Gender and firm performance around the world: The roles of finance, technology and labor

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ARTICLE INFO	ABSTRACT
	We study the effect of having a female top manager (FTM) on firm performance using World Bank Enterprise Survey data that cover 130,000 firms in 130 mostly developing countries from 2008 to 2017. We show that firms with FTMs underperform their male-led counterparts. FTMs' underperformance is largely driven by small and medium-sized enterprises and varies widely across world regions. FTMs influence firm performance through affecting firms' three critical factors of production, which are finance, technology, and labor. Our mediation analyses indicate that the negative FTM–performance relation can be partially mediated by firms' access to finance, technology usage, and labor selection, which are proxied by lines of credit, internet purchases, and labor cost, correspondingly. This study synthesizes the leadership literature, extends upper echelon and social role theories, and brings clarity to the equivocal findings in the literature on the relation between female leadership and firm performance.

1. Introduction

International Labor Organization (ILO) data show that the share of female employers steadily grew from 17.3 % in 1991 to 22 % in 2018 (ILO, 2019). Further, over the past three decades women have been starting businesses at higher rates in all regions of the world. This attests to the increasingly important role of female-owned businesses as economic engines of job creation. However, ILO surveys also point out that female managers face "glass ceilings," "glass walls," and "leaky pipelines" (ILO, 2019, p. 40).[1] The World Bank Enterprise Survey (WBES), which is the database employed in this study, shows that about 16 % of over 130,000 surveyed firms indicate that their CEO-equivalent top manager is female—hereafter operationalized as our independent variable and named *female top managers* (FTMs). As the size of the enterprises increases, the share of firms with female CEOs shrinks. Only 2.6 % of CEO positions at Fortune Global 500 firms were occupied by women as of August 2020 (Catalyst, 2021). These statistics naturally lead to the question of whether FTMs matter to firm performance. Fig. 1.

To answer that question, scholars have produced many studies on the impact of female leadership, which have increased tenfold between 2008 and 2017 (Moreno-Gómez et al., 2018). However, scholars have not reached a consensus on the relation between female leadership and firm performance. Some scholars document a positive relation (see, e.g, Conyon & He, 2017; Krishnan & Park, 2005; Krishnan & Parsons, 2008; Christiansen et al. 2016; Liu et al., 2014; Palvia et al., 2015; Perryman et al., 2016; Qian, 2016), while others find a negative relation (see e.g., Adams & Ferreira, 2009; Ahern & Dittmar, 2012; Dixon-Fowler et al., 2013; Du Rietz & Henrekson, 2000; Fairlie & Robb, 2009; Klapper & Parker, 2011; Lemma et al., 2022; Post & Byron, 2015). Other studies find no association between female leadership and firm performance (e. g., Robb & Watson, 2012; Dale-Olsen et al., 2013). In a comprehensive *meta*-analysis (K = 78, n = 117,239 organizations) of the direct effects of female leadership on financial performance, Hoobler et al., (2018) find the overall empirical results to be "equivocal" and advocate further research on the underlying mechanisms linking female leadership and performance.

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  [1] A "glass wall" refers to occupational segregation within management functions, while a "leaky pipeline" refers to the decreasing number of female managers as the positions become more senior.

Fernando, et al. (2020) provide two reasons that may partially explain the inconclusive findings. The first is the "unsuitability" of performance measures used in previous studies. The most common performance proxies are either accounting measures such as return on assets (ROA), return on equity (ROE), and return on sales (ROS), or stock market–based measures such as Tobin's Q and stock returns. Executives can easily manipulate the accounting measures,[2] while market measures subsume both actual and expected performance, meaning these measures can fail to fully capture the effect of female leadership (Fernando et al., 2020). The second reason for the inconclusive findings is the "contextual" nature of the relation between women in leadership and performance. Scholars have examined various factors and identified moderators of the relationship, including managerial ability (Fernando et al., 2020), ownership (Abdullah Ismail, & Nachum, 2016), technology (Crittenden et al., 2019), innovation intensity (Dezso & Ross, 2012), internal and external governance (Hoskisson et al., 2019; Jurkus et al., 2011), business complexity (Foss et al., 2022), organization and culture (Nekhili et al., 2018), and institutional contexts such as access to education, resources, and empowerment (Post & Byron, 2015) or the type of gender quota in place (Foss et al., 2022).

The above-mentioned studies largely support the "contingency theory," which posits that the effectiveness of female leadership is a function of the organizational and business environment in which the leaders operate (Nekhili et al., 2018). Contrary to Nekhili et al. (2018), Krishnan and Park (2005) find that the positive link between top management's gender diversity and performance in the Fortune 1000 firms is not moderated by environmental characteristics, such as munificence, dynamism, and complexity. They further declare that "the role played by top female managers transcends the demands of the environment" (Krishnan & Park, 2005, p. 17).

The extant literature on whether FTMs affect firm performance is vast. We summarize selected relevant studies on female leadership and firm performance from 2000 in Table 1. As shown, we list the scope of the study (geographic location), sample size, time period, methodology, independent variables, dependent variables, and findings. At the end of the table, we describe our paper in a similar manner, so to highlight differences with previous studies and visualize our contribution.

Given the unsettled nature of the literature on the relation between female leadership and performance, our paper adds to this ongoing debate by investigating two questions. What is the impact of FTMs on firm performance around the world? What roles, if any, do finance, technology, and labor play in the performance outcomes? Or more specifically, is the relationship between FTMs and firm performance mediated by finance, technology, or labor?

To answer these questions, we first use a multi-theoretical approach to extend the upper echelon theory (UET) and social role theory (SRT) and explain how female leadership's social goals influence strategy decisions that impact performance. We draw theoretical arguments about why the psychological characteristics and socialization processes influence FTMs to make different decisions in the financial, technology, and labor channels.

Next, utilizing the 2008–2017 firm-level World Bank Enterprise Survey (WBES) data from 130 countries, our empirical results indicate that women-led businesses underperform men-led businesses in terms of sales growth (SG), employee growth (EG), and labor productivity (LP). We employ these three relatively hard-to-manipulate performance measures to alleviate the "unsuitability" concern of the accounting- and market-based measures used in many prior studies (Fernando et al., 2020). The negative FTM–performance relation remains stable in various robustness tests. The result also holds after we address the endogeneity concern using the two-stage least squares (2SLS) and propensity score matching (PSM) methods.

Our results also indicate that the effect of FTMs on performance varies greatly by region and by firm size. For example, the negative FTM–performance effect is stronger in Europe and Central Asian countries and weaker in South Asian countries. The effect also becomes stronger in small and medium-sized enterprises (SMEs) and disappears in large firms. Moreover, using the results from mediation analyses, we find that gender gaps in access to finance, technology use, and labor market practices partially mediate the negative gap in FTM
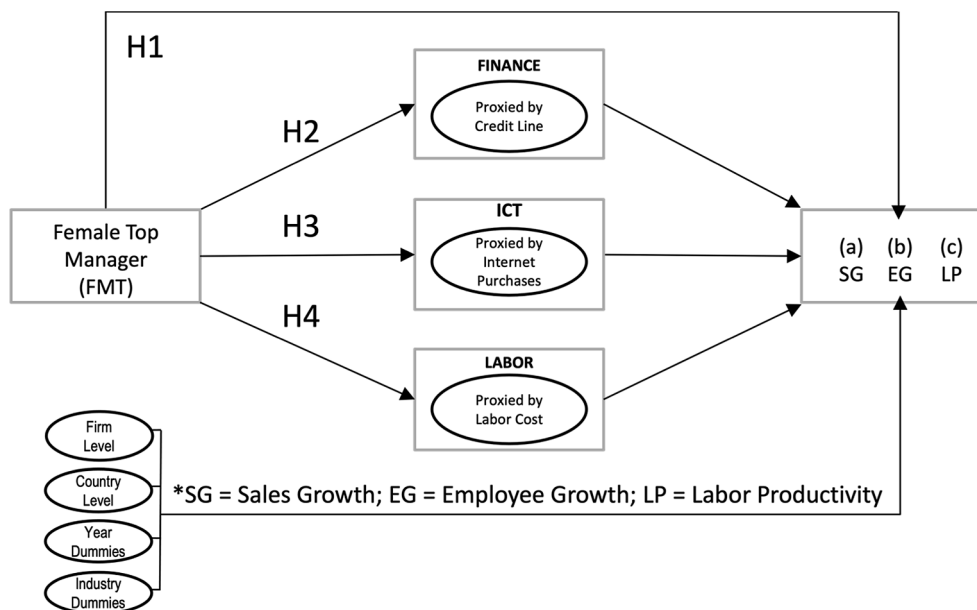

Fig. 1. Conceptual Model, This diagram illustrates the conceptual model of our research design and the hypotheses to be tested.

performance.

In comparison to the prior studies, our study is much more comprehensive in terms of number of countries covered and sampled firms. Our paper also looks beneath the surface of FTMs by examining not only if but also how FTMs affect firm performance. We use a

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[2] Liu et al. (2016) find that male CFOs are more likely to manipulate earnings than female CFOs. Gupta et al. (2020) find that male CFOs are more likely to misreport their financial statements than female CFOs.

Table 1
Prior Studies on Female Leadership and Firm Performance.

Year Authors Journal	Country/region Sample size Sample period	Method	Gender measure Main Independent Variables	DVs	Finding
(2000) Du Rietz and Henrekson *Small Business Economics*	Sweden 4200 small firms 1995 phone interviews	Multivariate regressions	Gender of entrepreneurs	Sales, profitability, employment, orders	On average, female entrepreneurs tend to underperform male counterparts in all 4 performance measures. However, with a large number of controls, multivariate regression results show female underperformance disappears in 3 of the 4 measures, with the exception of sales.
(2005) Krishnan and Park *Journal of Business Research*	US Fortune 1000 listed firms 1998	Multivariate regressions	Women representation on the top management team (TMT)	Organizational performance	A significant and positive relation between women representation on TMT and organizational performance.
(2009) Adam and Ferreira *J. of Financial Economics*	U.S. Listed S&P 500, S&P MidCap S&P SmallCap listed firms 1998–2003	Multivariate regressions Industry/firm fixed effects	% Women board directors	Tobin's Q ROA	On average, the effect of board gender diversity on performance is negative, largely driven by firms with fewer takeover defenses.
(2009) Fairlie and Robb *Small Business Economics*	U.S. firms Characteristics of Business Owners (CBO) Survey Sent to 75,000 firms and 115,000 owners 1992	OLS, decomposition technique	Gender of business owners	Firm survival rates Profit Employment Sales	Compared to male-owned firms, female-owned firms have lower survival rates, profit, employment, and sales.
(2011) Jurkus et al. *Journal of Business Research*	U.S. Fortune 500 firms 1995–2006	Multivariate regression 2SLS	Gender diversity on TMT	Agency costs	OLS results show a negative link between gender diversity on TMT and agency costs. Endogeneity check (2SLS analysis) shows the aforementioned negative link disappears.
(2012) Robb and Watson *Journal of Business Venturing*	US 4000 new ventures 2004–2009	Univariate tests Multivariate regressions	Female-owned firms	4-year closure rate ROA, Sharpe ratio	No performance difference between female-led and male-led new ventures.
(2012) Dezso and Ross *Strateg. Manag. J.*	US S&P 1500 firms 1992–2006	Panel data regressions	Female representation on TMT interaction with innovation intensity	Tobin's Q	Female representation on TMT interaction with innovation intensity leads to positive and significant Tobin's Q.
(2014) Amore et al. *Management Science*	Italian medium & large, 2400 family firms 2000–2010	PSM, triple-difference approach	Female directors	Profitability	Female directors significantly improve female-led family firms.
(2016) Christiansen et al. *IMF Working Paper*	35 European countries 2,000,000 private firms 2013	Multivariate regressions	% Women in senior positions	ROA Labor productivity ratio	A positive association between women leadership and ROA where women form a larger share of labor force, in sectors where complementarities in skills and critical thinking are required.
(2013) Dixon-Fowler et. *Strateg. Manag. J.*	US Fortune 1000 firms And Global Fortune 500 firms 1991–2006	Text analysis	Announcement of female CEO appointments	Announcement abnormal returns	The stock market on average has a negative reaction to the announcement of a female CEO.
(2013) Dale-Olsen et al. *Femmist Econ.*	Norway All public limited companies and ordinary limited companies 2003–2007	Difference-in-Difference	Board of directors' gender quotas	ROA Operating revenues	The impact of the Norwegian board gender reform on firm performance is insignificant.
(2014) Levi et al. *J. Corp. Fin.*	U.S. S&P 1500 firms 1997–2009	Multivariate regressions Difference-in-difference	Female board directors	M&A activities M&A performance: bid premium	When CEOs surround themselves with more female directors, they engage in fewer M&A activities. When they do, they garner better M&A performance (lower bid premium).
(2014) Liu et al. *J. Corp. Fin.*	China Listed firms in Shanghai and Shenzhen Stock Exchanges 1999–2011	Multivariate regressions Difference-in-difference	Female board directors	ROA ROS	A positive link between board gender diversity and firm performance. Critical mass is documented: when boards have 3 or more female directors, board gender diversity has a stronger positive effect on performance.

Table 1 (*continued*)

Year Authors Journal	Country/region Sample size Sample period	Method	Gender measure Main Independent Variables	DVs	Finding
(2016) Qian *ADB Econ. WP Series*	10 Asian economies: Top 100 largest listed firms in each economy 2013–2014	2-Stage Heckman regressions	% Female directors on board	Stock return ROE	Female board representation is positively and significantly linked to firm performance.
(2017) Conyon and He *Journal of Business Research*	U.S. 3000 listed firms 2007–2014	Quartile regressions IV regressions	Women board directors	Tobin's Q ROA	The presence of women on boards is positively linked to firm performance.
(2018) Nekhili et al. *J. Bus.Ethics*	France 394 listed firms 2001–2010	GMM Regression	Female Chair Female CEO	Tobin's Q ROA	Female Chair is negatively related to ROA; Female CEO is positively related to Tobin's Q.
(2018) Moreno-Gómez et al. *Gend. Manag. An Int. J.*	Columbian Stock Market 54 listed firms 2008–2015	Fixed Effects Regression	Female CEO, % Females on Board, % Females on TMT	ROA ROE	Female CEO is positively linked to ROA. Female board % positively is linked to ROE. Female TMT % is positively linked to ROA and ROE.
(2020) Fernando et al. *Journal of Business Research*	U.S. S&P 500 firms 1992–2015	Mediation analysis	Gender diversity on TMT Interaction with managerial ability	Tobin's Q	The link between gender diversity on TMT and Tobin's Q can be mediated by managerial ability.
(2022) Lemma et al. *Small. Bus. Econ.*	Kenya & South Africa 1,522 SMEs 2018–2020	OLS & PSM	Female-owned firms	Labor productivity = Total annual sales / # full-time employees	Female-owned firms post lower performance outcomes compared to male peer firms, in both Kenya and South Africa.
Our Paper	World Bank Enterprise Survey 130 mostly developing countries, over 130,000 firms, Mostly SMEs 2008–2017	OLS, IV test PSM, country-fixed effects, mediation analysis	Female top manager (FTM), firm characteristics, country controls	Sales growth, employee growth, Labor productivity	FTM-led firms underperform their male top manager-led peers. The negative FTM–firm performance relation is largely driven by SMEs and varies widely across the globe. Our mediation analyses show that the gender-driven gaps in access to finance, technology use, and labor selection can explain the observed gender gaps in performance.

comprehensive set of methods, including ordinary least squares (OLS), two-stage least squares (2SLS), propensity score matching (PSM), and mediation analysis. Our mediation results are novel and provide empirical evidence that gender gaps in access to finance, technology use and labor selection can explain the observed negative FTM–performance relation. We choose to focus on access to finance, technology use, and labor selection because these are three of the most important inputs in the neoclassical economic production function.

Our contributions can be summarized from the following three perspectives. The first contribution comes from the dataset we employ to study the FTM–performance relation. The World Bank Enterprise Survey (WBES) data cover more than 130,000 unique firms across 130 countries from 2008 to 2017. In our study, we combine the rich WBES dataset that contains firm-level variables with country-level economic, institutional, and cultural variables. Specifically, one key difference between our study and the prior literature is that our study examines mainly SMEs, while most prior studies focus on listed or large private firms.

The second contribution is also related to our dataset selection. Another key difference between our study and the prior literature is that our study focuses on mainly developing countries, including the poorest countries in the world. Most of the studies cited above are in Western contexts where institutions and social norms are relatively more conducive for women to be in leadership positions. The global context of our study allows us to provide a more in-depth analysis of the "contextual" nature of the female leadership–performance relation (Fernando et al., 2020), as there are wide variations in economic development, labor demand requirements, institutional quality, and cultural characteristics across the 130 mostly developing countries in

our sample. Moreover, the above heterogeneity between developing and developed countries calls for an investigation of the mechanisms behind the presence of women in leadership positions, which is partially answered by our next contribution. These greater variations allow us to estimate correlations among variables with greater statistical power and to generalize our findings to a worldwide context.

The third contribution is that our study is among the first to present evidence that three of the most critical factors in the production function (finance, technology, and labor) mediate the negative influence of FTM on performance. Specifically, we show that leadership characteristics, which are related to gender-driven preferences, cognition, and goal orientation, impact decisions in the finance, technology, and labor channels. Each of the channels further mediate the effect of FTM on performance. These results imply that female-led firms should deploy their organizational resources to improve access to finance, to adapt new technologies in production and managerial processes, and to be mindful of labor cost control.[3]

Our paper is organized as follows. Section 2 synthesizes the existing literature to develop our conceptual model and hypotheses. Section 3 presents our data and summary statistics. Section 4 presents our empirical results of FTMs' effect on performance, including robustness checks and procedures to control for endogeneity. Subsample results of FTMs' effect on performance are also reported here. Section 5 presents our mediation analyses relating to the channels through which gender gaps in finance, technology, and labor explain the observed gender

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[3] We will elaborate more on the managerial implications of our study in the conclusion.

differences in performance. Section 6 concludes with a discussion of limitations.

2. Theoretical framework and hypothesis development

The ongoing global phenomenon of female leadership underrepresentation has been explained by institutional constraints (Sabarwal & Terrell, 2008), demand-side constraints such as gender stereotypes (Christiansen et al., 2016; Eagly & Wood, 2012) and glass ceilings (Adams & Funk, 2012; Bruhn, 2009), and supply-side constraints such as culture, social norms, and bias (Blau & Kahn, 2017; GEM, 2017). In tandem with the female underrepresentation issue are inconsistent findings on performance outcomes for female business owners and leaders. Across a host of measures (e.g., earnings, profits, capital return, growth, survival, turnover, employment growth, size, efficiency), much research supports the underperformance hypothesis (Bosma et al., 2004; Bruhn, 2009; Klapper & Parker, 2011; Sabarwal & Terrell, 2008).

However, other works suggest that female-owned businesses do not underperform in specific contexts, particularly considering the benefits of gender diversity (Christiansen et al., 2016; Dezso & Ross, 2012; Matsa & Miller, 2011; Post, 2015; Ritter-Hayashi et al., 2019). Meanwhile, Robb and Watson (2012) argue that research findings of underperformance are due to inappropriate performance measures and/or do not adequately control (due to data limitations) for important demographic differences.

2.1. A Multi-Theoretical perspective

The foregoing underscores the practical importance of empirical work in putting together the pieces of the gender puzzle, even as it echoes Lewin that "there is nothing so practical as good theory" (Lewin, 1951, p. 169) to solve it. Without effective theory, variations in the documented gender differences and similarities may appear random or spurious and create the illusion that gender plays a relatively inconsequential role in behavior, even as experience and observation attest that gender represents a multifaceted system of influence (Eagly, 2009). Integrating multiple theories, as exemplified by Conyon and He (2017) and Abdullah et al. (2016), may help address the confluence of joint, multi-level factors, such as those impacting the gender–performance relationship. To this end, we draw upon upper echelon theory and social role theory.

2.1.1. Upper echelon theory

Good leadership matters for the survival and prosperity of organizations (Day & Antonakis, 2012), and upper echelon theory (UET) predicts that good leadership is affected by the characteristics, personalities, and experience of those in top management, and that these weigh on organizational behaviors and outcomes (Hambrick & Mason, 1984). UET has informed leadership scholarship at the levels of the individual top manager as well as the top management team. The latter primarily investigates the makeup or diversity among the top management team for its influence (Jain et al., 2021; Krishnan & Park, 2005), while the former (as in this study), focuses on the specific top manager's influence on firm performance. Executives draw upon their own cognitions, experiences, values, perceptions, and evaluations to make decisions, solve problems, and implement strategies (Hambrick, 2007; Hambrick et al., 2005; Pryor et al., 2021), and this leads to variance in organizational performance outcomes owing to the heterogeneity in the individuals managing the organizations.

2.1.2. Social role theory

Social role theory (SRT) suggests that women are disadvantaged due to institutionalized and systematic discrimination that denies them access to critical resources (Fischer et al., 1993), leading to the observed gendered performance differences. The two central premises of SRT are: (i) economic development is a critical determinant of societal

progression toward gender equality, which is a prerequisite for the dissolution of gender roles; and (ii) gender-specific roles instill distinct preferences in women and men, constituting a crucial component in explaining the gender preference gap (Eagly & Wood, 2013). According to SRT, women tend to prioritize fairness and equality because they have been socialized to be accommodating, cooperative, and "other" oriented (Wood & Eagly, 2012). As an example, women demonstrate a willingness to sacrifice personal gain to punish unfair behavior, to the extent the they deem the costs tolerable (Eckel & Grossman, 1996). Both women and men are prosocial, though women are inclined toward more communal and relational behaviors, whereas men are inclined toward strength-intensive, agentic, and collectively oriented behaviors (Eagly, 2009). Also, women prioritize empathy owing to a more relational, connected, and interdependent self-construal leadership relative to men's more independent self-construal one (Gabriel & Gardner, 1999).

2.2. Conceptual model and hypothesis development

We propose the following conceptual model to represent the impact of FTM on firm performance and the mediating influence of the finance, technology, and labor channels.

The lens through which women see the world is influenced by gendered socialization processes, shaping FTM characteristics and perspectives (Eagly & Wood, 2012). FTMs bring unique cognitive frames, including personalized interpretations of situations, contexts, and environments, which in turn influence managerial behaviors and business outcomes (Post & Byron, 2015; Moreno-Gómez et al., 2018). For instance, SRT predicts that FTMs will exhibit a higher proclivity than male top managers (MTMs) for prosocial behaviors that are communal and relational. More participative, collaborative leadership styles offer a number of benefits, but also carry costs. One such cost is time. For example, building trust for effective decision making as well as successful team building requires significant time investment. Other costs include risk of oversharing sensitive information in collaborative settings, possibly compromising the firm's competitive position. Furthermore, the increased amount of time spent on team building and decision deliberations may cause FTMs to delay or even forgo time-sensitive, positive net present value (NPV) projects. Additionally, FTMs' more participative leadership styles can lead to their expert opinions being marginalized or muted due to groupthink, leading to potentially lowered decision quality. Taken together, FTMs' more participative leadership style and focus on fairness and equality may negatively influence firm performance in the immediate term, especially when measured by sales growth and labor productivity.[4]

The potential negative association between FTMs and the employment growth rate warrants further discussion. First, FTMs may be more risk averse than MTMs. As such, they may be more reluctant to take on new and riskier projects, which offer the greatest growth potential. Second, FTMs' prosocial behaviors could potentially hinder their ability to access government contracts, as FTMs may be more reluctant to strongly compete with their male counterparts in the highly competitive market for government contracts (Gneezy et al., 2003). In developing countries, government spending and government contracts contribute significantly to national employment and correspondingly to new hires for the participating firms. Thus, FTMs' lower participation rate in government contracts will likely adversely influence a firm's employment growth rate (Rasheed, 2004). Moreover, the degree of gender inequality—in terms of, for instance, access to education, freedom, and autonomy, which are then correlated with the chances of women being in leadership positions—is a more severe concern in developing countries (Jayachandran, 2015).

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[4] We do not suggest that FTMs' participative leadership style is less effective in the long term. Our dataset does not provide time-series longitudinal data to test the long-term effects of this leadership style.

Based on the aforementioned discussions, we hypothesize:

H1. FTMs negatively influence firm performance.

2.3. Gender and the finance channel

There is consensus in the literature that access to finance is critical for the success of any business (Beck et al., 2005b; Marlow & Patton, 2005; Wang, 2016). The literature further provides extensive support for the notion that women are consistently disadvantaged when accessing external credit to grow their businesses (Marlow & Patton, 2005). Overall, credit constraints continue to be a serious impediment for female-led firms in terms of business creation, investment decisions, and growth (WB, 2012).

Female-led firms experience limited access to finance in many countries, which acts as a major constraint on performance. Sauer and Wiesemeyer (2018) examine the gender gap in access to finance and its impact on business value using a German dataset and find that men have more favorable access to finance. They further find that access to a bank loan appears to be a critical factor in explaining the business value gender gap. Morsy (2020) examines the World Bank Global Findex database for 141 countries over time and finds that women have more difficulty accessing finance in countries with a smaller foreign-owned bank presence, a bigger share of state-owned banks in the banking system, lower availability of credit information via public and private credit registries, and large gender education gaps. Chaudhuri et al. (2020) examine a large dataset on micro, small, and medium firms in India and find that gender discrimination in the small business credit market leads to significant underperformance by women-owned firms compared to those owned by men.

More recently, using firm-level data from 80 countries, Chundak-kadan and Sasidharan (2022) document that institutional gender equality benefits female entrepreneurs' access to finance. Seema et al. (2021) find that female owners generally face more credit constraints compared to their male counterparts. They further find that women-owned firms face fewer credit constraints in countries that have a more inclusive institutional and policy environment, supporting the notion that the institutional context matters when examining the relationship between gender and access to finance.

Lack of bank lines of credit impedes firms from carrying out efficient day-to-day operations due to reduced working capital; this constrains firms' ability to innovate and bring new products to markets (Ayyagari et al., 2011). Overall, studies show that FTMs employ lower levels of both debt and equity capital than MTMs (Brush et al., 2018; Coleman & Robb, 2009). These findings suggest that female-led firms likely have slower growth rates.

In fact, women's difficulty accessing external finance is consistently-one of the most cited reasons for the gendered performance differences observed in the relevant literature. Thus, we operationalize the construct of access to finance using the WBES question, "*At this time, does this establishment have a line of credit or loan from a financial institution?*" As far as the FTM encounters financial access constraints, we predict that this barrier will be to the detriment of sales growth, employee growth, and labor productivity. Therefore, we hypothesize:

H2. The finance channel mediates the negative relationship between FTMs and firm performance.

2.4. Gender and the technology channel

Studies have shown that internet access and the intensity of its use are positively linked to economic growth at the country level (Hitt & Brynjolfsson, 1996) and to firm growth and productivity at the micro level (Clarke et al., 2015). Information and communication technology (ICT) is a great equalizer as it provides resource-challenged enterprises with an ability to reach national and international markets in a cost-effective manner.[5] ICT is fundamental to the growth and survival of a modern business (Ahuja & Thatcher, 2005; Ali & Yusuf, 2021; Bharadwaj, 2000; Makarius et al., 2020), and the importance of the internet in conducting business cannot be overstated as it increases sales (Stansfield & Grant, 2003), lowers advertising costs (Riquelme, 2002), and facilitates differentiation (Bharadwaj, 2000; Stansfield & Grant, 2003; Tan et al., 2010, 2009). Internet deliveries can improve customer service (Stansfield & Grant, 2003), enhance customer information searches, transfers, and flow (Tan et al., 2009; Vickery et al., 2004), and accelerate knowledge transmission and innovation (Paunov & Rollo, 2016). Internet transactions, such as internet purchases, reduce transaction costs (Vickery et al., 2004), increase consumer value and productivity (Hitt & Brynjolfsson, 1996), enhance efficiency (Tan et al., 2010), and support business transformation (Tan et al., 2009).

However, Ahuja and Thatcher (2005) argue that women's diverse social roles may lead them to experience overload from too many responsibilities, which may preclude them having the time and inclination to explore and adopt new technologies (Maruping & Magni, 2012). Venkatesh and Morris (2000) find that women adopt and sustain technology in the workplace at lower rates than men. The authors also find that gender can moderate the perceived usefulness of technology. Finally, female technology usage and adoption is significantly lower than male web usage and adoption (Ahuja & Thatcher, 2005; Hargittai & Shafer, 2006; Maruping & Magni, 2012; Venkatesh & Morris, 2000). With respect to opportunities for women, the internet is particularly vital for its power to increase market efficiency by making transactions quicker, cheaper, and more convenient (Clarke & Wallsten, 2006) and to reduce barriers historically challenging to female business leaders.

We expect that the possible lower adoption rate and usefulness perception of internet purchasing for women can mediate FTMs' negative influence on performance. We capture internet purchases with this indicator, "*Does the establishment use the internet to make purchases for this establishment?*" Therefore, we hypothesize:

H3. The technology channel mediates the negative relationship between FTMs and firm performance.

2.5. Gender and the labor channel

Managers bring their own leadership styles to the job, leaving an imprint on the firm through strategic decisions (Bertrand & Schoar, 2003; Carpenter et al., 2004; Eagly, 2009; Grilli et al., 2020). This means that consistency of business goals between male and female managers cannot be assumed because there is inconsistency among motivating psychological factors (Hechavarría et al., 2017). For instance, strategic and human resource management literature finds that women have different entrepreneurial motivations, leading to strategies that value continuity over growth (Verheul et al., 2002). Female entrepreneurs are also more inclined to focus on social value goals relative to male counterparts. Similarly, women tend to pursue intrinsic goals over extrinsic ones, such as financial gains (Brush, 1992; Chaganti & Parasuraman, 1997; Rosa et al., 1996) and assess their success based on attainment of these goals in lieu of financial measures. As a result, women gauge business success by holistically integrating a number of performance goals, some of which are not financial. In other words, women deliberately choose to invest in more social goals and contributions, making trade-offs, which is consistent with the blended value framework, known as the triple bottom line (Hechavarria et al., 2012). Bertrand (2011) further posits that women demonstrate greater concern

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[5] ICT is defined as computer hardware, software, and networks to connect to the internet, ranging from simple applications such as e-mail, file sharing, and a web presence, to more complex internet purchases/deliveries, payment processing, resource planning, inventory management, customer services, etc. (Forman et al., 2012; Tan et al., 2010).

about how others judge their behavior and may feel more obligated towards others. Alesina and Giuliano (2009) show strong evidence that women are more willing than men to pay higher costs for altruism and have a higher preference for redistribution. These gendered psychological and social traits likely lead to different labor decisions, and by extension, different firm outcomes. Hence, we theorize that FTMs give a higher priority than MTMs to improving the welfare of employees, such as providing employees with a decent salary and a permanent contract, which are akin to altruism and redistribution.

Moreover, risk-averse employers choose educated workers over uneducated ones as an insurance policy (Spence, 1973) when facing uncertainty and information asymmetry, and this carries a premium on labor cost. Women tend to be more risk-averse (Croson & Gneezy, 2009), and FTMs may be less informed than MTMs due to "glass walls," thus plausibly leading FTMs to hire a more educated workforce to overcome information asymmetry and serve as an insurance policy. Paradoxically, overqualified workers are more disposed to voluntarily terminating jobs (Verhaest & Omey, 2009), engaging in cynical, counterproductive behaviors, expressing higher rates of job dissatisfaction (Johnson & Johnson, 2000), lacking effective commitment to the organization (Bolino & Feldman, 2000; Maynard et al., 2006), and reporting higher rates of stress (Johnson & Johnson, 2000; Luksyte et al., 2011; Verhaest & Omey, 2009) and meaningless work (Luksyte et al., 2011) than workers whose education and skills better match what is required for the job. Taken together, risk-averse behaviors and prosocial goal preferences may increase costs in the labor channel, thus mediating FTMs' influence on performance. We use the percent of labor cost, which is calculated as labor cost divided by sales, to proxy labor market practices in our mediation analyses and hypothesize that:

H4. The labor channel mediates the negative relationship between FTMs and firm performance.

3. Data

3.1. The sample

We employ the most recent World Bank Enterprise Survey (WBES) data from 2008 to 2017. The dataset covers over 130,000 firms in 130 countries. A country may be surveyed once, twice, or three times during this period. The WBES uses standardized survey instruments to collect data on a representative sample of firms operating in manufacturing and service industries worldwide and their business environment from business owners and top managers. In each country, the initial population of firms is sourced by the national statistical office and is often enriched with government agencies' sources such as tax or business licensing authorities, business associations, or marketing databases. To make data comparable across countries, stratified random sampling techniques are used to address attrition in firm-level surveys.

The WBES data are suitable for answering our research questions for three reasons. First, the survey directly asks detailed questions about the firm's operating environment while protecting anonymity. These anonymous and direct responses are likely associated with less measurement error than indirect and non-anonymous answers. Second, the WBES also asks the respondents to describe the firm's financing patterns, technology adoptions, and labor market hiring practices (including labor costs), which provides the requisite information for our study. Third, the dataset covers 130 countries, most of which are developing countries. Gender disparity in leadership representation is more pronounced in the developing than in the developed world (ILO, 2019). In addition, there are wide variations in cultural, institutional, and economic developments across our sampled countries. These greater variations allow us to estimate correlations among variables more precisely and to generalize our findings to a worldwide context.

However, the WBES data also have limitations. First, firms are selected randomly in each country-year survey. Due to the lack of time-series data, we can only run pooled regressions rather than panel estimations. The inability to control for firm fixed effects may lead to omitted variable bias. To alleviate this concern, we include multiple firm-level and country-level control variables in all our regressions, perform two types of endogeneity tests, and run various robustness tests. Second, unlike publicly listed firms, firms included in the WBES do not have detailed financial information. Although annual sales, number of employees, and various types of costs (e.g., costs of labor, raw materials, intermediate goods, electricity, and fuel) are available, operating profit, net profit, assets, liabilities, and equity are not available. Therefore, we cannot use profit margins, return on assets (ROA), or return on equity (ROE) to measure firm performance, nor can we use financial leverage to measure firm risk. As alternatives, we use sales growth, employee growth, and labor productivity to proxy firm performance, and firm size and firm age to proxy firm risk.[6]

Sections 3.2, 3.3, and 3.4, present a detailed discussion of the measurement of gender, dependent variables, and control variables, respectively. All variable definitions are reported in our Online Appendix 1.

3.2. Female leadership measure: FTM

Our main explanatory variable, female top manager (*FTM*), is a dummy that equals one if the firm's highest-ranked manager is female, and zero otherwise. As shown in Table 2, Panel C, 16 % of the firms in the dataset have an FTM.

Table 2
Summary Statistics, Summary statistics of dependent and independent variables.

Variable	N	Mean	Median	Std	Min	Max
Panel A: Firm Performance						
Sales Growth	97,502	0.08	0.04	0.54	−5.91	6.70
Employee Growth	122,812	0.05	0.00	0.21	−2.90	3.52
Labor Productivity	115,174	5.32	5.31	2.02	−5.82	15.74
Panel B: Mediator Variables						
Line of Credit	131,498	0.36	0	0.48	0	1
Internet Purchases	18,666	0.73	1.00	0.44	0	1
Labor Cost	110,161	21.67	16.23	19.25	0.15	93.97
Panel C: Independent Variables						
FTM	107,781	0.16	0.00	0.36	0	1
Ln(Employees)	122,735	3.16	2.94	1.43	0	11.07
Ln(Age)	134,562	2.69	2.71	0.75	0	5.83
Ln(Experience)	132,685	2.70	2.77	0.69	0	4.51
State Ownership	134,248	0.02	0	0.13	0	1
Foreign Ownership	134,203	0.11	0	0.31	0	1
Top Owner	129,240	79.28	100.00	26.37	0.2	100
Public	135,506	0.05	0	0.22	0	1
Exporter	135,089	0.21	0	0.41	0	1
Ln(GDP)	135,172	25.27	25.26	2.01	19.48	29.53
GDP Growth	135,910	4.65	5.25	4.21	−26.05	29.32
GDP per Capita	135,172	8.00	7.94	1.06	5.39	10.87
Inflation	134,182	7.32	6.97	5.86	−35.84	59.22
College Education	121,652	10.93	9.19	6.57	1.65	30.17
LFP	135,032	44.68	42.40	12.87	19.02	79.81
Buddhism & Hinduism	136,583	10.82	0.00	26.20	0	97.3
Judaism	136,583	0.27	0.00	4.49	0	75.6
Christianity	136,583	51.75	64.40	39.54	0	100
Islam	136,583	27.08	5.90	37.04	0	100
Folk Religions	136,583	2.47	0.00	7.44	0	45.3
Atheism	136,583	7.61	3.60	11.69	0	76.7

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[6] For a detailed user's guide, please go to: https://www.enterprisesurveys.org/en/enterprisesurveys.

Fig. 2 illustrates the fraction of FTMs by world regions, with the highest in the East Asia and Pacific regions and the lowest in the Middle East and North Africa regions. Fig. 3 shows the fraction of FTMs by industry. As shown, FTMs are more likely to operate in the food, textile, retail, and wholesale industries.

Our Online Appendix 2 presents the number and percentage of FTMs and MTMs by country. The percentage of FTMs varies widely across countries in our sample. Thailand and Cambodia have the highest percentage of FTMs (69 % and 55 %, respectively), while Iraq and Yemen each have only 1 % of FTMs among all top managers.

3.3. Dependent variables

Following Fisman and Svensson (2007), we use sales growth and employee growth to measure firm performance as follows[7]:

$$\text{Sales Growth}_{i,t} = [\text{Ln}(\text{Sales}_{i,t-1}) - \text{Ln}(\text{Sales}_{i,t-3})] / 2$$

$$\text{Employee Growth}_{i,t} = [\text{Ln}(\text{Employee}_{i,t-1}) - \text{Ln}(\text{Employee}_{i,t-3})] / 2$$

We use labor productivity to measure firm efficiency, which is a well-established measure in the financial economics literature (Maksimovic & Phillips, 2008; Ullah et al., 2014). Labor productivity is calculated as the logarithm of sales over the number of employees:

$$\text{Labor Productivity}_{i,t} = \text{Ln}(\text{Sales}_{i,t-1}/\text{Employee}_{i,t-1})$$

Sales values used in the above equations are translated from local currencies to constant 2010 U.S. dollars and winsorized at the top and bottom 1 % to reduce the impact of outliers. The summary statistics in Table 1, Panel A indicate that the means of *Sales Growth* (SG), *Employee Growth* (EG), and *Labor Productivity* (LP) are 8 %, 5 %, and 5.32, respectively.

One of our main contributions is to go beyond the direct effect of *FTM* on firm performance. We examine if and how three critical channels (i.e., finance, technology, and labor) influence the FTM–performance relation. As the WBES contains several proxies for each of the three channels, for brevity, we choose one representative proxy for each channel mediator.[8] Specifically, we use *Line of Credit* (a dummy variable that equals one if the firm has a line of credit or loan from a financial institution, and zero otherwise), *Internet Purchases* (a dummy variable that equals one if the firm has used the internet connection to order purchases for this establishment, and zero otherwise), and *Labor Cost* (labor cost divided by sales) to represent access to finance, technology adoption, and hiring practices, respectively.

The summary statistics in Table 2, Panel B indicate that in our sample, 36 % of the firms have a line of credit at a bank, 73 % use the internet to make purchases, and labor costs account for 22 % of sales on average.

3.4. Control variables

Following prior literature that employs the WBES dataset (see e.g., Beck et al., 2005b; D'Souza et al., 2017; Liu et al., 2021), we control for the following firm characteristics: firm size (*Ln(Employees)*), firm age (*Ln(Age)*), top manager's years of industry-specific experience (*Ln(Experience)*), a state ownership dummy, a foreign ownership dummy, ownership concentration (*Top Owner*), a public listing status dummy (*Public*), and an export status dummy (*Exporter*). All firm-level controls are lagged one year to alleviate identification concerns.

Following Beck et al. (2005a) and Zheng et al. (2013), we control for four country-level macroeconomic variables, which are also lagged one

year: *Ln(GDP)* (in constant 2010 US dollars), *GDP Growth*, *GDP per Capita* (in constant 2010 US dollars), and *Inflation*. Following Boedo and Şenkal (2014), we also include the percentage of the population (aged 25 +) with a college or equivalent degree (*College Education*) and the labor force participation rate (of the population aged 15–64) (*LFP*) to control for country-level labor market conditions. These six variables are sourced from World Development Indicators (WDI). Moreover, prior studies have shown that religions affect country growth and firm performance (Barro & McCleary, 2004; Callen & Fang, 2015; Guiso et al., 2003; Hilary & Hui, 2009). We hence include Buddhism and Hinduism, Judaism, Christianity, Islam, and folk religions in our regressions, with atheism as the default category (PEW, 2014). Detailed variable definitions are reported in our Online Appendix 1. Table 2 (Panel C) reports the summary statistics of our firm- and country-level control variables.

3.5. Correlation matrix and univariate tests

Table 3A reports the correlation matrix. We observe no correlation coefficients greater than 0.50 between any two independent variables. Further, the variance inflation factor (VIF) in our data has a mean VIF ranging from 3.57 to 3.84 across our model specifications in Table 4, lower than the common threshold of 10. This indicates that multicollinearity is unlikely to be an issue. Table 3B presents univariate test results for key variables between FTM-led firms (*FTM* = 1) and MTM-led firms (*FTM* = 0). As shown, an average female-led firm is smaller and younger, has slower employee growth, and has lower labor productivity than an average male-led firm. An average female-led firm has a less experienced top executive and more-concentrated ownership and is less likely to have a foreign ownership stake, to be publicly listed, or to be an exporter.

4. Does gender affect firm performance?

4.1. Baseline results

In this section, we test H1 on whether and how *FTM* influences firm performance. We initially employ the following model specification:

$$\text{Performance} = \beta_0 + \beta_1 \text{FTM} + \text{firm \& country controls} + \text{year \& industry dummies} + \varepsilon_1. \quad (1)$$

Performance is proxied by *Sales Growth, Employee Growth,* or *Labor Productivity*, alternatively. Firm-level controls, country-level controls, year, and industry dummies are included in all regressions. We cluster standard errors at the country level to mitigate potential heteroscedasticity issues. According to H1, we expect β_1 to be negative and significant.

Table 4 reports estimation results of Eq. (1). The coefficients of FTM, β_1, are negative and statistically significant for all the three performance measures. Having a female CEO is associated, on average, with 2.4 %, 1.7 %, and 16.6 % lower *Sales Growth*, *Employee Growth*, and *Labor Productivity*, respectively. Our baseline results show that H1 is supported. As discussed in Section 2, both the upper echelon and social role theories can help explain the negative relation between *FTM* and performance.[9]

Regarding control variables, we observe that larger and older firms grow slower but have higher labor productivity. Firms with foreign ownership and exporters perform better, consistent with prior studies (Beck et al., 2005a, 2005b; D'Souza et al., 2017; Fisman & Svensson, 2007).

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[7] The survey asks a firm to provide sales and the number of employees for years t-1 and t-3, where t is the survey year. The survey does not provide sales or employee data for the year t-2.

[8] See more discussion in Section 5.

[9] As a sensitivity test, we employ the natural log of sales revenue (in constant 2010 US $), instead of the natural log of employees, as a firm size proxy in our main regressions. The results still suggest that female-led firms underperform male-led firms. Detailed results are available upon request from the authors.
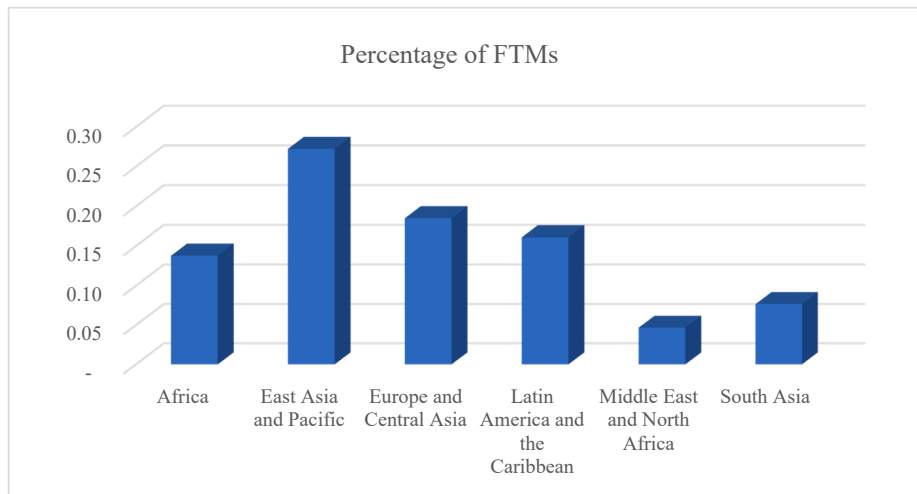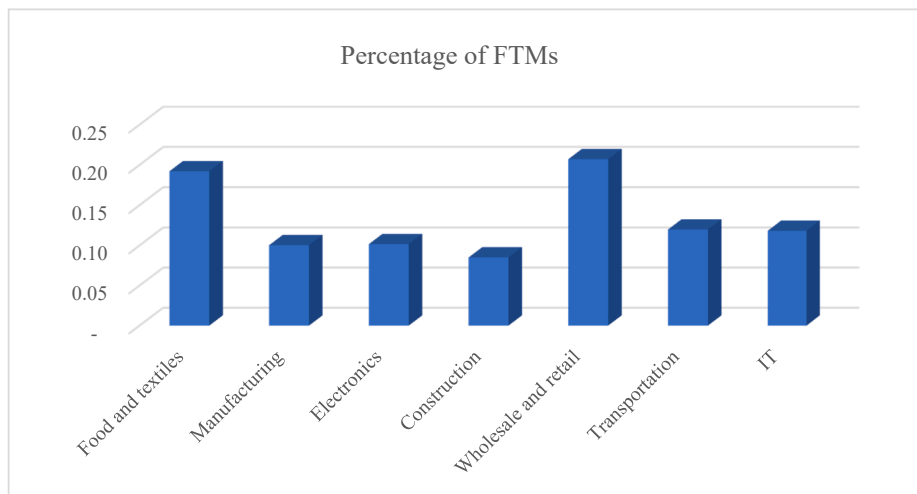
Fig. 2. Percentage of FTMs by Region.

Fig. 3. Percentage of FTMs by Industry.

Table 3A

Correlation Matrix. Bold values indicate p < 0.10.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FTM	(1)												
Sales Growth	(2)	0.00											
Employee Growth	(3)	−0.01	**0.19**										
Labor Productivity	(4)	−0.02	**0.20**	−0.02									
Ln(Employees)	(5)	**−0.08**	−0.03	**−0.22**	**0.10**								
Ln(Age)	(6)	−0.04	−0.07	**−0.17**	**0.09**	**0.31**							
Ln(Experience)	(7)	−0.06	−0.02	−0.08	**0.10**	**0.13**	**0.44**						
State Ownership	(8)	−0.01	0.01	−0.02	0.00	**0.10**	0.06	−0.01					
Foreign Ownership	(9)	−0.02	0.03	0.01	**0.09**	**0.21**	0.00	−0.03	**0.09**				
Top Owner	(10)	0.02	0.00	0.03	**−0.14**	**−0.26**	**−0.15**	**−0.13**	−0.07	**−0.10**			
Public	(11)	−0.02	0.01	−0.03	0.05	**0.18**	**0.10**	0.01	**0.14**	**0.11**	**−0.12**		
Exporter	(12)	−0.03	0.02	0.00	**0.09**	**0.34**	**0.14**	**0.10**	0.06	**0.20**	**−0.14**	0.07	

4.2. Robustness tests

Results in Table 4 may be sensitive to the inclusion of over-represented countries in terms of number of firms surveyed or the lack of adequate country-level controls. To ascertain the robustness of our results in Table 4, we conduct four robustness tests. First, Egypt, India, Nigeria, and Russia have a disproportionately large number of observations in our sample (see Online Appendix 2). To exclude the possibility

that our main findings in Table 4 are driven by these countries, we drop them and re-estimate Eq. (1); the results are reported in Table 5 (Panel A). Second, we substitute country-level controls with country dummies and re-estimate Eq. (1); the results are reported in Table 5 (Panel B).

Third, a country's culture affects workplace culture (Hofstede,

Table 3B
Univariate Tests, This table displays mean values of key variables, and mean differences of these variables between female-led businesses and male-led businesses. We use *t*-tests to test mean differences. *** p < 0.01; ** p < 0.05; * p < 0.10.

	Female		Male		F–M	
	Top Managers		Top Managers			
Variable	N	Mean	N	Mean	Diff	
Sales Growth	11,533	0.044	63,862	0.049	−0.006	
Employee Growth	15,350	0.040	82,660	0.047	−0.007	***
Labor Productivity	13,711	5.243	74,481	5.348	−0.105	***
Ln(Employees)	15,351	2.970	82,641	3.273	−0.304	***
Ln(Age)	16,646	2.654	89,432	2.730	−0.076	***
Ln(Experience)	16,540	2.623	88,816	2.741	−0.118	***
State Ownership	16,618	0.014	89,426	0.019	−0.005	***
Foreign Ownership	16,615	0.089	89,385	0.109	−0.020	***
Top Owner	15,772	79.877	85,830	78.558	1.319	***
Public	16,755	0.044	89,996	0.056	−0.012	***
Exporter	16,707	0.192	89,723	0.222	−0.030	***
Ln(GDP)	16,783	25.276	89,587	25.526	−0.250	***
GDP Growth	16,853	4.167	90,255	4.339	−0.172	***
GDP per Capita	16,783	8.178	89,587	8.038	0.140	***
Inflation	16,709	7.140	88,747	7.400	−0.260	***
College Education	16,911	10.815	90,870	10.772	0.043	
LFP	16,745	45.496	89,553	43.692	1.805	***
Buddhism & Hinduism	16,911	14.537	90,870	12.103	2.434	***
Judaism	16,911	0.149	90,870	0.376	−0.227	***
Christianity	16,911	54.416	90,870	46.577	7.839	***
Islam	16,911	18.582	90,870	30.559	−11.977	***
Folk Religions	16,911	3.073	90,870	2.638	0.434	***
Atheism	16,911	9.244	90,870	7.748	1.496	***

1987), thus affecting organizational outcomes. Therefore, we add individualism, uncertainty avoidance, and masculinity as controls to Eq. (1) and report the regression results in Table 5 (Panel C).[10] Fourth, a country's institutional development plays an important role in firm performance (Beck et al., 2005b; Boubakri et al., 2013). We use the World Bank's Worldwide Governance Indicators (WGI) to proxy a country's institutional quality and development. The WGI contains six institutional measures: voice and accountability, rule of law, regulatory quality, political stability, government effectiveness, and control of corruption. Because these six measures are highly correlated pairwise with one another, we create an aggregate measure, *WGI Total*, which is the sum of the values of the six indicators, to represent a country's overall institutional development. The regression results controlling for *WGI Total* are reported in Table 5 (Panel D).[11]

As shown in Table 5, the results from all four robustness tests support H1.

4.3. Endogeneity

Our baseline results in Table 4 may be driven by selection bias. The presence of an FTM in a firm is unlikely to be random. Firms search for top managers with certain characteristics, while competent top executives may self-select into certain types of firms. To address this endogeneity concern, we employ-two-stage least squares (2SLS) and propensity score matching (PSM) methods.

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[10] These three culture measures are not included in the main regression because they do not have a significant coefficient on firm performance in our robustness test.
[11] As *WGI Total* does not have a significant coefficient on firm performance in our robustness test, and the correlation between *WGI Total* and *GDP per Capita* is high (correlation = 0.61), we do not include *WGI Total* in our main regression in Table 4.

Table 4
Gender and Firm Performance, This table examines the impact of FTMs on firm performance. Year and industry dummies are included in all regressions. Standard errors (in parentheses) are adjusted for heteroscedasticity. *** p < 0.01; ** p < 0.05; * p < 0.10.

	Sales Growth (1)	Employee Growth (2)	Labor Productivity (3)
FTM	−0.0242*	−0.0175***	−0.1660***
	(0.01)	(0.00)	(0.04)
Ln(Employees)	−0.0093**	−0.0293***	0.0821***
	(0.00)	(0.00)	(0.03)
Ln(Age)	−0.0480***	−0.0256***	0.0647*
	(0.01)	(0.00)	(0.03)
Ln(Experience)	−0.0003	−0.0061***	0.0624*
	(0.01)	(0.00)	(0.03)
State Ownership	0.0275	0.0018	−0.4146
	(0.04)	(0.01)	(0.39)
Foreign Ownership	0.0363**	0.0241***	0.4933***
	(0.02)	(0.01)	(0.09)
Top Owner	−0.0002	−0.0002***	−0.0052***
	(0.00)	(0.00)	(0.00)
Public	−0.0107	0.0092	0.0268
	(0.02)	(0.01)	(0.09)
Exporter	0.0414***	0.0356***	0.2277***
	(0.01)	(0.00)	(0.07)
Ln(GDP)	0.0128	0.0007	0.0046
	(0.02)	(0.00)	(0.04)
GDP Growth	0.0048	0.0031***	0.0191
	(0.00)	(0.00)	(0.03)
GDP per Capita	−0.0384	0.0028	0.5539***
	(0.04)	(0.00)	(0.09)
Inflation	0.0064	0.0003	0.0429
	(0.00)	(0.00)	(0.03)
College Education	0.0012	0	0.0033
	(0.00)	(0.00)	(0.00)
LFP	−0.0061	0	0.0134
	(0.00)	(0.00)	(0.01)
Buddhism & Hinduism	−0.0031	−0.0002	−0.009
	(0.00)	(0.00)	(0.01)
Judaism	0.0011	0.0005**	0.0005
	(0.00)	(0.00)	(0.01)
Christianity	−0.0021*	−0.0003	−0.0083
	(0.00)	(0.00)	(0.01)
Islam	−0.0030*	−0.0002	−0.0157**
	(0.00)	(0.00)	(0.01)
Folk Religions	−0.0058**	0	−0.0136
	(0.00)	(0.00)	(0.01)
N	66,384	85,237	73,134
R^2	0.08	0.07	0.20

4.3.1. Two-Stage least squares (2SLS)

We employ-two instrumental variables (IVs) that affect the likelihood of a firm's having an FTM but should not directly affect firm performance. The first is the fraction of firms with FTMs at the country level (*National FTM*), and the second is a dummy variable that equals one if the firm is at least partially owned by a woman, and zero otherwise (*Female Owner*).

We expect that *National FTM* is positively linked to the likelihood of a firm's having an FTM (Terjesen & Singh, 2008). We also expect that a firm with a female owner is more likely to choose a woman as her top executive. As the median firm in our sample has<20 employees, a female owner could very well serve as the top manager herself (Matsa & Miller, 2011). We estimate the following first- and second-stage models:

FTM = α_0 + α_1National FTM + α_2 Female Owner + firm & country controls.

+ *year & industry dummies* + ε_2. (2).

Performance = β_0 + β_1Predicted FTM + firm & country controls.

+ *year & industry dummies* + ε_3. (3).

Table 6 reports 2SLS results. The first-stage results show that both *National FTM* and *Female Owner* have a positive and statistically significant (at the 1 % confidence level) influence on *FTM*. The IVs' high relevance to *FTM* is also supported by our first-stage *F* statistics, which

Table 5

Gender and Firm Performance—Robustness Tests, In Panel A, we drop countries that have a disproportionately large number of observations. In Panel B, we substitute country-level controls with country dummies. In Panel C, we control for the effect of culture measures in addition to the controls included in Eq. (1). In Panel D, we control for the effect of Worldwide Governance Indicators in addition to the controls included in Eq. (1). For the sake of brevity, only the coefficient of *FTM* is presented below. Year and industry dummies are included in all regressions. Standard errors (in parentheses) are adjusted for heteroscedasticity. *** p < 0.01; ** p < 0.05; * p < 0.10.

	Sales Growth	Employee Growth	Labor Productivity
Panel A: Drop Outlier Countries			
FTM	−0.0163	−0.0191***	−0.1406***
	(0.01)	(0.00)	(0.05)
N	51,238	66,833	56,662
R2	0.108	0.066	0.229
Panel B: Use Country Dummies			
FTM	−0.0029	−0.0146***	−0.1114***
	(0.01)	(0.00)	(0.04)
N	66,384	85,237	73,134
R^2	0.228	0.09	0.445
Panel C: Control for Culture Variables			
FTM	−0.0241*	−0.0183***	−0.1451***
	(0.01)	(0.00)	(0.04)
N	65,814	84,184	72,316
R^2	0.08	0.067	0.214
Panel D: Control for Institutional Development (*WDI Total*)			
FTM	−0.0211*	−0.0184***	−0.1588***
	(0.01)	(0.00)	(0.04)
N	63,224	81,553	69,804
R^2	0.08	0.07	0.20

Table 6

Gender and Firm Performance—IV Test, This table presents the 2SLS regression results. Exclusion restrictions are *National FTM* and *Female Owner*. For the sake of brevity, only the coefficient of the exclusion restrictions and *FTM* are reported. Firm- and country-level controls and year and industry dummies are included in all regressions. Standard errors (in parentheses) are adjusted for heteroscedasticity. *** p < 0.01; ** p < 0.05; * p < 0.10.

Dependent Vars	FTM	Sales Growth	FTM	Employee Growth	FTM	Labor Productivity
	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
National FTM	0.0066***		0.0064***		0.0064***	
	(0.00)		(0.00)		(0.00)	
Female Owner	0.3059***		0.3170***		0.3116***	
	(0.02)		(0.02)		(0.02)	
FTM		−0.0863*		−0.0255***		−0.3708
		(0.05)		(0.01)		(0.23)
N	62,032	62,032	79,556	79,556	68,173	68,173
R^2		0.03		0.06		0.17
First-stage *F* test statistics		159.52		196.41		167.63
First-stage *F* test *p* value		0.00		0.00		0.00
Hansen's *J* test statistics		3.29		1.67		1.28
Hansen's *J* test *p* value		0.07		0.20		0.26

sample by matching each treated observation (female-led firm) with one or more control observations (male-led firm) using the nearest neighbor matching method without replacement, with the common support constraint (for details see, for instance, Grilli & Murtinu, 2014). We report the PSM test results in Table 7. As shown, the average treatment effects (ATT) strongly support H1.

4.4. Subsample analysis

In this section, we investigate whether geography or firm size affect the FTM–performance relationship.

4.4.1. Analysis by region

The WBES divides the sample into six subsamples by geographic regions: Africa, East Asia and the Pacific (EAP), Europe and Central Asia (ECA), Latin America and the Caribbean (LAC), the Middle East and North Africa (MENA), and South Asia (SA). We re-estimate Eq. (1) separately for each region and report the results in Table 8A. We observe some interesting results. The negative FTM–performance relation is strong in EAP, ECA and LAC countries, while the baseline results in Table 4 do not hold for Africa, MENA, and SA countries.

Societal norms, institutional development, and unequal application of legal frameworks vary widely within and between regions in their impact on women in business. Consider the example of Saima,[12] a young female Pakistani entrepreneur who sells handmade clothing. Her country's cultural norms place her in a position where close stakeholders provide inadequate emotional and financial support for both her business venture and her advanced educational endeavors. Saima perseveres

are well above both the Stock-Yogo weak identification test critical values and the threshold value of 10 (Staiger & Stock, 1997). The second-stage results are largely consistent with our baseline results in Table 4. However, the Hansen's J tests of exogeneity show that the combination of the two IVs is only valid for *Employee Growth* and *Labor Productivity*, but invalid for *Sales Growth* (*p*-value = 0.07). Hence, we do not rely on IV test results to interpret the impact of FTM on Sales Growth.

4.3.2. Propensity score matching (PSM)

One valid concern is that our baseline results may be driven by the possibility that female-led and male-led firms have different characteristics. To address this endogeneity concern, researchers have widely and efficiently used the PSM method in experimental and non-experimental causal studies (Dehejia & Wahba, 2002; Smith & Todd, 2001). Using a probit model with the same set of firm characteristics described above, we first estimate propensity scores for all observations, that is, the likelihood of all firms having an FTM. We then produce a matched

and plans to provide childcare for her female employees to alleviate their burdens and other related social obligations, indicating her pro-social behavior. Moreover, societal norms are much friendlier to male entrepreneurs, as evidenced by stronger family and institutional support in the areas of, for instance, access to finance, professional development, social/business networks, and advanced education. Despite being just a single example, Saima's story demonstrates how such deep-rooted sociocultural norms likely have an adverse impact on female-led businesses in Pakistan.

Our study underscores this with evidence that regional institution development and societal and cultural norms play an important role in influencing the FTM–performance relationship.

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[12] At the request of the entrepreneur, her real name has been changed to hide her identity.

Table 7

Gender and Firm Performance—PSM Test, This tables presents the PSM results. *** p < 0.01; ** p < 0.05; * p < 0.10.

Outcome	Sample	Treated (1) Female	Controlled (2) Male	Difference (1)-(2)	t-Statistics	
		Top Manager	Top Manager			
Sales Growth	Unmatched	0.036	0.043	−0.007	−1.18	
	ATT	0.036	0.063	−0.028	−3.54	***
Employee Growth	Unmatched	0.036	0.044	−0.008	−4.05	***
	ATT	0.036	0.054	−0.019	−7.11	***
Labor Productivity	Unmatched	5.269	5.365	−0.096	−4.81	***
	ATT	5.272	5.417	−0.144	−5.45	***

Table 8A

Subsample Analysis by Region, This table presents subsample analysis results by region. Year and industry dummies are included in all regressions. Standard errors (in parentheses) are adjusted for heteroscedasticity. *** p < 0.01; ** p < 0.05; * p < 0.10.

Variable	Sales Growth	Employee Growth	Labor Productivity
Panel A: Africa			
FTM	0.0307	−0.0137***	−0.1224*
	(0.02)	(0.00)	(0.06)
N	9837	14,488	11,326
R^2	0.08	0.10	0.29
Panel B: East Asia and Pacific			
FTM	−0.0126	−0.0171**	−0.0414
	(0.01)	(0.01)	(0.05)
N	11,700	12,876	12,351
R^2	0.56	0.08	0.22
Panel C: Europe and Central Asia			
FTM	−0.0232**	−0.0221***	−0.2200***
	(0.01)	(0.01)	(0.03)
N	13,821	20,431	15,941
R^2	0.08	0.11	0.35
Panel D: Latin America and the Caribbean			
FTM	−0.0122**	−0.0145**	−0.2047***
	(0.01)	(0.01)	(0.03)
N	13,488	16,731	14,870
R^2	0.04	0.06	0.18
Panel E: Middle East and North Africa			
FTM	0.0572***	−0.0038	−0.1108*
	(0.02)	(0.02)	(0.05)
N	5994	7479	6369
R^2	0.19	0.12	0.49
Panel F: South Asia			
FTM	0.0107	−0.0008	0.1188
	(0.01)	(0.01)	(0.11)
N	11,544	13,232	12,277
R^2	0.06	0.03	0.14

Table 8B

Subsample Analysis by Firm Size, This table presents subsample analysis results by firm size. Year and industry dummies are included in all regressions. Standard errors (in parentheses) are adjusted for heteroscedasticity. *** p < 0.01; ** p < 0.05; * p < 0.10.

Variable	Sales Growth	Employee Growth	Labor Productivity
Panel A: Small			
FTM	−0.027	−0.0139***	−0.1756***
	(0.02)	(0.00)	(0.05)
N	28,238	38,141	31,736
R^2	0.1	0.364	0.233
Panel B: Medium			
FTM	−0.0138	−0.0112**	−0.1513***
	(0.01)	(0.00)	(0.06)
N	23,887	29,825	26,046
R^2	0.083	0.387	0.185
Panel C: Large			
FTM	−0.0267	−0.0022	−0.1322
	(0.02)	(0.01)	(0.08)
N	14,259	17,271	15,352
R^2	0.064	0.202	0.173

5. Mediation Analyses: How does gender affect firm performance?

In previous sections, we documented a negative relation between *FTM* and firm performance. In this section, we go a step further and examine three critical channels through which *FTM* influences firm performance, specifically, the finance, technology, and labor channels. We conduct mediation analyses to test hypotheses H2, H3, and H4.

5.1. The finance, technology, and labor channels

We investigate whether the negative relation between *FTM* and performance documented in previous sections can be mediated through the finance, technology, or labor channels. Following prior studies, we use a procedure that involves three equations as described below (Fernando et al., 2020; Imai et al., 2010a, 2010b). Eq. (1), which is our baseline model, is used to examine the relation between *FTM* and firm performance. Eq. (4) is used to investigate the relation between FTM and the focal mediator channel. In Eq. (5), we add the focal mediator as an additional explanatory variable in Eq. (1), and re-estimate the impact of *FTM* on performance.

Performance = $\beta_0 + \beta_1$FTM + firm & country controls + year & industry dummies + ε_1. (1).

Mediator = $\theta_0 + \theta_1$FTM + firm & country controls + year & industry dummies + ε_4. (4).

Performance = $\delta_0 + \delta_1$FTM + δ_2Mediator + firm & country controls + year & industry dummies + ε_5. (5)

β_1 represents the total effect of *FTM* on performance and δ_1 represents the direct effect of *FTM* on performance. The value of the product,

4.4.2. Analysis by firm size

In Table 3B, we show that female-led firms are significantly smaller than male-led firms. Smaller firms are faced with greater financial, legal, and corruption obstacles (Beck et al., 2005b). As institutional development improves, small firms benefit more than large firms. To shed light on how firm size may influence the FTM–performance relation, we split our sample into three groups: small firms with<20 employees, medium-sized firms with 20 to 100 employees, and large firms with more than 100 employees. We re-estimate Eq. (1) and report the results in Table 8B.

As shown, our baseline results in Table 4 are largely driven by SMEs in Panels A and B where H1 is supported. The negative FTM–performance relation vanishes in large firms (Panel C). These results suggest that policies aimed at narrowing gender gaps in access to critical resources and organizational outcomes should start at the SME level to have the highest impact.

$\delta_2 \times \theta_1$, represents the indirect effect of having an FTM on firm performance through the finance, technology, or labor channel mediator.

As discussed earlier, for brevity, we use *Line of Credit, Internet Purchases*, and *Labor Cost* to represent the finance, technology, and labor channel mediators, respectively.[13] The same set of firm and country level controls as well as year and industry dummies used in our baseline model Eq. (1) are also included in Eqs. (4) and (5). Regression results of Eq. (1) are those presented in Table 4. Regression results of Eqs. (4) and (5), estimated with seemingly unrelated regressions (SUR), are presented in Tables 8, 9, and 10, respectively for *Line of Credit, Internet Purchases*, and *Labor Cost* as mediators.

We bootstrap standard errors in SUR to correctly estimate the significance of the indirect effect, $\delta_2 \times \theta_1$ (Fernando et al., 2020; Imai et al., 2010a, 2010b; Preacher & Hayes, 2004; Zhao et al. 2010). In our study, the bootstrap procedure generates 100 samples from the original dataset, with observations randomly selected with replacement. For every sample generated, one set of coefficients in SUR are calculated. After 100 repetitions, the coefficients are ranked from the smallest to the largest. Then the 5th (1st) and 95th (99th) estimated coefficients are used to serve the upper and lower limits of 95 % (99 %) confidence internal. We choose to replicate the sample 100 times in our bootstrapping because Mooney and Duval (1993) have pointed out that 50 to 200 replications are sufficient for getting unbiased standard error estimates.

5.2. Mediation analysis results and discussions

Table 9 reports the H2 testing results on whether the negative FTM–performance relation is mediated by *Line of Credit*. Columns (2), (4), and (6) present regression results of Eq. (4) and show that *FTM* is significantly and negatively related to *Line of Credit*. Columns (1), (3), and (5) report regression results of Eq. (5). When both *FTM* and *Line of Credit* are included in the regression, we find that *FTM* still has a negative and significant influence on all the three performance measures (i. e., SG, EG, and LP), while *Line of Credit* is positively and significantly linked to SG, EG, and LP. Upon examining the significance of the value of $\delta_2 \times \theta_1$, along with the above results, we conclude that our mediation analyses support H2.

In sum, the negative FTM–performance relation can be partially mediated by a firm's access to finance as proxied by *Line of Credit*. In principle, narrowing the gender gap in access to finance should be helpful for narrowing the gender gap in performance.

Table 10 reports the H3 testing results on whether the negative FTM–performance relation is mediated by technology as proxied by *Internet Purchases*. In Table 10, columns (2), (4), and (6) present regression results of Eq. (4) and indicate that *FTM* is negatively associated with *Internet Purchases*. Columns (1), (3), and (5) present regression results of Eq. (5). When both *FTM* and *Internet Purchases* are included in the regression, *FTM* is still negatively associated with EG and LP, while *Internet Purchases* is positively associated with the three performance measures.

The insignificant effect of *FTM* on SG in column (1) indicates that the negative FTM–SG relation is fully mediated by *Internet Purchases*, while the negative and significant effect of *FTM* on EG and LP in columns (3) and (5), respectively, shows that the negative FTM–EG/LP relations can be partially mediated by *Internet Purchases*. Upon examining the significance of the value of $\delta_2 \times \theta_1$, along with the results mentioned above, we conclude that our mediation analyses support H3.

Table 11 reports the H4 testing results on whether the negative FTM–performance relation is mediated by a firm's labor market hiring practices, proxied by *Labor Cost*. In Table 11, columns (2), (4), and (6)

show that *FTM* is positively and significantly associated with *Labor Cost*. Columns (1), (3), and (5) show that *FTM* is still negatively associated with SG, EG, and LP, after *Labor Cost* is added, while *Labor Cost* is negatively related to all three performance measures.

In sum, the negative and significant effect of *FTM* on all three performance measures in columns (1), (3), and (5) attests to the fact that the negative FTM–performance relation can be partially mediated by *Labor Cost*. In other words, our mediation analyses support H4. This finding reveals that FTMs employ the labor factor to produce goods and services differently than MTMs. The fact that the labor cost to sales ratio is 1.7 % higher in female-led firms than in male-led firms suggests an opportunity for FTMs to deploy their workforces more efficiently, which raises some managerial and policy implications. FTMs' cautiousness may lead them to hire overqualified, overeducated workers as an insurance policy under uncertainty (Spence, 1973). Our data show that female-led firms are more likely to provide formal contracts to full-time employees than male-led firms, likely increasing labor costs. For this reason, governments may consider nudge policies that stimulate female-led firms to fully unfold the talent of their workforce via exploring high product quality niches or policies supporting female-led firms in their strategies to enhance benefits to protect workers' welfare.

6. Conclusions and limitations

This study addresses the equivocal findings in the literature concerning the relationship between female leadership and firm performance (Hoobler et al., 2018). In so doing, we answer calls from Amore et al. (2014), Hoobler et al., (2018) and Robb and Watson (2012) for further research on this topic. Using the WBES, a large dataset containing over a decade of survey responses on 130,000 firms in 130 countries across the globe, we find that female-led firms underperform male-led firms. Our paper adds clarity to the relation between women in leadership and performance by addressing the unsuitability of accounting- and market-based performance measures commonly found in the literature (Beck et al., 2005b; Fernando et al., 2020). In particular, we employ sales growth, employee growth, and labor productivity as our performance measures, which are relatively harder to manipulate.

Furthermore, we make novel contributions to the literature by examining three critical channels through which female leadership may negatively impact performance. Our mediation analyses show that gender gaps in access to finance, technology usage, and labor market practices can partially mediate gender performance gaps. Regarding the finance channel, we find that female-led firms are more financially constrained than male-led firms, consistent with the literature documenting women being less confident and more cautious in their financial decisions (Barber & Odean, 2001; Croson & Gneezy, 2009; Gneezy et al., 2003; Levi et al., 2014). FTMs are more often unbanked, resulting in their having less overdraft protection and formal lines of credit. FTMs also underinvest in capital projects. In the technology channel, FTMs are less likely to adopt ICT to facilitate critical business functions such as communication, delivery, purchasing, and R&D. ICT is vital to efficiency and scale, and deficiencies in adopting and embedding ICT in business operations hinder productivity and growth. In the labor channel, we find that FTMs use fewer temporary workers and maintain a significantly more educated and skilled labor force. They are also more likely to provide formal contracts for full-time employees.[14] These labor market practices by FTMs lead to higher labor costs.

We acknowledge that this study has several limitations. First, the WBES dataset limits our ability to conduct longitudinal analyses. To reduce the omitted variable bias caused by the lack of longitudinal data, we not only include many firm-level and country-level controls in our regressions, but also perform multiple endogeneity and robustness tests

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[13] We also conduct mediation analyses using additional finance/technology/labor channel mediators. These additional results are largely consistent with those in Tables 8, 9, and 10 and are available upon request.

[14] For brevity, some of the results mentioned in this paragraph are not tabulated but are available upon request.

Table 9
Gender and Financing Patterns, This table examines whether a firm's access to finance, proxied by *Line of Credit*, mediates the gender–performance relation. Firm- and country-level controls and year and industry dummies are included in all regressions. Standard errors (in parentheses) are adjusted for heteroscedasticity. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Dependent Vars	Sales Growth (1)	Line of Credit (2)	Employee Growth (3)	Line of Credit (4)	Labor Productivity (5)	Line of Credit (6)
FTM	−0.0257*** (0.01)	−0.0219*** (0.00)	−0.0170*** (0.00)	−0.0271*** (0.00)	−0.1614*** (0.02)	−0.0254*** (0.00)
Line of Credit	0.0382*** (0.00)		0.0372*** (0.00)		0.3609*** (0.01)	
Firm and country controls	Yes	Yes	Yes	Yes	Yes	Yes
N	65,466	65,466	83,593	83,593	72,007	72,007
R^2	0.08	0.15	0.08	0.15	0.21	0.15
Total Effect β_1	−0.0242*		−0.0175***		−0.1660***	
Direct Effect δ_1	−0.0257***		−0.0170***		−0.1614***	
Indirect Effect $\delta_2 \times \theta_1$	−0.0008***		−0.001***		−0.0092***	

Table 10
Gender and Technology Adoption, This table examines whether a firm's technology adoption, proxied by *Internet Purchases*, mediates the gender–performance relation. Firm- and country-level controls and year and industry dummies are included in all regressions. Standard errors (in parentheses) are adjusted for heteroscedasticity. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Dependent Vars	Sales Growth (1)	Internet Purchases (2)	Employee Growth (3)	Internet Purchases (4)	Labor Productivity (5)	Internet Purchases (6)
FTM	−0.0182 (0.01)	−0.0646*** (0.01)	−0.0163*** (0.01)	−0.0545*** (0.01)	−0.1684*** (0.03)	−0.0560*** (0.01)
Internet Purchases	0.0165* (0.01)		0.0171*** (0.00)		0.1642*** (0.03)	
Firm and country controls	Yes	Yes	Yes	Yes	Yes	Yes
N	11,066	11,066	13,936	13,936	12,240	12,240
R^2	0.09	0.03	0.08	0.03	0.14	0.03
Total Effect β_1	−0.0242*		−0.0175***		−0.1660***	
Direct Effect δ_1	−0.0182		−0.0163***		−0.1684***	
Indirect Effect $\delta_2 \times \theta_1$	−0.0011*		−0.0009***		−0.0092***	

Table 11
Gender and Labor Selection, This table examines whether a firm's labor cost, proxied by *Labor Cost*, mediates the gender–performance relation. Firm- and country-level controls and year and industry dummies are included in all regressions. Standard errors (in parentheses) are adjusted for heteroscedasticity. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Dependent Vars	Sales Growth (1)	Labor Cost (2)	Employee Growth (3)	Labor Cost (4)	Labor Productivity (5)	Labor Cost (6)
FTM	−0.0179*** (0.01)	0.0143*** (0.00)	−0.0160*** (0.00)	0.0157*** (0.00)	−0.0863*** (0.02)	0.0152*** (0.00)
Labor Cost	−0.4112*** (0.01)		−0.0471*** (0.00)		−4.0142*** (0.03)	
Firm and country controls	Yes	Yes	Yes	Yes	Yes	Yes
N	62,843		69,905		67,924	
R^2	0.10	0.05	0.07	0.05	0.38	0.05
Total Effect β_1	−0.0242*		−0.0175***		−0.1660***	
Direct Effect δ_1	−0.0179***		−0.0160***		−0.0863***	
Indirect Effect $\delta_2 \times \theta_1$	−0.0059***		−0.0007***		−0.0405***	

in this study. In the future, when worldwide firm-level panel data, which includes SMEs in emerging economies like WBES did, becomes available, we would perform panel regressions to further test the link between female leadership and firm performance. When such panel data become available, for example, it would be intriguing to examine whether FTMs and MTMs behave differently in making firm decisions as their careers progress.

Second, WBES has limited information on the demographics of top managers, such as age, education level, marriage status, number of children, etc. Studies have shown that these characteristics significantly affect managers' job performance (Bertrand, 2011). It would be interesting to perform additional mediation analyses using top managers' attributes, such as education background, tenure in the top job, etc. Additionally, WBES cannot provide financial ratios such as profit margins, ROA, ROE, or financial leverage since most SMEs in developing countries do not have standard financial statements. Although the current proxies we use in the study have their own advantages and are less likely to be manipulated, missing the standard firm performance measure and common controls is still an obvious weakness. We expect this issue will be resolved in the coming year, as more firms in developing countries start to adopt International Financial Reporting Standards (IFRS).

Third, the WBES data do not allow us to empirically test for some alternative explanations of the FTM-performance relationship. For instance, are our results driven by systematic differences of female talent across countries? The negative FTM–performance relationship observed in our paper could also be driven in part by cultural values and social norms that limit women's access to more advanced education, which is an important credential for top managerial positions. Are our results driven by reactions of male managers and employees to the appointment of women CEOs? Our data do not allow us to control for firm differences in inclusive cultures, openness to diversity, corporate discrimination policies against women, etc. that may foster or hamper the effectiveness of women leadership in firms. Are our results driven by top management teams' composition? An over-diverse team may lead to conflicts driven by differences in values, beliefs, and culture (van Knippenberg et al., 2004) resulting in lack of agreement and coordination on investments and corporate strategies. Are our results driven by gender-specific informal and social networks? Literature has shown how networks affect firm outcomes and how networks are strongly influenced by the identity of the dominant gender (Mayer & Puller, 2008), and by backlash on perceptions about the ability of the leader (Price, 2012; Grossman, 2013). Future studies that combine various relevant datasets may provide useful insights for the above questions.

Our work provides several meaningful managerial implications for businesses. First, we provide worldwide evidence that the influence of FTMs on firm performance may be hampered by some obstacles. Thus, organizations need to look beneath the surface of their internal processes, strategies, hierarchies, team design, structures, and incentives to understand the source of such a negative correlation. Next, the relation between FTMs and firm performance exhibits geographic heterogeneity. The geographic heterogeneity is probably the outcome of country-specific policies aimed at regulating gender composition of management teams or influencing labor market dynamics. Third, the negative relation between FTMs and firm performance vanishes in large firms. Large firms are more complex organizations to manage than SMEs, and literature has shown that an advantage of women managers is their superior perspective-taking capability, which plays a key role in complex businesses (Foss et al., 2022).

Finally, the effectiveness of FTMs is contingent on gender gaps in access to finance, technology usage, and labor market practices. In terms of access to finance, organizations need to investigate whether the underfinancing of female-led firms is caused by FTMs' personal preferences or caused by a behavioral response to the anticipated financial market obstacles imposed upon female managers. Next, technology adoption seems to be a necessary condition to make FTMs' leadership effective. Even when FTMs are very capable and experienced, lack of technology in their organizations may be an obstacle to firm performance. Regarding the gender gap in labor practice, women leadership is typically associated with fewer temporary workers and a more educated and skilled labor force. These features may be important in some businesses (e.g., complex firms, innovative industries), while they represent a burden in others (e.g., seasonal businesses). This finding calls for a careful matching between types of businesses and CEO characteristics. When selecting female business leaders, care should also be taken in countries where the government has a strong impact on the economy, as the market-oriented matching process is hampered in such countries (Murtinu et al., 2022).

CRediT authorship contribution statement

Lee Allison: Methodology, Conceptualization, Validation, Visualization, Writing - original draft, Writing - review & editing. **Yu Liu:** Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Project administration, Methodology, Formal analysis. **Samuele Murtinu:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Zuobao Wei:** Writing – review & editing, Writing – original draft, Methodology, Formal

analysis, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jbusres.2022.113322.

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