UNIVERSITY OF CAMBRIDGE

Bennett Institute for Public Policy Cambridge

WORKING PAPER

Gender, firm performance, and FDI supply-purchase spillovers in emerging markets

Authors

Ioannis Bournakis[ac] and Jen-Chung Mei[bc]

[a]SKEMA Business School France;
[b]University of Cambridge, Bennett Institute for Public Policy, Cambridge, UK.

[c]Correspondence: Ioannis.bournakis@skema.edu; jcm220@cam.ac.uk

May 2022

Gender, Firm Performance, and FDI supply-purchase Spillovers in Emerging Markets

Ioannis Bournakis [a], Jen-Chung Mei [b*]

May 2022

Abstract

The paper measures gender premium (or penalties) in productivity and innovation using firm-level data from 32 emerging economies. Further, we estimate whether the gender status of local firms in FDI recipient countries, as well as the ownership structure of Multinational Enterprises (MNEs), matters for the size of spillovers from supply and purchase links between local firms and MNEs. Our results show that female-owned firms are on average less innovative and productive. These gender performance handicaps cancel out Total factor productivity (TFP) gains through supply linkages with MNEs. In general, domestic firms benefit from the supply of inputs to MNEs not only in terms of TFP, but also in a number of characteristics related to innovation, and this highlights the importance of backward spillovers on the performance of FDI host countries. Nonetheless, domestic female-owned firms cannot reap any of these gains. There is also a gender penalty imposed by MNEs on local firms' TFP. Female-owned MNEs do not promote technology transfer through spillovers to local firms, which might be another explanation for why domestic firms do not usually experience productivity gains when purchasing inputs from foreign firms. A key message of the present paper is that enhancing productivity in emerging economies depends on mitigating factors that cause gender discrimination. Eliminating any gender penalty in firm performance will also help local firms absorb spillovers from MNEs.

Keywords: MNEs; supply; purchase; gender ownership

JEL classification: D22; F23

*We thanks to Diane Coyle for her valuable suggestions. [a]SKEMA Business School France; [b]Bennett Institute for Public Policy, University of Cambridge. Contact E-mail: ioannis.bournakis@skema.edu; jcm220@cam.ac.uk

1 Introduction

Foreign direct investment (FDI) has long been acknowledged as a conduit of knowledge transfer from Multinational Enterprises (MNEs) to local firms (Gorg & Strobl, 2001). The advanced managerial expertise and technological know-how of MNEs are sources of knowledge spillovers that can benefit domestic buyers and suppliers. Knowledge spillovers from MNEs are diffused in the recipient economy either within the same sector (horizontal or intra-sector spillovers) or through customer-supplier relationships between MNEs and domestic producers (vertical or inter-industry spillovers) (Javorcik, 2004; Newman, Rand, Talbot, & Tarp, 2015). Two facts are highlighted in this voluminous amount of literature:[1] domestic firms[2] improve productivity by supplying inputs to MNEs, and second, the capacity in absorbing FDI related knowledge differs substantially among local firms (Rojec & Knell, 2018). In the present literature, the various characteristics that determine a domestic firm's absorption capacity have not been thoroughly conceptualized and empirically tested. Currently, the focus is primarily on the level of human capital (Narula & Marin, 2003; Damijan, Rojec, Majcen, & Knell, 2013; Demena & van Bergeijk, 2017) and innovation activity (i.e., in the form of R&D) of domestic firms (Castillo, Salem, & Guasch, 2012; Rojec & Knell, 2018). Even though they play a pivotal role in enhancing the absorption capacity of local firms in host countries, the effective integration of external knowledge in developing countries may also be influenced by other structural factors, such as the gender breakdown of domestic ownership, that have been ignored in existing literature.

Given the increasing role of female entrepreneurship in the developing world[3] and the large amount of FDI flows directed to these geographical regions,[4] it makes imperative to incorporate the role of gender differences in understanding the evolution of productivity and innovation as well as the potential to absorb gains from FDI spillovers. In this paper, we examine whether the gender status of ownership at local firms in 32 emerging countries has an effect first, on productivity and various innovation characteristics and second, on the ability of local firm to capture productivity gains from supply and purchase linkages with MNEs.

[1] See Lin, Qin, & Xie, 2021, de Nicola, Muraközy, & Tan, 2021, Iacovone, Javorcik, Keller, & Tybout, 2015, Blalock & Gertler, 2008, Bournakis, 2021.

[2] We use the term local firms and domestic firms interchangeably. The meaning is identical and refers to firms with foreign presence less than 10% in their capital structure.

[3] Current World Bank estimations indicate that there are about 8 to 10 million SMEs with at least one female owner in the developing world.

[4] The share of FDI flows to developing economies account for 72% of global FDI in 2019 (UNCTAD, 2021)

On macroeconomic level, the increased participation of women in the labor market has produced numerous positive welfare effects such as higher returns for female employment and faster accumulation of human capital (Knowles, Lorgelly, & Owen, 2002; Galor & Weil, 1996). These factors have contributed to growth in countries with historically high rates of unofficial female employment (Seguino, 2000; Fang, Shamseldin, & Xu, 2019). A more active female participation in the labour market also results in lower fertility rates and better quality childcare, which in turn improves educational prospects and human capital for future generations (Galor & Weil, 2000; Galor, 2005).

The performance and absorption of FDI spillovers in local firms by gender highlights aspects of female entrepreneurship. Even though the common trend indicates that the number of successful female entrepreneurs is growing, female-owned firms are lagging behind on several fronts (Amoroso & Audretsch, 2020). We identify four key aspects that can potentially cause a productivity handicap in female-owned firms: (a) access to finance; (b) response to competition; (c) networks development; (d) work flexibility. Consequently, these factors are also related to the ability of domestic firms to facilitate knowledge, which is developed elsewhere. We expect that even though productivity laggard firms in the FDI host country are likely to gain more learning from MNEs, effective absorption of external knowledge requires a certain level of technical expertise in the recipient firm for the transfer to be successful.

The ultimate goal of the present paper is to investigate whether underlying gender differentials in terms of performance induce a productivity penalty for female-owned domestic firms, which in turn drives their ability to capture gains from FDI supply-purchase spillovers. Methodologically, the paper is developed as follows: we first search for systematic differences in productivity and knowledge-creation activities based on the gender ownership status of domestic firms. We then assess the impact of supply-purchase spillovers from MNEs on the productivity of domestic firms controlling for the gender status of the ownership. We construct supply-purchase linkages with MNEs using firm-specific information contrary to previous studies that measure spillovers with MNEs only at the sectoral level (Barrios, Görg, & Strobl, 2011; Mei, 2021).[5] Our approach allows us to identify not only gender differences in productivity, but also how these productivity differentials affect the ability of domestic firms to facilitate foreign knowledge spillovers. Since women-owned MNEs may also share some characteristics with domestic small firms (i.e. lower working flexibility and limited ability to develop networks), which may hinder technology

[5]Sectoral level studies use coefficients from input-output tables to measure the degree of supply and purchase linkages between sectors, whereas the present study directly measures how many inputs the local firm sells to MNEs as well as what it purchases from MNEs.

transfer and knowledge externalities from MNEs to local firms through input linkages, we further explore whether productivity gains from FDI is driven by the gender status in the ownership of MNEs. To robustify our results we control for selectivity bias, which may be caused in part by the tendency of female business owners to acquire small and service-oriented firms due to limited access to external financing and political power.

The contributions of our paper are twofold: first, we provide an extensive and systematic assessment of the correlation between gender diversification in ownership and firm characteristics, the first of that kind in the emerging world and, second, we evaluate empirically how gender differences impact FDI productivity gains. Our main findings show that female-owned domestic firms (in 32 emerging countries) are 7.2-16.7% less productive, 2.3-3.6% less likely to participate in R&D activities, 0.6-2.6% less likely to obtain international recognition, and 3.9-4.5% less likely to involve into product innovation and quality upgrading. Second, supplying inputs to MNEs generates productivity gains and promote all innovation aspects of domestic firms, these beneficial effects vanish in female-owned domestic firms. Purchasing inputs from MNEs does not improve productivity of domestic firms (regardless of gender ownership), which might represent a gender penalty from female-owned MNEs. Overall, our findings suggest that the diversification of gender in firm ownership is key to understanding productivity in emerging countries.

The remainder of the paper is structured as follows; Section 2 formulates hypotheses for gender ownership and firm performance, Section 3 describes the data, compares firm performance based on gender and defines the supply-purchase linkages, Section 4 shows econometric results from measuring the gender premium (or penalty) on productivity and innovation as well as estimates the effects of FDI linkages and their interaction with the gender status on TFP of domestic firms, Section 5 concludes the paper.

2 Hypotheses Formulation: Gender Diversification and Firm Performance

Based on the evidence from the developed world, gender diversity in ownership does not appear to be related to profitability (Shrader, Blackburn, & Iles, 1997; Carter, Simkins, & Simpson, 2003).[6] Nonetheless, Aterido and Hallward-Driemeier (2011) finds a 12%

[6]In developed countries, a positive correlation between women's presence in the management board and firm performance is a common phenomenon. Weber and Zulehner (2010) highlight that start-up firms with female CEOs have higher rates of survival, while women in the top management of 2,500 Danish firms impact positively on firm performance Smith, Smith, and Verner (2006).

productivity gap for female-owned firms in a sample of developing countries, which gets smaller as women become more (and better) educated with advanced managerial skills. A similar productivity disadvantage of female-owned firms is found in Bardasi, Sabarwal, and Terrell (2011) for a group of four underdeveloped geographical regions, while Ackah, Asuming, Agyire-Tettey, and Asuman (2021) shows that female-owned firms in Ghana's manufacturing sector are on average less productive with gender differentials in productivity to vary significantly across the quantiles of the distribution. Women-owned firms suffer from this productivity handicap because they are less able to access finance, respond to competition, develop networks, and work flexible arrangements. In a vicious circle of low productivity, women-owned firms struggle to create a business environment conducive to innovation and knowledge transfer for productivity improvements.

Taking a closer look at the factors related to the performance handicap of female-owned firms, access to external finance is a crucial channel for business development, since it allows for investing in organizational capital (i.e., software, advertising, and marketing) and innovation abilities, which are major productivity enhancers (Bournakis, 2021). However, the evidence remains discouraging regarding women-owned firms' ability to borrow from commercial banks in the emerging world, which limits innovation and business growth opportunities (Hill, Leitch, & Harrison, 2006; Bui, Nguyen, Pham, & Phung, 2019). In countries with underdeveloped institutional frameworks, female-owned businesses often lack access to external finance, limiting their participation in bribe-based business expansion (Xia, Tan, & Bai, 2018). It is expected that the relationship between external borrowing and women's entrepreneurship will also weaken in cases with strong inherited gender prejudices, which is why India's loan rejection rate for women entrepreneurs is so high (Sandhu, Hussain, & Matlay, 2012). Following the previous discussion about the links between female entrepreneurship and access to finance, we formulate the first hypothesis as follows:

H1: *In emerging economies, women-owned firms face restrictions on external borrowing, which deprives them of the liquidity needed to invest in innovation.*

The second aspect of female entrepreneurship that matters for productivity and absorptive capacity is the weak reaction to external competition. It is found that female-owned firms have difficulty implementing best practices to increase efficiency within the firm when competition becomes tight (Croson & Gneezy, 2009; Gneezy & Rustichini, 2004; Gneezy, Niederle, & Rustichini, 2003). The third weak aspect of female entrepreneurship,

which undermines the learning prospects from the organisational structure of MNEs is the restricted access to networks (Boden Jr & Nucci, 2000; del Mar Fuentes-Fuentes, Bojica, & Ruiz-Arroyo, 2015). To facilitate the replication of advanced managerial know-how, local firms and MNE executives should maintain informal contacts. Because female entrepreneurs struggle to build external networks, they are unable to decode the tacit knowledge embedded in materials purchased from MNEs, which reduces the potential productivity gains from partnering with MNEs.

The fourth aspect in the female entrepreneurship-productivity nexus is the degree of work flexibility of female owners. Female entrepreneurs do not usually have the flexibility to adjust working hours, partly because they tend to prioritize family to business (Etemad, Gurau, & Dana, 2021). Owning and managing a business requires commitment outside the standard working time frame, communication with partners in different time zones and traveling within a short notice. The lack of flexibility in female-owned firms impacts adversely on performance, while increases the wage gap between firms with different gender ownership (Bøler, Javorcik, & Ulltveit-Moe, 2018). These considerations lead us to the formulation of the second hypothesis of the paper:

H2: *Due to weak competition reactions, weak external networks, and high degree of rigidity in working hours, female-owned firms in emerging economies are less likely to benefit from knowledge spillovers from MNEs.*

The third hypothesis of the paper derives as a corollary of H1 and H2 concerning the weak position of female-owned firm in terms of innovation and low capacity to facilitate spillovers from supply and purchase linkages with MNEs.

H3: *In emerging economies, female-owned firms are less productive than their male-owned counterparts because they are less innovative and capable to absorb spillovers from partnerships with MNEs.*

Bøler et al. (2018) emphasize that even in internationally oriented firms (i.e. exporters and MNEs), women in top managerial positions tend to have a lower degree of working flexibility with limited ability to work outside the standard time schedule, travel within a short notice and communicate with partners in different time zones. A key finding in the gender-innovation literature is that women are less likely to get involved in activities that commercialize innovation (Matricano, 2022). Moreover, effective technology transfer

through FDI requires from MNEs a proactive attitude that stimulates interaction between customers (local firms) and suppliers (MNEs), which can be more challenging if female-owned firms face time constraints (Etemad et al., 2021), while they are also less inclined to bring innovation in the market (Matricano, 2022). To sum up, systematic differentials in the behavioral pattern between female and male-owned MNEs as far as innovation, production and risk-taking are concerned can affect the cost of inputs purchased by domestic partners. With these considerations into account, we formulate our fourth hypothesis:

H4: *Domestic firms are likely to suffer a negative productivity effect from purchasing inputs from female-owned MNEs.*

Foreign MNEs demand more advanced input from local suppliers in terms of technical standards, so one can expect that synergies between MNEs and local suppliers will lead the latter to invest in innovation capabilities as a way of meeting their customers' standards. Similarly, purchasing inputs from MNEs reflects the scope of domestic firms to produce differentiated products that cater for the needs of specific market segments. (Bournakis, 2021). Essentially, the business partnerships between domestic firms and MNEs demonstrate the efforts of the former group to improve quality of existing products and develop new ones. Through this strategy, domestic firms achieve a more sophisticated level of technology (Görg & Seric, 2016; Görg, Hanley, & Strobl, 2011; Giroud, Jindra, & Marek, 2012). Our fifth hypothesis is formulated as:

H5: *The technological profile of domestic firms is improved through supply and purchase links with MNEs.*

3 Data, Descriptive Evidence and Measurement

3.1 Data Sources and Description

The firm level data are obtained from the European Bank for Reconstruction and Development (henceforth, EBRD), in conjunction with Business Environment and Enterprise Performance Survey (BEEPs thereafter) and cover 32 emerging economies and eight sectors.[7] The data merge two waves 2002-2005, and 2003-2006 and gather information that

[7]See Appendix II.B for the list of countries and Appendix II.A for the list of sectors alongside with the number of domestic firms and MNEs in each sector.

provides high degree of consistency for cross-country analysis.[8] BEEPs offer detailed information on firms' purchasing materials, supplying activities, and gender ownership. First, we employed two questions to construct the firm-level measurement of the supply linkage to MNEs ($SupplyMNEs_{ijt}$): (i) *"What proportion of your total sales were sold domestically?"*; and (ii) "*What proportion of your total domestic sales was to multinationals located in your country (not including your parent company, if applicable)?*". Second, we employ the following four survey questions to construct the firm-level purchase linkage ($PurchaseMNE_{ijt}$): (i) "*What proportions of total sales were to the sectors Mining and quarrying; Construction; Manufacturing; Transport, Storage and Communication; Wholesale, Retail trade and Repair of motor vehicles; Real estate; Hotel and Restaurants and Other services?*"; (ii) "*What proportion of your total domestic sales were to the large domestic firms (those with approximately 250 plus workers, not including your parent company)?*"; (iii) "*What proportion of your material inputs and supplies were purchased from domestic sources*"; and (vi) "*What proportion of your input materials were imported?*". To account for the role of gender in firm performance, we employ a key survey question "*Is owner female?*".

3.2 Performance Comparisons Based on Gender

The share of females in the top manager position in female-owned domestic firms is 60% (3,083 out of 5,209), while the share of females in the top manager position in male-owned domestic firms is 50% (4,529 out of 9,236). These figures mainly reflect policy initiatives across countries to improve gender equality in employment while, they do also indicate a tendency of female-owned firms to recruit employees of the same gender for the top management position.

We compare productivity and innovation measures based on the gender status of the ownership. Specifically, we consider Total Factor Productivity (*TFP*);[9] the strength of process innovation (*process*); the use of new product lines or services (*product*); a firm's propensity to engage in core product competence (*competence*); core product line upgrade (*upgrade*); and international recognized qualification on products (*qualification*). The measures of *process* and *product* highlight the innovation efforts of the firm, while

[8]BEEPS was administered in-person by trained interviewers and anonymous participants. Perception bias from individuals may be reasonably disregarded as comparison between qualitative measures and BEEPS does not reveal statistically significant correlation Fries, Lysenko, and Polanec (2003). In addition, as also argued in Godart and Görg (2013), a remainder perception bias in the sample is unlikely to affect the empirical results of the analysis.

[9]The calculation of TFP is shown in Appendix I.

Table 1: Firms performance through gender and supply-purchase linkages

	Female-owned Firms $N = 2,653$ (1a)	Male-owned Firms $N = 5,845$ (2a)
PANEL A: All Firms		
TFP	0.702	0.971
process	0.118	0.183
competence	0.748	0.794
product	0.304	0.362
upgrade	0.462	0.532
qualification	0.084	0.116
Foreign ownership	0.046	0.086
R&D expenditure (in log)	1.114	1.800
Total sales	12.847	13.147
	Female-owned Domestic Firms $N = 2,169$ (1b)	Male-owned Domestic Firms $N = 4,572$ (2b)
PANEL B: Domestic Firms		
TFP	0.707	0.941
process	0.113	0.171
competence	0.745	0.791
product	0.300	0.352
upgrade	0.463	0.523
qualification	0.081	0.109
R&D expenditure (in log)	1.056	1.662
Total sales	12.752	12.954

	Purchase from MNEs (1b)	Supply to MNEs (2b)	Purchase from MNEs (3b)	Supply to MNEs (4b)
PANEL C: Domestic Firms Purchase-Supply Linkages				
TFP	0.417	0.382	0.590	0.552
process	0.106	0.151	0.177	0.193
competence	0.716	0.772	0.797	0.802
product	0.290	0.358	0.357	0.383
upgrade	0.430	0.504	0.509	0.573
qualification	0.076	0.134	0.108	0.163
R&D expenditure (in log)	0.991	1.455	1.700	1.964
Total sales	13.102	13.683	13.275	13.646

Notes: process is a dummy equal to 1 if the firm invested in R&D in house or outsource and 0 otherwise, R&D expenditure is the amount spent on R&D in logs. *product* is a dummy equals to 1 if the firm introduced new product lines or services and zero otherwise, *competence* is a dummy equal to 1 if the firm is engaged to a core product competence and zero otherwise, *product* is a dummy if the price of the main product has increased or remained constant in the last fiscal year and zero otherwise, *upgrade* is a dummy equal to 1 if the main product lines have been upgraded and zero otherwise, and *qualification* is a dummy equal to 1 if the firm has obtained a international recognized certificate and zero otherwise. Firms are in pooled (i.e.,involved in either panel or cross-section).

competence and *upgrade* reflect more upon efficiency. As globalization fosters market competition, firms concentrate on their core competencies to stimulate efficiency (Eckel & Neary, 2010). This enhances gains from specialization, which further results in higher productivity across firms, as well as higher productivity at the industry level. Specialisation into core products also reduces marginal cost providing incentives for quality upgrading (Eckel, Iacovone, Javorcik, & Neary, 2015). Systemic differences in core product development, quality upgrading, and product competence among firms indicate a more structural pattern caused by differences in the responses to globalisation within firms. Toward this end, we seek to identify whether gender diversity in firm ownership is an element that might help us understand these structural differences.

To start with, Figure 1 (Appendix I) shows that male-owned domestic firms have a higher level of TFP for the sample years of this study (i.e. 2002, 2003, 2005, 2006). In Table 1, we compare the average performance of all firms in the sample (i.e. both domestic

and foreign) based on the gender status of the ownership. In panel A, male-owned firms are more likely to be foreign owned (mean=0.086 v.s mean=0.046), to engage in R&D activities (mean=0.183 v.s mean=0.118), to introduce new product lines (mean=0.362 v.s mean=0.304) and upgrade existing products (mean=0.532 v.s mean=0.462). Panel B shows that female-owned domestic firms have, on average, lower levels of sales (mean=12.752 v.s mean=12.954), while they are also less likely: to engage in R&D (mean=0.133 v.s mean=0.171), to launch new products (mean=0.300 v.s mean=0.352), and to improve product competence (mean=0.745 v.s mean=0.791). Similar performance advantages of male-owned firms in emerging countries are found in (Fang et al., 2019; Bardasi et al., 2011; Aterido & Hallward-Driemeier, 2011).

3.3 Supply and Purchase Linkages

This section defines the variables of spillover linkages that emerge from business ties between domestic firms and MNEs. We, first, define the variable $PurchaseMNEs$, which is the firm-level percentage of output that is purchased from foreign MNEs.[10] To account for differences in the size of the downstream sector h, we weight $PurchaseMNEs$ by the number of domestic firms in the sector (i.e. $\sum_d Domesticfirm_{dht}$):

$$PurchaseMNEs_{ijt} = \frac{\sum_{j \neq h} \sum_m MNEsSold_{mjht}}{\sum_d Domesticfirm_{dht}} \times LS_{ijt} \tag{1}$$

where $MNEsSold_{mjht}$ is the proportion of supply sales of MNE m in sector j to domestic firms, in downstream sector h (label as jh with $j \neq h$, i.e., purchases from its own sector are excluded) at time t; LS_{ijt} is the proportion of inputs domestic firm i sourced in domestic market at time t. To assess how the gender ownership of MNEs, as per our H4, affects the diffusion of spillovers to domestic firms, we construct a variant of (1) that includes only the sample of female-owned MNEs:

$$PurchaseMNEs^{female}_{ijt} = \frac{\sum_{j \neq h} \sum_m MNEsSold^{female}_{mjht}}{\sum_d Domesticfirm_{dht}} \times LS_{ijt} \tag{2}$$

where $MNEsSold^{female}_{mjht}$ is the proportion of female-owned MNEs m in sector j that supply domestic firms. Finally, the spillovers variable that captures the supply of inputs

[10] Purchase and supply linkages between MNEs and domestic firms are also referred to as forward and backward channels, respectively.

to MNEs is defined as:

$$SupplyMNEs_{ijt} = a_{ijt} \times \delta_{ijt} \times Sales_{ijt}^{domestic} \tag{3}$$

where a_{ijt} is the proportion of total sales to the domestic market, δ_{ijt} is the proportion of total domestic sales from firm i in sector j at time t to MNEs. $Sales_{ijt}^{domestic}$ represents the total sales of domestic firm i in sector j at time t. All spillover indices (1) to (3) are expressed in natural logarithms.

4 Estimation Strategy

4.1 Measuring the Gender Premium

Before analyzing the association between TFP, gender-ownership and FDI spillovers, we map out the differences between gender status and firm performance. To implement this task, we specify the following regression:

$$Z_{ijt}^{'} = \gamma_0 + \gamma_1 FEOs_{ijt} + \mathbf{X}_{ijt}^{'}\beta + \lambda_j + \theta_c + \tau_t + \vartheta_{jt} \tag{4}$$

where $Z_{ijt}^{'} = \{TFP, process, competence, product, upgrade, qualification\}$, $FEOs_{ijt}$ is a dummy variable equal to one if the firm is female-owned and zero otherwise and parameter γ_1 measures the gender premium. The regression is augmented with sector λ_j and country θ_c fixed effects to control for time invariant idiosyncrasies and time fixed effects τ_t to capture time variant macroeconomic shocks common across units. Vector $\mathbf{X}_{ijt}$ includes the percentage of employees with a university degree, size (equal to 1 if the number of employees < 20, 2 if employees $20 - 99$, and 3 if employees > 99) to capture scale economies, government subsidies (a dummy variable equal to 1 if the firm has received subsidies from the government), export activity (measured as the share of export to total sales) and import status (a dummy equal to 1 if the firm reports purchases from foreign markets).

Although regression (4) controls for unobserved firm heterogeneity that varies over time, some characteristics remain uncontrolled. For instance, if female tend to be owners of small firms because they have limited access to external finance, then the lower productivity of those firms could be due to the selection of small domestic firms. This signifies selection bias between firm characteristics and the gender status of local firms. To mitigate this bias, we implement a propensity score estimator that re-weights firms

in Eq. (4). The propensity score of the male and female-owned firms through each year is estimated based on the set of variables included in $\mathbf{X}_{ijt}$. Once the propensity score is obtained, each female-owned firm is weighted by $1/\hat{p}$, while each male-owned firm is weighted by $1/(1-\hat{p})$.[11] This transformation yields consistent estimates of the Average Treatment Effect, which is the difference in the average outcomes in variables included in Z between non-female and female-owned firms in the sample (Guadalupe, Kuzmina, & Thomas, 2012).

Results from Eq.(4) are provided in Table 2. For each characteristic in Z we show estimates in three columns, without controls (1a, 1b, 4a, 4b, 7a, 7b), with controls (2a, 2b, 5a, 5b, 8a, 8b), and robust for selection bias (the rest columns). Regarding TFP, the linear regression in Panel A suggests that female-owned firms are, on average, less productive at the 1% significance level. The TFP premium in male-owned firms is slightly lower when differences in firm size and high-skilled workers are accounted for. Column (3a) presents re-weighted regression estimates that allow for potential time-varying selection. The size of the coefficient γ_1 is smaller, indicating a potential selection bias due to differences in gender.

On (geometric) average, the ratio of TFP of female-owned domestic firms relative to that of male-owned firms is calculated as: $e^{(0.072)} = 1.074$, which means that female-owned firms are 7.4% less productive than their male-owned counterparts. As shown in Appendix II.C, the TFP premium of male owned firms remains qualitatively similar even when the entire sample (including MNEs) are taken into account. For the sub-sample of MNEs (Table Appendix II.D), there is no significant TFP premium based on the gender status of teh ownership when other controls (such as size, skill, and gender selection) are included in the regression. In essence, estimates from Eq. (4) suggest that the male productivity premium in the entire sample is largely driven by the productivity handicap of female-owned domestic firms in emerging countries.

Columns 4-9 in Table 2 examine how the gender ownership is associated with the rest of variables in Z. Female-owned firms are less likely to participate in R&D (2.3-3.6% lower), to have core product lines upgraded (4.5-1.7% lower), and be internationally recognized (0.6-2.6% lower). Finally, Table 2 illustrates that female-owned firms are negatively associated with core product competence. On average, female-owned firms are less likely to have an increase in the core product price (2.4-4.3% lower) and introduce

[11] We restrict the balancing property to all treated (female-owned) plus those controls (non-female owned) in the region of common support. We then define $\hat{p}$ as the predicted probability of female-owned firms, with the propensity score range from [0.146, 0.533], [0.077, 0.232], [0.102, 0.469], [0.088, 0.541], [0.111, 0.474], [0.165, 0.552], [0.192, 0.647], and [0.209, 0.839] through each sector (1-8), respectively.

Table 2: Female-owned Domestic Firms and Firm Characteristics

PANEL A	*TFP*			*process*			*competence*		
	(1a)	(2a)	(3a)	(4a)	(5a)	(6a)	(7a)	(8a)	(9a)
$FEOs_{ijt}$	-0.167***	-0.172***	-0.072*	-0.036***	-0.023**	-0.023*	-0.043***	-0.030**	-0.024
	(0.038)	(0.038)	(0.038)	(0.011)	(0.011)	(0.012)	(0.014)	(0.015)	(0.015)
Observations	3,435	2,707	2,682	3,735	3,159	3,142	4,937	4,156	4,127
PANEL B	*product*			*upgrade*			*qualification*		
	(1b)	(2b)	(3b)	(4b)	(5b)	(6b)	(7b)	(8b)	(9b)
$FEOs_{ijt}$	-0.039**	-0.024	-0.012	-0.045***	-0.029*	-0.017	-0.026***	-0.013	-0.006
	(0.015)	(0.016)	(0.017)	(0.016)	(0.017)	(0.017)	(0.010)	(0.010)	(0.011)
Observations	4,937	4,156	4,127	4,936	4,156	4,127	4,936	4,155	4,126
Controls	x	✓	✓	x	✓	✓	x	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Propensity score weighting	x	x	✓	x	x	✓	x	x	✓

Notes: process represents "strength of process innovation" (dummy), *product* represents "new product Introduced" (dummy), *competence* represents "main product price increased" (dummy), *upgrade* represents "product lines upgraded" (dummy), and *qualification* refers to "international recognized quality" (dummy). Controls in $\mathbf{X}$ include size (equal to 1 if employees < 20, 2 if employees $20 - 99$, and 3 if employees > 99), the percentage of employees with a university degree, government subsidies (a dummy variable equal to 1 if the firm has received subsidies from the government), export activity (measured as the share of export to total sales) and import status (a dummy equal to 1 if the firm reports purchases from foreign markets). Observations vary across specifications due to data availability in the variable under consideration. FEOs is a dummy equal to one if the firm is female-owned and zero otherwise. Robust standard errors clustered at the firm-level are provided in parentheses. *, **, and *** represent significant at the 10%, 5% and 1% levels, respectively.

new product lines (3.9-1.2% lower). The results confirm that female-owned domestic firms suffer an innovation and productivity penalty, which confirm H1 and H3.

4.2 TFP Determinants - The role of FDI Linkages and Gender Status

This section starts with a parsimonious model, which specifies TFP of domestic firms as a function of $SupplyMNEs$, $PuchaseMNEs$ and a vector $\mathbf{X}_{ijt}$ of firm specific characteristics as previously defined. The model is also augmented with sector λ_j, country θ_c and time fixed effects τ_t:

$$\begin{aligned} lnTFP_{ijt} = \alpha_0 + \alpha_1 SupplyMNEs_{ijt} + \alpha_2 PurchaseMNEs_{ijt} \\ + \mathbf{X}'_{ijt}\beta + \lambda_j + \theta_c + \tau_t + \vartheta_{ijt} \end{aligned} \tag{5}$$

Following the previous discussion, we include in the baseline model a gender ownership variable $FEOs_{ijt}$ and its interactions with $PuchaseMNEs_{ijt}$ (purchase) and $SupplyMNEs_{ijt}$

(supply) to test propositions stated in H2 and H3:

$$\begin{aligned} lnTFP_{iJt} = {} & \alpha_0 + \alpha_1 SupplyMNEs_{ijt} + \alpha_2 PurchaseMNEs_{ijt} \\ & + \alpha_3 SupplyMNEs_{ijt} \times FEOs_{ijt} + \alpha_4 PurchaseMNEs_{ijt} \times FEO_{ijt} \\ & + \alpha_7 FEOs_{ijt} + \mathbf{X}'_{ijt}\beta + \lambda_j + \theta_c + \tau_t + \vartheta_{ijt} \end{aligned} \tag{6}$$

To test H4 that female-owned MNEs result in a different amount of spillovers through the purchase linkage, we specify the following variant:

$$\begin{aligned} lnTFP_{ijt} = {} & \alpha_0 + \alpha_1 SupplyMNEs_{it} + \alpha_3 SupplyMNEs_{ijt} \times FEOs_{ijt} \\ & + \alpha_5 PurchaseMNEs_{ijt}^{female} \\ & + \alpha_6 PurchaseMNEs_{ijt}^{female} \times FEOs_{ijt} \\ & + \alpha_7 FEOs_{ijt} + \mathbf{X}'_{ijt}\beta + \lambda_j + \theta_c + \tau_t + \vartheta_{ijt} \end{aligned} \tag{7}$$

where $PurchaseMNEs_{ijt}^{female}$ refers to purchase from female-owned MNEs.

We, first, estimate Eq.(5) that takes into account only supply and purchase linkages. Results are presented in Table 3 Panel A. Estimates from Eq.(6) and Eq.(7), which allow for gender ownership to vary across domestic firms are shown in Panel B. Estimates in Panel C mitigate the selectivity bias in TFP of female-owned firms.

Column (1a) in Table 3 suggests that supplying materials to MNEs is positively associated with TFP of domestic firms. On average, a 10% increase in the intensity of supply linkages with MNEs increases TFP in domestic firm by 0.03%. When the gender status of the ownership varies across domestic firms in Panel B (column (1b)), the effect of supply linkage from MNEs in TFP remains unchanged. The effect of female ownership in domestic firms in TFP is negative; on average, female-owned domestic firms are 16.7% less productive. When we allow for the effects of supply and purchase linkages to vary with gender status (i.e., $SupplyMNEs_{ijt} \times FEOs_{ijt}$, $PurchaseMNEs_{ijt} \times FEOs_{ijt}$), the positive effect on TFP disappears. The positive effect of $SupplyMNEs_{ijt}$ remains positive in column (1c) after controlling for selection bias across firms and sectors. Despite the effect being smaller (0.069), female ownership impacts negatively TFP of domestic firms. The main message from columns (1b) and (1c) is that female gender ownership cancels out the facilitation of spillovers through the supply linkage. Any effect from purchase linkage ($PurchaseMNEs_{ijt}$) appears to be weak regardless of the gender ownership status of the local firms.

The importance of supplying materials to foreign MNEs for TFP of the entire sample

Table 3: TFP Gains from Spillovers through Supply and Purchase Linkages and Female ownership

	TFP		
	(1a)		
PANEL A: Eq.4			
$SupplyMNEs_{ijt}$	0.003***		
	(0.001)		
$PurchaseMNEs_{ijt}$	-0.012		
	(0.008)		
Observations	4,844		
	TFP		
	(1b)	(2b)	
PANEL B: Eqs (5) and (6)			
$SupplyMNEs_{ijt}$	0.003**	0.003**	
	(0.001)	(0.001)	
$PurchaseMNEs_{ijt}$	-0.003		
	(0.014)		
$SupplyMNEs_{ijt} \times FEOs_{ijt}$	0.000	0.001	
	(0.002)	(0.002)	
$PurchaseMNEs_{ijt} \times FEOs_{ijt}$	-0.014		
	(0.016)		
$PurchaseMNEs_{ijt}^{female}$		-0.465***	
		(0.147)	
$PurchaseMNEs_{ijt}^{female} \times FEOs_{ijt}$		-0.016*	
		(0.009)	
$FOEs_{ijt}$	-0.167***	-0.169***	
	(0.040)	(0.040)	
Observations	2,649	2,649	
	TFP		
	(1c)	(2c)	
PANEL C: Eqs. (5) and (6) with propensity score weighting			
$SupplyMNEs_{ijt}$	0.003*	0.003*	
	(0.001)	(0.001)	
$PurchaseMNEs_{ijt}$	-0.021		
	(0.015)		
$SupplyMNEs_{ijt} \times FEOs_{ijt}$	0.000	0.000	
	(0.002)	(0.002)	
$PurchaseMNEs_{ijt} \times FEOs_{ijt}$	0.005		
	(0.016)		
$PurchaseMNEs_{ijt}^{female}$		-0.439***	
		(0.148)	
$PurchaseMNEs_{ijt}^{female} \times FEOs_{ijt}$		-0.014	
		(0.009)	
FOEs	-0.069*	-0.064*	
	(0.041)	(0.040)	
Observations	2,624	2,624	
Controls	✓	✓	
Year fixed-effects	✓	✓	
Sector fixed-effects	✓	✓	
Country fixed-effects	✓	✓	

Notes: Robust standard errors clustered at the firm-level are provided in parentheses. *, **, and *** represent significant at the 10%, 5% and 1% levels, respectively.

of firms is also highlighted in Javorcik (2004), Newman et al. (2015), Gorodnichenko, Svejnar, and Terrell (2014) and Mei (2021). Consequently, domestic firms benefit from backward spillovers as a result of the requirements accompanying these orders and the possible technology transfers that facilitate meeting these requirements. Nonetheless, female-owned domestic firms miss out on these gains due to the weaknesses previously discussed. Our findings imply that the negative effects of supply linkages documented in

previous studies (Simona & Axèle, 2012), can be partly explained by gender differences. Overall, estimates from Eq.(6) and Eq.(7) confirm H2 and H3, at least, as far as the penalty imposed by the female gender ownership in supply linkages.

4.3 TFP and Purchase Linkages from Female-owned MNEs

Having examined the correlations between the purchase-supply relationships and domestic firms' performance with differences in gender ownership, we now show results from Eq.(7) that refer to the role of gender status in MNEs in TFP of domestic firms. Columns (2b) and (2c) in Table 3 show that purchasing input materials from female-owned MNEs ($PurchaseMNEs_{ijt}^{female} \times FEOs_{ijt}$) affects negatively TFP of domestic firms (-0.465 in column 2b), which remains robust to negative selectivity bias (-0.439 in column 2c).

These finding suggest that the scope of TFP gains from trade relationships with MNEs is subject to the ownership status of the MNE. The presence of a female owner in MNE is a barrier to knowledge transfer, more likely because female leaders limit the spread of networks between MNEs and domestic firms. Furthermore, it is likely that working rigidities in female-owned MNEs inflate operational costs which are passed on to the price of commodities traded with domestic firms, causing inefficiency losses for them. More importantly, the negative coefficient of $PurchaseMNEs_{ijt}^{female}$ implies that negative or insignificant effects from forward FDI spillovers are not always due to the weak absorption capacity of domestic firms but are also represent structural characteristics from the side of MNEs that distort international knowledge transfer. The relationship between female-owned MNEs and female-owned domestic firms in the purchase linkage ($PurchaseMNEs_{ijt}^{female} \times FEOs_{ijt}$) reinforces this negative pattern in TFP in column 2b. Estimates in columns (2b) and (2c) are in accordance with H4.

4.4 Innovation, FDI Linkages Spillovers and Gender

Besides TFP improvements from supply-purchase links, interactions with MNEs can also lead to positive effects on other measures as specified in H5. This section examines how linkages with MNEs affect innovation activities of domestic firms, namely, to invest in R&D (*process*); to use new product lines or services (*product*); to engage to core product competence; (*competence*) to upgrade core product (*upgrade*); and to qualify for international product recognition (*qualification*). There remains a question of empirical investigation as to whether diversity in ownership may partially restrict the creation of an advanced technological profile in domestic firms.

Table 4: Baseline Spillovers through Supply and Purchase Linkages and Female-owned Firms

	process (1a)	*product* (2a)	*competence* (3a)	*upgrade* (4a)	*qualification* (5a)
PANEL A: Eq.(4)					
$SupplyMNEs_{ijt}$	0.001***	0.001***	0.001***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$PurchaseMNEs_{ijt}$	0.009***	-0.005*	-0.003	-0.007**	-0.000
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
Observations	4,777	7,330	7,325	7,326	7,318
	process (1b)	*product* (2b)	*competence* (3b)	*upgrade* (4b)	*qualification* (5b)
PANEL B: Eq.(5)					
$SupplyMNEs_{ijt}$	0.002***	0.001**	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
$PurchaseMNEs_{ijt}$	0.015***	0.008	-0.006	-0.008	0.004
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)
$SupplyMNEs_{ijt} \times FEOs_{ijt}$	-0.001	-0.000	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$PurchaseMNEs_{ijt} \times FEOs_{ijt}$	-0.009	-0.011	0.009	0.005	0.003
	(0.006)	(0.007)	(0.006)	(0.009)	(0.007)
$FEOs_{ijt}$	-0.017	-0.018	-0.032**	-0.030*	-0.010
	(0.011)	(0.017)	(0.016)	(0.018)	(0.010)
Observations	3,102	4,078	4,078	4,078	4,077
	process (1c)	*product* (2c)	*competence* (3c)	*upgrade* (4c)	*qualification* (5c)
PANEL C: Eq.(5) with propensity score weighting					
$SupplyMNEs_{ijt}$	0.002**	0.001	0.001***	0.002***	0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
$PurchaseMNEs_{ijt}$	0.020**	0.008	-0.001	-0.012*	-0.000
	(0.008)	(0.006)	(0.005)	(0.007)	(0.002)
$SupplyMNEs_{ijt} \times FEOs_{ijt}$	-0.001	0.000	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$PurchaseMNEs_{ijt} \times FEOs_{ijt}$	-0.017**	-0.007	0.004	0.011	0.013**
	(0.008)	(0.008)	(0.006)	(0.009)	(0.006)
$FEOs_{ijt}$	-0.017	-0.009	-0.022	-0.018	-0.008
	(0.013)	(0.018)	(0.016)	(0.018)	(0.011)
Observations	3,085	4,049	4,049	4,049	4,048
Controls	✓	✓	✓	✓	✓
Year fixed-effects	✓	✓	✓	✓	✓
Sector fixed-effects	✓	✓	✓	✓	✓
Country fixed-effects	✓	✓	✓	✓	✓

Notes: process represents "strength of process innovation" (dummy), *product* represents "new product Introduced" (dummy), *competence* represents "main product price increased" (dummy), *upgrade* represents "product lines upgraded" (dummy), and *qualification* refers to "international recognized quality" (dummy). Controls represent for the university degree and firm's size, government subsidies (a dummy variable equal to one if the firm reported as received subsidies from government), firm's export (measured as the share of export in sales) and import (a dummy equal to one if the firm reported as participation of import market) status. Observations vary across specifications, subjected to the availability of interested variables. FEOs is a dummy equal to one if the firm is female-owned and zero otherwise. R&D is a dummy equal to 1 if firm participated in R&D activities and 0 otherwise. New product introduced is a dummy equal to 1 if firm introduced new product lines and 0 otherwise. Robust standard errors clustered at the firm-level are provided in parentheses. *, **, and *** represent significant at the 10%, 5% and 1% levels, respectively.

Results in Table 4 show that supply linkages ($SupplyMNEs_{ijt}$) maintain a positive effect in almost all five measures of innovation performance of domestic firms across the three panels. This positive association supports the view that supplying inputs to MNEs provides the incentive to invest in aspects of innovation that will allow domestic firms to cope with the requirement of their technologically advanced buyers. MNEs usually outsource activities to local firms through contracts, which are governed by specific rules

and regulations regarding the specifications of these inputs (Bournakis, 2021). This pattern remains robust regardless of whether we control for gender ownership (Panel B) and selectivity bias (Panel C).

The estimated coefficient of purchasing materials ($PurchaseMNEs_{ijt}$) is positive and robust to selectivity bias only as far as the process innovation (*process*) of domestic firms is concerned. The more domestic firms purchase inputs from MNEs, the greater their R&D investment likelihood. Interestingly column (1c) shows that the potential benefit of purchasing materials from MNEs is distorted in female-owned domestic firms ($PurchaseMNEs_{ijt} \times FEOs_{ijt}$), which highlights the weakness of female entrepreneurs in facilitating the knowledge embedded in the inputs purchased from MNEs. It is yet another signal of the negative role of female ownership in creating a stronger innovation environment within domestic firms. The effect of purchasing inputs from MNEs ($PurchaseMNEs_{ijt}$) has no effect on the remaining innovation measures in Table 4. In contrast to previous findings of (Simona & Axèle, 2012), our results suggest that in emerging economies, the technological gap between MNEs and domestic firms is not the result of insufficient R&D effort on the part of domestic firms (*process*), but rather gender distortions cancel out the benefits that contacts with MNEs can bring to in-house innovation (i.e. insignificant coefficients of $SupplyMNEs_{ijt} \times FEOs_{ijt}$ and $PurchaseMNEs_{ijt}^{female} \times FEOs_{ijt}$).

Female-owned domestic firms are more likely to have an internationally certified product (*qualification*) as the number of purchase inputs from MNEs increases (column (5c)). It is the only result showing a female gender premium after domestic firms interacting with MNE. Female-owned domestic firms seem to benefit from the interaction with MNEs in terms of management and corporate social responsibility, which brings value and knowledge outside domestic firms' narrow scope (Post & Byron, 2015; Liu, Lei, & Buttner, 2020; Bear, Rahman, & Post, 2010). Equally important to this result is the requirement in some countries to have at least a certain amount of female members on the executive board in order to be eligible for an internationally certified qualification (Liu et al., 2020). Table 4 shows a positive pattern in accordance with H5, at least in terms of the importance of supply linkages, regardless of whether domestic firms are women or men-owned. In fact, the advantages accrue primarily to male-owned companies, as the inherited weaknesses of female counterparts do not enable them to gain innovation gains through supply contacts with MNEs.

5 Conclusions

Understanding the nature and role of gender gaps in firm performance is a complex issue, yet it is key to designing policies that diminish gender penalties while ensuring a smooth economic development process. We use a firm-level dataset from 32 emerging economies to examine the role of gender status in a series of local firms' characteristics. The primary focus was on productivity, innovation and the ability of female-owned firms to facilitate spillovers from supply and purchase with foreign MNEs.

Throughout the analysis and other things being equal, we find that female-owned domestic firms are 7.2-16.7% less productive compared to male-owned domestic firms, 2.3-3.6% less likely to participate in R&D, 0.6-2.6% less likely to gain international recognition, 3.9-4.5% less likely to achieve product innovation and upgrade quality. When interacting gender ownership with the supply-purchase linkage in the TFP specification, the positive spillover effects from MNE are eliminated. Although supply spillovers are in general an important conduit for boosting TFP of domestic firms, these benefits are mainly reaped by male-owned domestic firms. There is no evidence that purchasing input materials from female-owned MNEs enhance TFP in domestic firms, pointing to, among other factors, the lack of networking skills, limited access to financial resources, and work rigidities of female entrepreneurs in emerging economies. Our findings suggest that female-owned MNEs are subject to similar challenges, which impede potentially the amount of knowledge spillovers that domestic firms can capture from foreign affiliates. Inherited difficulties in female entrepreneurship within an emerging world context are detrimental not only to productivity but also undermine in-house innovation initiatives that domestic firms can develop as a result of their linkages with MNEs.

Our findings pull multiple streams of literature together and raise a concern about the existence of a female performance penalty in both domestic and foreign-owned MNEs. In developing countries, a similar female penalty in performance has been reported in Fukunishi (2009), Bloom, Mahajan, McKenzie, and Roberts (2010), and Li and Rama (2015) which call for policies to eliminate the factors which trigger gender-related gaps in firm performance, such as access to private investment and gender legal framework within countries. Reforms of that kind would reduce barriers to female entrepreneurship and improve the negotiating position of female-owned firms, but even more importantly, they would increase aggregate productivity in emerging economies through better absorption of FDI spillovers.

Although our findings are informative in various aspects regarding the performance of female-owned firms in the emerging world, they are subject to a caveat. The empirical

analysis is restricted to two waves 2002 and 2003; 2005 and 2006, which implies that estimates should be interpreted as correlation not as causal effects, with potential sources of endogeneity and omitted variables remaining. Future research with more appropriate panel data should revisit this issue mitigating more systematically potential feedback effects between gender and performance. Future research should also examine cultural spillovers from MNEs and how differences in gender status affect the absorption of these spillovers.

References

Ackah, C. G., Asuming, P. O., Agyire-Tettey, F., & Asuman, D. (2021). Gender gaps in total factor productivity: The case of manufacturing smes in ghana.

Amoroso, S., & Audretsch, D. B. (2020). The role of gender in linking external sources of knowledge and r&d intensity. *Economics of Innovation and New Technology*, 1–17.

Aterido, R., & Hallward-Driemeier, M. (2011). Whose business is it anyway? *Small Business Economics*, *37*(4), 443–464.

Aw, B. Y., Chung, S., & Roberts, M. J. (2000). Productivity and turnover in the export market: micro-level evidence from the republic of korea and taiwan (china). *The World Bank Economic Review*, *14*(1), 65–90.

Bardasi, E., Sabarwal, S., & Terrell, K. (2011). How do female entrepreneurs perform? evidence from three developing regions. *Small Business Economics*, *37*(4), 417–441.

Barrios, S., Görg, H., & Strobl, E. (2011). Spillovers through backward linkages from multinationals: Measurement matters! *European economic review*, *55*(6), 862–875.

Bear, S., Rahman, N., & Post, C. (2010). The impact of board diversity and gender composition on corporate social responsibility and firm reputation. *Journal of business ethics*, *97*(2), 207–221.

Blalock, G., & Gertler, P. J. (2008). Welfare gains from foreign direct investment through technology transfer to local suppliers. *Journal of international Economics*, *74*(2), 402–421.

Bloom, N., Mahajan, A., McKenzie, D., & Roberts, J. (2010). Why do firms in developing countries have low productivity? *American Economic Review*, *100*(2), 619–23.

Boden Jr, R. J., & Nucci, A. R. (2000). On the survival prospects of men's and women's new business ventures. *Journal of business venturing*, *15*(4), 347–362.

Bøler, E. A., Javorcik, B., & Ulltveit-Moe, K. H. (2018). Working across time zones: Exporters and the gender wage gap. *Journal of International Economics*, *111*, 122–133.

Bournakis, I. (2021). Spillovers and productivity: Revisiting the puzzle with eu firm level data. *Economics Letters*, *201*, 109804.

Bui, A. T., Nguyen, C. V., Pham, T. P., & Phung, D. T. (2019). Female leadership and borrowing constraints: Evidence from an emerging economy. *International Review of Financial Analysis*, 101332.

Carter, D. A., Simkins, B. J., & Simpson, W. G. (2003). Corporate governance, board diversity, and firm value. *Financial review*, *38*(1), 33–53.

Castillo, L. L., Salem, D. S., & Guasch, J. L. (2012). Innovative and absorptive capacity of international knowledge: an empirical analysis of productivity sources in latin american countries. *World Bank Policy Research Working Paper*(5931).

Caves, D. W., Christensen, L. R., & Diewert, W. E. (1982). The economic theory of index numbers and the measurement of input, output, and productivity. *Econometrica: Journal of the Econometric Society*, 1393–1414.

Commander, S., & Svejnar, J. (2011). Business environment, exports, ownership, and firm performance. *The Review of Economics and Statistics*, *93*(1), 309–337.

Croson, R., & Gneezy, U. (2009). Gender differences in preferences. *Journal of Economic literature*, *47*(2), 448–74.

Damijan, J. P., Rojec, M., Majcen, B., & Knell, M. (2013). Impact of firm heterogeneity on direct and spillover effects of fdi: Micro-evidence from ten transition countries. *Journal of comparative economics*, *41*(3), 895–922.

del Mar Fuentes-Fuentes, M., Bojica, A. M., & Ruiz-Arroyo, M. (2015). Entrepreneurial orientation and knowledge acquisition: effects on performance in the specific context of women-owned firms. *International Entrepreneurship and Management Journal*, *11*(3), 695–717.

Demena, B. A., & van Bergeijk, P. A. (2017). A meta-analysis of fdi and productivity spillovers in developing countries. *Journal of Economic Surveys*, *31*(2), 546–571.

de Nicola, F., Muraközy, B., & Tan, S. W. (2021). Spillovers from high growth firms: evidence from hungary. *Small Business Economics*, *57*(1), 127–150.

Eckel, C., Iacovone, L., Javorcik, B., & Neary, J. P. (2015). Multi-product firms at home and away: Cost-versus quality-based competence. *Journal of International Economics*, *95*(2), 216–232.

Eckel, C., & Neary, J. P. (2010). "Multi-Product Firms and Flexible Manufacturing in the Global Economy.". *The Review of Economic Studies*, *77*(1), 188–217.

Etemad, H., Gurau, C., & Dana, L.-P. (2021). International entrepreneurship research agendas evolving: A longitudinal study using the delphi method. *Journal of International Entrepreneurship*, 1–23.

Fang, S., Shamseldin, H. M., & Xu, L. C. (2019). *Foreign direct investment and female entrepreneurship*. The World Bank.

Fries, S., Lysenko, T., & Polanec, S. (2003). The 2002 business environment and enterprise performance survey: Results from a survey of 6,100 firms. (84).

Fukunishi, T. (2009). Has low productivity constrained the competitiveness of african firms? a comparison of kenyan and bangladeshi garment firms. *The Developing*

Economies, *47*(3), 307–339.

Galor, O. (2005). The demographic transition and the emergence of sustained economic growth. *Journal of the European Economic Association*, *3*(2-3), 494–504.

Galor, O., & Weil, D. N. (1996). The gender gap, fertility, and growth. *The American Economic Review*, *86*(3), 374.

Galor, O., & Weil, D. N. (2000). Population, technology, and growth: From malthusian stagnation to the demographic transition and beyond. *American economic review*, *90*(4), 806–828.

Girma, S., Kneller, R., & Pisu, M. (2005). Exports versus fdi: an empirical test. *Review of World Economics*, *141*(2), 193–218.

Giroud, A., Jindra, B., & Marek, P. (2012). Heterogeneous fdi in transition economies–a novel approach to assess the developmental impact of backward linkages. *World Development*, *40*(11), 2206–2220.

Gneezy, U., Niederle, M., & Rustichini, A. (2003). Performance in competitive environments: Gender differences. *The quarterly journal of economics*, *118*(3), 1049–1074.

Gneezy, U., & Rustichini, A. (2004). Gender and competition at a young age. *American Economic Review*, *94*(2), 377–381.

Godart, O. N., & Görg, H. (2013). Suppliers of multinationals and the forced linkage effect: Evidence from firm level data. *Journal of Economic Behavior & Organization*, *94*, 393–404.

Good, D. H., Nadiri, M. I., & Sickles, R. C. (1997). Index number and factor demand approaches to the estimation of productivity. *Handbook of applied econometrics*, *2*, 14–80.

Görg, H., Hanley, A., & Strobl, E. (2011). Creating backward linkages from multinationals: is there a role for financial incentives? *Review of International Economics*, *19*(2), 245–259.

Görg, H., & Seric, A. (2016). Linkages with multinationals and domestic firm performance: The role of assistance for local firms. *The European Journal of Development Research*, *28*(4), 605–624.

Gorg, H., & Strobl, E. (2001). Multinational companies and productivity spillovers: A meta-analysis. *The economic journal*, *111*(475), F723–F739.

Gorodnichenko, Y., Svejnar, J., & Terrell, K. (2014). When does fdi have positive spillovers? evidence from 17 transition market economies. *Journal of Comparative Economics*, *42*(4), 954–969.

Guadalupe, M., Kuzmina, O., & Thomas, C. (2012). Innovation and foreign ownership.

American Economic Review, *102*(7), 3594–3627.

Hill, F. M., Leitch, C. M., & Harrison, R. T. (2006). 'desperately seeking finance?'the demand for finance by women-owned and-led businesses. *Venture Capital*, *8*(02), 159–182.

Iacovone, L., Javorcik, B., Keller, W., & Tybout, J. (2015). Supplier responses to walmart's invasion in mexico. *Journal of International Economics*, *95*(1), 1–15.

Javorcik, B. S. (2004). Does foreign direct investment increase the productivity of domestic firms? in search of spillovers through backward linkages. *American Economic Review*, *94*(3), 605–627.

Knowles, S., Lorgelly, P. K., & Owen, P. D. (2002). Are educational gender gaps a brake on economic development? some cross-country empirical evidence. *Oxford economic papers*, *54*(1), 118–149.

Li, Y., & Rama, M. (2015). Firm dynamics, productivity growth, and job creation in developing countries: The role of micro-and small enterprises. *The World Bank Research Observer*, *30*(1), 3–38.

Lin, Y., Qin, Y., & Xie, Z. (2021). Does foreign technology transfer spur domestic innovation? evidence from the high-speed rail sector in china. *Journal of Comparative Economics*, *49*(1), 212–229.

Liu, Y., Lei, L., & Buttner, E. H. (2020). Establishing the boundary conditions for female board directors' influence on firm performance through csr. *Journal of Business Research*, *121*, 112–120.

Matricano, D. (2022). The influence of gender on technology transfer processes managed in italian young innovative companies: A stochastic frontier analysis. *Technovation*, *111*, 102383.

Mei, J.-C. (2021). Refining vertical productivity spillovers from fdi: Evidence from 32 economies. *International Review of Economics & Finance*.

Narula, R., & Marin, A. (2003). Fdi spillovers, absorptive capacities and human capital development: evidence from argentina.

Newman, C., Rand, J., Talbot, T., & Tarp, F. (2015). Technology transfers, foreign investment and productivity spillovers. *European Economic Review*, *76*, 168–187.

Post, C., & Byron, K. (2015). Women on boards and firm financial performance: A meta-analysis. *Academy of management Journal*, *58*(5), 1546–1571.

Rojec, M., & Knell, M. (2018). Why is there a lack of evidence on knowledge spillovers from foreign direct investment? *Journal of Economic Surveys*, *32*(3), 579–612.

Sandhu, N., Hussain, J., & Matlay, H. (2012). Barriers to finance experienced by fe-

male owner/managers of marginal farms in india. *Journal of Small Business and Enterprise Development*.

Seguino, S. (2000). Gender inequality and economic growth: A cross-country analysis. *World Development*, *28*(7), 1211–1230.

Shrader, C. B., Blackburn, V. B., & Iles, P. (1997). Women in management and firm financial performance: An exploratory study. *Journal of managerial issues*, 355–372.

Simona, G.-L., & Axèle, G. (2012). Knowledge transfer from tncs and upgrading of domestic firms: The polish automotive sector. *World Development*, *40*(4), 796–807.

Smith, N., Smith, V., & Verner, M. (2006). Do women in top management affect firm performance? a panel study of 2,500 danish firms. *International Journal of productivity and Performance management*.

Van Biesebroeck, J. (2007). Robustness of productivity estimates. *The Journal of Industrial Economics*, *55*(3), 529–569.

Weber, A., & Zulehner, C. (2010). Female hires and the success of start-up firms. *American Economic Review*, *100*(2), 358–61.

Xia, H., Tan, Q., & Bai, J. (2018). Corruption and technological innovation in private small-medium scale companies: Does female top management play a role? *Sustainability*, *10*(7), 2252.

Appendix I: The Measurement of Firm-level TFP

The structure of the dataset is mainly cross-sectional with about 605 firms surveyed in 2002 and 2005. Many variables have a retrospective component, which does not allow pooling observations over time spans 2002-2005 and 2003-2006. Given these features of the data, the multilateral index approach (Caves, Christensen, & Diewert, 1982; Good, Nadiri, & Sickles, 1997; Van Biesebroeck, 2007) is the most appropriate methodology for deriving a TFP measure at the firm level. See Aw, Chung, and Roberts (2000) and Girma, Kneller, and Pisu (2005), among others, that follow a similar approach.The early literature typically pools data across sectors or firms applying an Ordinary Least Squares (OLS) to estimate the parameters of a Cobb-Douglas production function and derive a TFP measure (Commander & Svejnar, 2011; Gorodnichenko et al., 2014; Mei, 2021). To obtain robust results from a Solow residual estimation of TFP reuires instruments for the input variables that are hardly available Commander and Svejnar (2011). The current approach assumes a flexible translog production function with constant returns to scale and full utilization of capital. The multilateral index uses a separate reference point to construct a hypothetical firm whose output and input levels are calculated as the log of the geometric mean across all firms in the industry. The input share chain-links the reference points over time in the same way as the conventional Tornqvist index. After these consideration, the formula of TFP is defined as:

$$\begin{aligned} lnTFP_{ijt} = &\Big[(lnY_{ijt} - ln\bar{Y}_{jt}) - \tilde{s}_{ijt}(lnL_{ijt} - ln\bar{L}_{jt}) \\ &- (1 - \tilde{s}_{ijt})(lnK_{ijt} - ln\bar{K}_{jt})\Big] \\ &+\Big[(ln\bar{Y}_{js} - ln\bar{Y}_{js-3}) - \tilde{s}_{js}(ln\bar{L}_{js} - ln\bar{L}_{js-3}) \\ &-(1 - \tilde{s}_{js})(ln\bar{K}_{js} - ln\bar{K}_{js-3})\Big] \end{aligned} \tag{AI 1}$$

where $\tilde{s}_{ijt} = (s^L_{ijt} + s^L_{jt})/2$ and $\tilde{s}_{js} = (s^L_{js} + s^L_{js-3})/2$. The s_{ijt} is the labour share.[12] In equation (4), $ln\bar{Y}_{jt}$ is the average log total sales, $ln\bar{L}_{jt}$ is labour (number of employees), and $ln\bar{K}_{jt}$ is capital (at the replacement value) in sector j at time t. We calculate TFP for two-periods (2002-2005 and 2003-2006), which suits better our data structure and summarizes consistently the cross-sectional distribution of firm TFP.

[12]BEEPs does not report information on total wage bill for individual firms. To overcome this limitation, we derive labour shares using the country-level share of gross capital formation at current PPPs from the PWT 10.0 database.

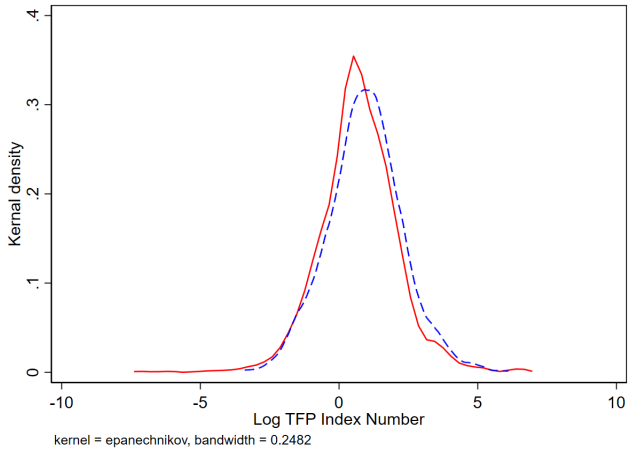

Figure 1: Distribution of kernel density estimate of the distribution of total factor productivity between female-owned (red) and male-owned (blue) domestic firms
Notes: TFP index number is calculated based on Caves et al. (1982) method.

Appendix II: Further Statistics

Appendix II.A: Number of Firms in Each Sector

Industry(sector)	Code#	No. Domestic firms	No. Multinational firms
Mining, Quarrying	1	147	31
Construction	2	1,060	108
Manufacturing	3	2,996	646
Transport and storage	4	587	116
Wholesale, Retail trade and Repair of motor vehicles	5	2,207	420
Real estate	6	755	141
Hotels, Restaurants	7	443	76
Other services	8	1,066	179

Notes: Sector stratification is based on the survey question - "how would you best describe your firm's main area of activity in terms of sales?". It reflects the relative contribution of each sector to the size of the economy. Note that the numbers presented here refer to the total number of firms available the dataset. However, firms may not report their gender ownership information, results in a less number of observations. Table 1 in the main context provides useful information regarding the number of available observation. for more details. Details of the sampling methodology are available at www.Enterprisesurveys.

Appendix II.B: Mean Values of Supply and Purchase Linkages through Gender Ownership across Countries

Country	Code	Supply to MNEs				Purchase from MNEs			
		Female-owned firms		Male-owned firms		Female-owned firms		Male-owned firms	
	#	Mean	S.d	Mean	S.d	Mean	S.d	Mean	S.d
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Albania	1	4.58	15.877	3.698	14.044	0.011	0.039	0.130	0.475
Armenia	2	2.258	8.045	5.238	10.846	0.209	0.484	0.077	0.276
Azerbaijan	3	0	0	0	0	0	0	0	0
Belarus	4	0.555	3.333	1.291	7.467	0.306	0.987	0.136	0.701
Bosnia	5	2.272	10.660	3.725	13.260	0.225	0.732	0.052	0.312
Bulgaria	6	0.750	4.743	1.086	6.705	0.205	0.400	0.195	0.461
Croatia	7	5.208	20.402	5.043	13.673	0.069	0.291	0.067	0.279
Czech Republic	8	4.268	12.627	3.220	10.882	0.062	0.145	0.096	0.200
Ecuador	9	3.75	13.035	6.486	17.945	0	0	0	0
El Salvador	10	2.858	9.599	3.651	10.228	0	0	0	0
Estonia	11	6.190	18.993	7.971	17.950	0.215	0.550	0.191	0.597
FYROM	12	5.000	10.000	2.722	9.614	0.064	0.154	0.224	0.318
Georgia	13	1.538	8.123	1.725	8.631	0.129	0.550	0.279	0.700
Guatemala	14	1.25	2.5	10	23.452	0	0	0	0
Honduras	15	0	0	2.5	4.183	0	0	0	0
Hungary	16	5.626	15.011	9.712	20.528	0.187	0.367	0.147	0.298
Kazakhstan	17	1.813	9.945	3.551	13.128	0.204	0.373	0.117	0.313
Kyrgyz	18	0.285	1.690	3.820	13.964	0.486	1.174	0.238	0.793
Latvia	19	4.604	14.550	4.292	10.255	0.076	0.305	0.077	0.161
Lithuania	20	4.125	16.616	1.883	10.731	0.195	0.467	0.154	0.280
Moldova	21	0.119	0.771	2.307	9.048	0.212	0.439	0.226	0.433
Montenegro	22	0	0	0	0	0	0	0	0
Nicaragua	23	6.25	11.877	8.461	14.489	0	0	0	0
Poland	24	4.780	15.796	4.754	14.208	0.106	0.227	0.062	0.339
Romania	25	4.561	15.796	2.350	10.604	0.106	0.227	0.105	0.273
Russia	26	0.342	2.404	1.798	10.049	0.049	0.079	0.090	0.188
Serbia	27	3.333	10.289	4.25	14.136	0.292	0.845	0.215	1.058
Slovakia	28	8.076	20.970	5.202	15.690	0.666	1.417	0.144	0.479
Slovenia	29	0.694	3.412	2.848	8.868	0.203	0.481	0.173	0.415
Tajikistan	30	8.333	25	3.148	10.669	0	0	0.013	0.081
Ukraine	31	0.933	5.319	2.039	9.205	2.259	6.275	2.863	7.040
Uzbekistan	32	0	0	0.603	4.984	0.066	0.306	0.013	0.136

Notes: Although we are conscious that Serbia and Montenegro, and Yugoslavia they were the same country from 1992-2006, as highlighted in Mei (2021) there are different country fixed-effects that slightly influence the estimates. It implies that it is more reassuring to allow Serbia, Montenegro, and Yugoslavia to have different country fixed-effects in the specifications. We therefore keep Serbia, Montenegro, and Yugoslavia as different countries in our sample.

Appendix II.C: Female-owned firms' productivity - all firms

	TFP			*process*			*competence*		
	(1a)	(2a)	(3a)	(4a)	(5a)	(6a)	(7a)	(8a)	(9a)
PANEL A									
$FEOs_{ijt}$	-0.188***	-0.169***	-0.069*	-0.040***	-0.023**	-0.021*	-0.042***	-0.025*	-0.018
	(0.032)	(0.030)	(0.030)	(0.011)	(0.011)	(0.012)	(0.013)	(0.014)	(0.014)
Observations	3,779	2,921	2,891	4,027	3,385	3,367	5,349	4,481	4,447
	product			*upgrade*			*qualification*		
	(1b)	(2b)	(3b)	(4b)	(5b)	(6b)	(7b)	(8b)	(9b)
PANEL B									
$FEOs_{ijt}$	-0.043***	-0.025	-0.013	-0.052***	-0.033**	-0.020	-0.028***	-0.012	-0.006
	(0.015)	(0.016)	(0.016)	(0.015)	(0.016)	(0.017)	(0.009)	(0.010)	(0.011)
Observations	5,349	4,481	4,447	5,348	4,481	4,447	5,348	4,480	4,446
Controls	x	✓	✓	x	✓	✓	x	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Propensity score weighting	x	x	✓	x	x	✓	x	x	✓

Notes: process represents "strength of process innovation" (dummy), *product* represents "new product Introduced" (dummy), *competence* represents "main product price increased" (dummy), *upgrade* represents "product lines upgraded" (dummy), and *qualification* refers to "international recognized quality" (dummy). Controls represent for the university degree and firm's size, government subsidies (a dummy variable equal to one if the firm reported as received subsidies from government), firm's export (measured as the share of export in sales) and import (a dummy equal to one if the firm reported as participation of import market) status. Observations very across specifications, subjected to the availability of interested variables. FEOs is a dummy equal to one if the firm is female-owned and zero otherwise. Robust standard errors clustered at the firm-level are provided in parentheses. *, **, and *** represent significant at the 10%, 5% and 1% levels, respectively.

Appendix II.D: Female-owned firms and productivity

	TFP			*process*			*competence*		
	(1a)	(2a)	(3a)	(4a)	(5a)	(6a)	(7a)	(8a)	(9a)
PANEL A: MNEs									
$FEOs_{ijt}$	-0.325**	-0.181	-0.104	-0.045	0.020	-0.005	0.003	0.060	0.075
	(0.153)	(0.171)	(0.164)	(0.065)	(0.077)	(0.069)	(0.051)	(0.056)	(0.049)
Observations	346	216	211	292	226	225	412	325	320
	product			*upgrade*			*qualification*		
	(1b)	(2b)	(3b)	(4b)	(5b)	(6b)	(7b)	(8b)	(9b)
PANEL B: MNEs									
$FEOs_{ijt}$	-0.040	-0.050	-0.039	-0.114*	-0.134*	-0.104	0.002	0.013	0.018
	(0.071)	(0.079)	(0.074)	(0.067)	(0.076)	(0.076)	(0.050)	(0.057)	(0.053)
Observations	412	325	320	412	325	320	412	325	320
Controls	x	✓	✓	x	✓	✓	x	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Propensity score weighting	x	x	✓	x	x	✓	x	x	✓

Notes: process represents "strength of process innovation" (dummy), *product* represents "new product Introduced" (dummy), *competence* represents "main product price increased" (dummy), *upgrade* represents "product lines upgraded" (dummy), and *qualification* refers to "international recognized quality" (dummy). Controls represent for the university degree and firm's size. Observations very across specifications, subjected to the availability of interested variables in the pooled sample. FEOs is a dummy equal to one if the firm is female-owned and zero otherwise. Robust standard errors clustered at the firm-level are provided in parentheses. *, **, and *** represent significant at the 10%, 5% and 1% levels, respectively.

UNIVERSITY OF CAMBRIDGE

Bennett Institute for Public Policy Cambridge

www.bennettinstitute.cam.ac.uk