)
Corruption	0.0427
	(0.0596)
Crime	0.0385
	(0.0582)
Tel	0.0939
	(0.0620)
Elec	-0.0322
	(0.0577)
Trans	-0.00341
	(0.0562)
Land	-0.0848
	(0.0569)
Policy	0.124**
	(0.0537)
Taxrates	0.00402
	(0.0601)
Taxadmin	-0.0763
	(0.0628)
Customs	-0.0390
	(0.0595)
Labour	-0.0438
	(0.0570)
Country and Sector FE	yes
Pseudo R^2	0.11
Observations	1,875

Note: robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

Table A4: Regression analysis for female majority in the management team

Dependent VARIABLE:	(1)	(2)	(3)	(4)
Ln total sales per worker in 2012 (USD, deflated)	All	All	Services	Manufactures
Independent VARIABLES:				
1 if at least 50% of managers are female	-0.054	-0.062	-0.125**	0.090
	(0.044)	(0.045)	(0.054)	(0.082)
Observations	1,820	1,820	1,221	599
R-squared	0.247	0.349	0.326	0.446
Independent VARIABLES:				
There are males and females in management team	0.017	0.004	0.030	-0.019
	(0.048)	(0.051)	(0.062)	(0.096)
Observations	1,822	1,822	1,221	601
R-squared	0.247	0.349	0.323	0.445
Country FE	Yes			
Sector FE	Yes			
Country-sector FE		Yes	Yes	Yes
Manufactures				Yes
Services			Yes	

Note: robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

Table A5: Blinder–Oaxaca decomposition results for female majority in the management team

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Diff.	Decomp.	Diff.	Decomp.	Diff.	Decomp.	Diff.	Decomp.
Models:	A: Country and sector FE		B: A+MANAGER CHARACTERISTICS		C: B+FIRM CHARACTERISTICS		D: C+ ENVIRONMEN. CONSTRAINTS	
Prediction_1	10.601***		10.601***		10.597***		10.599***	
	(0.029)		(0.029)		(0.029)		(0.030)	
Prediction_2	10.537***		10.542***		10.540***		10.540***	
	(0.038)		(0.039)		(0.040)		(0.040)	
Difference	0.064		0.059		0.057		0.058	
	(0.048)		(0.048)		(0.049)		(0.050)	
Endowments		0.002		0.029		0.027		0.016
		(0.027)		(0.029)		(0.032)		(0.033)
Coefficients		0.129***		0.074		0.068		0.067
		(0.048)		(0.047)		(0.048)		(0.049)
Interaction		-0.067**		-0.044		-0.039		-0.025
		(0.029)		(0.030)		(0.032)		(0.034)
Observations	1,889	1,889	1,856	1,856	1,821	1,821	1,820	1,820
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

Table A6: Propensity score matching results for majority of female managers

Outcome:	Unexplained	Exact	Propensity score	
ln LABP	Difference[a]	Matching	Kernel	Mahalanobis
	(1)	(2)	(3)	(4)
ATT[b]	0.058	-0.0890	-0.0890	-0.10698
	(0.050)	(0.070)	(.07009)	(0.0664)
N treated	659	665	655	655
N control	1,161	1,148	1,161	1,161
Total obs.	1,820	1,803	1,816	1,816

Notes: [a]Blinder–Oaxaca decomposition from Table A5 (column 7). [b]Average treatment on the treated over the common support. Heteroskedasticity-consistent analytical standard errors in brackets. PSM with all controls, country, and sector FE. ATT denotes average treatment on the treated. Figure A2 indicates that the common support is satisfied.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

Table A7: Model with percentage of females in the management team

	(1)	(2)	(3)	(4)	(5)
Dependent VARIABLE	Sales per worker	Sales per worker	Sales per worker	Sales per worker	Sales per worker
Independent VARIABLES					
Share of female managers	-0.077	0.422**	0.233	0.411	-0.121
	(0.053)	(0.193)	(0.188)	(0.241)	(0.528)
Share of female managers^2		-0.557**	-0.393*	-0.512*	-0.188
		(0.225)	(0.220)	(0.266)	(0.458)
Turning point[a]		0.3766			
Observations	1,824	1,824	1,824	1,221	603
R-squared	0.252	0.255	0.354	0.327	0.457
Country FE	Yes	Yes			
Sector FE	Yes	Yes			
Country-sector FE			Yes	Yes	Yes
Manufactures					Yes
Services				Yes	

Notes: robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables included for firm characteristics, business environmental constraints, and manager team characteristics. Coefficients not shown to save space. [a]The turning point is calculated as 0.422/(2*0.557).

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

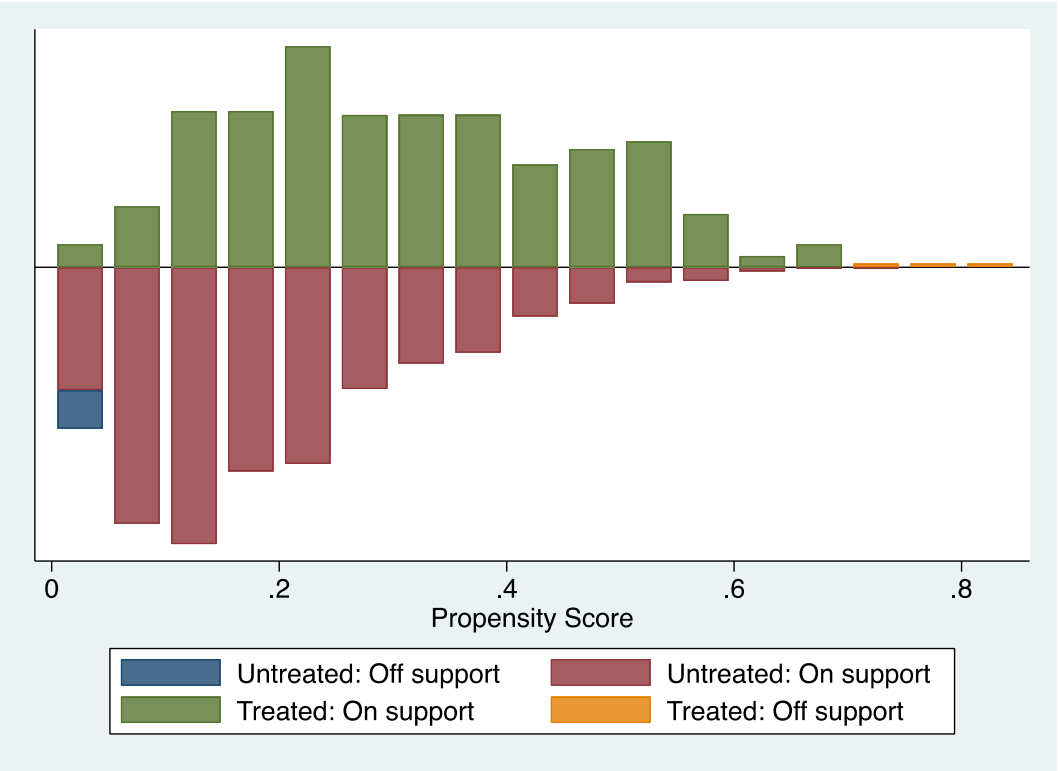
Table A8: Model with interaction between female workers and top manager dummy

	(1)	(2)	(3)	(4)
Dependent VARIABLE:	Ln total sales per worker	Ln total sales per worker	Ln total sales per worker	Ln total sales per worker
Independent VARIABLES				
Female top manager = 1	-0.284***	-0.280***	-0.347***	-0.104
	(0.083)	(0.090)	(0.118)	(0.140)
Percentage of female workers	0.000	-0.001	0.000	-0.003
	(0.001)	(0.001)	(0.001)	(0.002)
Female top manager*per cent of female workers	0.003*	0.004**	0.005**	0.000
	(0.002)	(0.002)	(0.002)	(0.004)
Observations	1,461	1,461	912	549
R-squared	0.233	0.346	0.302	0.490
Country FE	Yes			
Sector FE	Yes			
Country-sector FE		Yes	Yes	Yes
Manufactures				Yes
Services			Yes	

Notes: robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables included for firm characteristics, business environmental constraints, and manager team characteristics. Coefficients not shown to save space. Female workers refer to unskilled workers.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

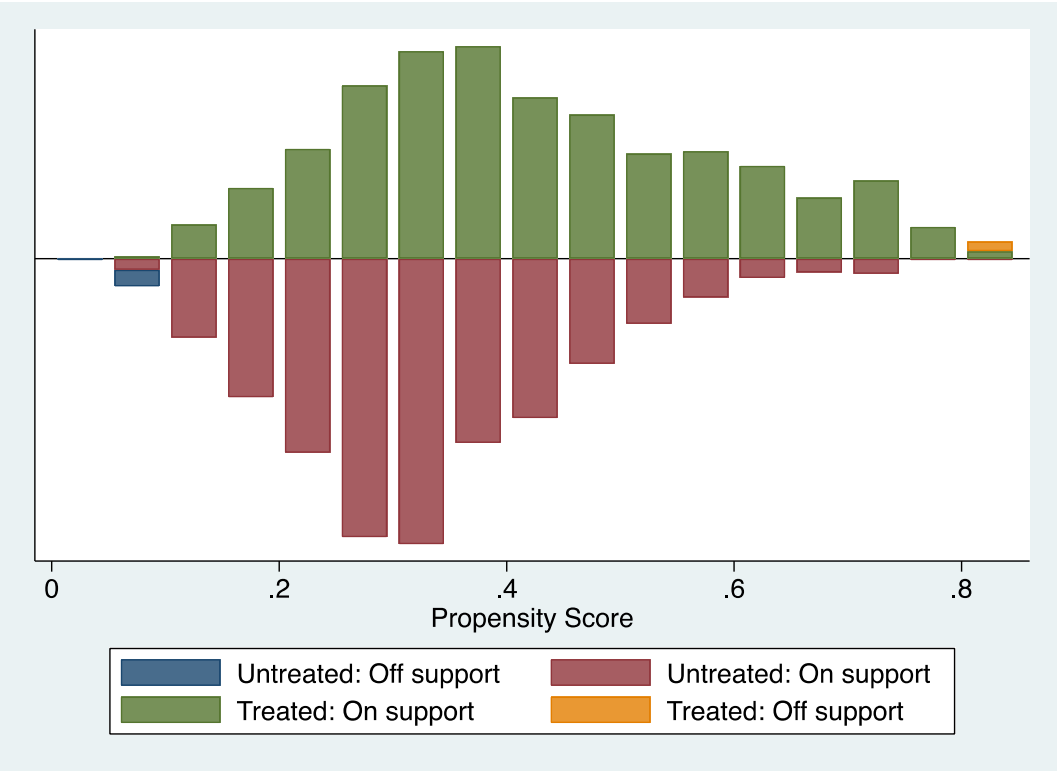
Figure A1: Common support for exact matching—top female manager



Note: based on results shown in Table 5, column 2.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

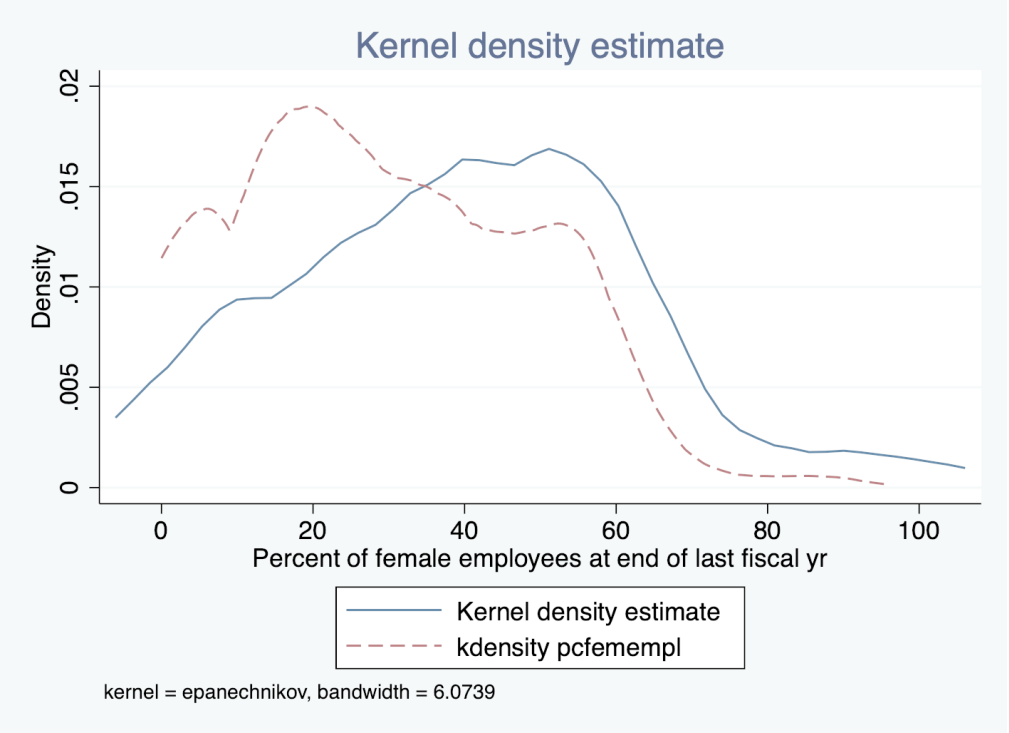
Figure A2: Common support for exact matching—majority of female managers



Note: based on results shown in Table A4, column 2, first panel.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).

Figure A3: Kernel density plots of the share of female workers by gender of the top manager



Note: solid line corresponds to female-managed firms and dotted line to male-managed firms.

Source: authors' computation based on data from Caribbean PROTEqIN Survey (2014).