

Women Managers and the Gender-Based Gap in Access to Education

Evidence from Firm-Level Data in Developing Countries

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WORLD BANK GROUP

Development Economics

Global Indicators Group

May 2015

Abstract

Several studies explore the differences in men's and women's labor market participation rates and wages. Some of these differences have been linked to gender disparities in education attainment and access. The present paper contributes to this literature by analyzing the relationship between the proclivity of a firm to have a female top manager and access to education among women relative to men in the country. The paper combines the literature on women's careers in

management, which has mostly focused on developed countries, with the development literature that has emphasized the importance of access to education. Using firm-level data for 73 developing countries, the analysis finds strong evidence that countries with a higher proportion of female top managers also have higher enrollment rates for women relative to men in primary, secondary, and tertiary education.

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Women Managers and the Gender-Based Gap in Access to Education: Evidence from Firm-Level Data in Developing Countries

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Keywords: Gender, Labor market, Managers, Education
JEL: J16, G30

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1. Introduction

A fairly established fact is that gender inequality exists in almost every country in the world along several important dimensions (Ricardo Hausmann, Laura D. Tyson, and Saadia Zahidi 2006; World Bank 2011). Women are less likely to work than men, and also tend to earn less than men in similar occupations (Zafiri Tzannatos 1999; Esther Duflo 2005; World Bank 2011). Access to higher levels of education tends to be restrictive for women in low income economies (Duflo 2005). A fairly large literature has documented the gender gap in education and labor markets and their consequence on economic growth (Robert J. Barro and Jong-Wha Lee 1994; David Dollar and Roberta Gatti 1999; Tzannatos 1999; Andrew Stephan Klasen and Francesca Lamanna 2009). The literature supports two obvious policy recommendations: increasing women's access to education and especially their participation in the labor market.

However, there is fear that increases in women's employment typically involves informal and vulnerable employment (Diane Elson 1999). Thus, a more pertinent question is what determines women's empowerment, or in the case of this study, the presence of women as top managers of private firms? Given the potential payoffs of having more female top managers including greater wage equality and women's empowerment, this is an important area of study (Duflo 2005; Philip Cohen and Matt Huffman 2007).¹ The literature on the careers of women managers and firm organization has explored this question (see for example, Terry C. Blum, Dail L. Fields, and Jodi S. Goodman 1994; Chris Rowley 2013). However, this body of work is mostly focused on developed economies. Further, many studies use small samples that are not necessarily reflective of the broader economy (Lilliiian T. Eby, Marcus Butts, and Angie Lockwood 2003, Ruth Simpson 1997). Hence, the results may or may not extend beyond the sample under study.

¹ Some studies in the area show that the benefits of women in positions of powers may be limited in small firms (Andrew M. Penner and Haorold J. Toro-Tulla 2010)

The present study contributes to two strands of literature – women’s involvement in the labor market in developing economies, and the career progression of women managers and firm organization - by exploring the likelihood of female top managers in private firms across countries and its relationship to access to education. A representative sample of private formal (registered) sector firms in developing economies is used. The paper’s particular focus on developing economies is useful, given limited research for these economies on gender and high-paying jobs. The use of representative firm level data is also useful in that it allows for inferences beyond the sample under study to the broader economy.

Understanding what factors drive women’s presence in top managerial positions is important because gender disparity in labor markets continues to persist, especially at managerial positions (Claudia Goldin 2006; Alison Cook and Christy Glass 2013; Julie A. Kmec and Sheryl Skaggs 2014). Acknowledging that gender equality, especially for high paying and influential jobs, may have several positive economic and social outcomes (Duflo 2005; Lori Beaman, Esther Duflo, Rohini Pande, and Petia Topalova 2012), policy makers are now grappling with practical policy recommendations that may reduce the gender gap in managerial/leadership positions despite a countries’ economic, social or cultural orientation (World Bank 2011). A great deal of focus has now turned to women’s education for reducing gender disparities in incomes and labor markets (World Bank 2011, Esther Duflo 2012, Nitya Rao and Carolina Sweetman 2014).

One may argue that access to education is more likely to play a key role in developing economies than in developed economies, since access to education is not as big an obstacle for women in developed economies. For instance, the ratio of women to men in tertiary enrollment in high income countries in 2012 is 126 percent, while the corresponding figure for low income economies is 65 percent (World Development Indicators). For the case of developed countries, the literature on women’s careers and firm organization has rigorously explored the various firm characteristics as well as social attitudes and cultural factors affecting women’s career

progressions (Rosabeth Kanter 1977, Blum, Fields and Goodman 1994; Kimberly E. O'Brien, Andrew Biga, Stacey R. Kessler and Tammy D. Allen 2010; Mingzhu Wang and Elisabeth Kelan 2013). However, in developing economies, where access to education is a crucial element for career development, it is difficult for women to even reach the position where they qualify for important positions in a firm, irrespective of the prevailing culture and social attitudes. Of course, this does not mean that culture and social attitude towards women managers is not important in developing countries (see for example, Pak-Wai Liu, Xin Meng and Junsen Zhang 2000, Andrew T. Newell and Barry Reilly 2001; Luigi Guiso, Paola Sapienza and Luigi Zingales 2003, Mandana Hajj and Ugo Panizza 2009;). The present study aims to explore the extent to which these other factors render education important for the cause of women managers.

In addition, we also explore heterogeneity in the relationship between access to education and women's employment in managerial positions along various dimensions, such as firm-size (small and medium firms vs. large firms), which has been the focus of many gender related studies (Candida G. Brush, Nancy M. Carter, Elizabeth .J. Gatewood, Patricia G. Greene and Myra M. Hart, 2006; Sara Carter and Eleanor Shaw 2006, Susan Coleman 2007; Shwetlana Sabarwal and Katherine Terrel 2008).

To investigate the link between women's access to education and the likelihood of female top managers in the country, we use data on the gender of the top manager in 16,000 manufacturing firms spread across 73 developing countries. We use a relative measure for access to education - the average of women's to men's enrollment rates for primary, secondary and tertiary levels of schooling (henceforth, education enrollment or access to education). We find that an increase in access to education for women in a country has a positive and highly significant relationship with the likelihood of (firms that have) female top managers. Our most conservative estimate shows that moving from the country with the lowest ratio of women's education enrollment in our sample (Chad) to the highest (Dominica) is associated with an increase of 16 percentage points in the

likelihood of having a top woman manager at a firm. This is a large increase given that only 19.5 percent of the firms in our sample have a top woman manager.

To summarize, this study contributes to the literature in the following ways: (i) it investigates the relationship between gender disparity in access to education and the likelihood of female top managers in developing economies, a hitherto unexplored area; (ii) it uses a sample of unique cross-country comparable firm level data sets that follow the same sampling methodology and design; (iii) it combines both the literature on gender and development – which has been limited with regards to the determinants of women managers, and the literature on women’s careers on management that has typically focused on developed economies or suffers from non-representative data (at the economy level), which hinders the ability to make economy-wide inferences; and (iv) it explores the importance of firm-size and other firm-level and country-level attributes for the relationship between women’s access to education and the likelihood of female top managers.

2. Conceptual Model

Career choices can be seen as a series of decisions based on a comparison of costs and benefits (see for example, Michael Keane and Kenneth Wolpin 1997). These costs and benefits may differ by gender, potentially providing a different set of incentives for men and women. The gender specific comparisons of costs and benefits serve as the theoretical underpinning of most research on the determinants of women managers.² Assuming that an individual has high career ambitions, there are combinations of factors that influence the chances of a woman as opposed to a man attaining a top managerial position in a firm. At the theoretical level, these factors can be grouped into two types. On the one hand, firm characteristics would define how woman-friendly the firm

² See for example, Jacob Mincer (1962), Gary Becker (1965), Florence Jaumotte (2003) and Andrew Morrison, Dhushyanth Raju and Nishtha Sinha (2007) for an overview of the more recent literature.

is, potentially encouraging or deterring women's participation in management (Blum, Fields, and Goodman 1994). On the other hand, especially in developing economies where there is a lack of basic public services, several economy-wide characteristics, including culture and social attitudes towards women and gender discrimination in access to finance, may limit women's participation in the labor market and hence in top management positions (Roger Clark, Thomas W. Ramsbey, and Emily S. Adler 1991; Tanja van der Lippe and Liset van Dijk 2002; Alexander Muravyev, Oleksandr Talavera and Dorothea Schäfer 2009; World Bank 2011, Mary Hallward-Driemeier , Tazeen Hasan and Anca Bogdana Rusu 2013; Mohammad Amin and Asif Islam 2015). Simply put, we can classify the types of obstacles faced into two broad categories - micro-level firm characteristics or organization structures; and macro-level or economy-wide institutional and public good access constraints that have a gender bias.

In developing economies, one of the most important factors for women's career paths is their level of education (World Bank 2011). It is well known that compared to men, women lack access to high levels education in low income economies (Duflo 2005, Andrew Morrison Dhushyanth Raju and Nishtha Sinha 2007, World Bank 2011). The repercussion is that women are at a disadvantage right at the beginning of their careers. Being already hindered at the beginning of the career ladder, the climb up is all the more difficult regardless of potential opportunities. It may be that only after the education obstacle has been overcome that several other firm-specific and economy-wide factors come into play. Thus, *ceteris paribus*, one can expect greater access to education having a strong positive effect on the likelihood of female top managers in developing economies. However, the connection between access to education and women's career achievements is not so obvious. For example, schools in developing economies tend to be underfunded, and given the public resources available, it is not completely surprising that they may be of poor quality (Jere Berhman 2009). Thus, if schooling quality is poor, increasing access to education may not prove helpful to women in their careers. Furthermore, other informal

mechanisms of signaling ability may develop, making schooling irrelevant for career progressions (Lans Pritchett 2001). The importance of education is therefore an empirical question.

Additionally, several macro-level factors may determine the likelihood of having women in top managerial positions. These include the nature of laws and institutions in the economy and whether they are favorable to women, whether women are typically in positions of power in the economy, and possibly the level of development in the economy. In terms of institutions, some studies have pointed to the importance of cultural factors such as religion and the degree of socialism or central planning in the economy as well as women's political empowerment for the overall well-being of women (see for example, Clark, Ramsbey and Adler 1991; Liu, Meng and Zhang 2000; Newell and Reilly 2001; Guiso, Sapienza and Zingales 2003; Hajj and Panizza 2009; Hallward-Driemeier, Hasan and Rusu 2013). Greater women's presence in parliament or more broadly, their political empowerment, can have a positive effect on women's labor market participation in a number of ways. For example, women in top political positions may have a positive effect on women's participation in the labor (and managerial) market by serving as role models for aspiring women, reducing the time spent on household duties through better provision of public goods and services that are important to women, and enacting laws that favor women (Julie Ballington 2008; Ejaz Ghani, Anandi Mani and Stephen O'Connell 2013; Hallward-Driemeier, Hasan and Rusu 2013). Greater women's presence in parliament may also proxy for better treatment of women and hence a greater likelihood of female top managers in the country. Similarly, the political environment as reflected in the quality of the rule of law can have a direct effect through better access to education and job opportunities for women, and also an indirect effect through the political empowerment of women. We account for several of these factors in our empirical analysis using proxies such as percentage of women in parliament, religion, legal origins, and the rule of law.

At the micro-level, there are several firm organizational characteristics that may determine if women are likely to be promoted to top managerial positions (Blum, Fields, and Goodman 1994). As noted in the literature, these include the degree of women's presence in the firm, access to mentoring, firm's age, availability of formal training, exporting status, underlying business environment, firm's location, and the industry the firm belongs to (Raymond A. Noe 1988; Belle Rose Ragins and Eric Sundstrom 1989; Diane Elson 1996; Stephanie Seguino 2000; Marcel Fafchamps and Forhad Shilpi 2005; Matthias Busse and Christian Spielmann 2006; Dan Black, Natalia Kolesnikova and Lowell Taylor 2007; Matt L. Huffman, Philip N. Cohen and Jessica Pearlman 2010; Asif Islam and Mohammad Amin 2014; Chinhui Juhn, Gergely Ujhelyi, Carolina Villegas-Sanchez 2014).

A high presence of men in the firm can result in a male dominated culture in the firm, which ends up attracting more men, selecting more men, and also may lead to more men staying longer in the firm. This fits in with the well-known Similarity-Attraction theory or its extension - the attraction-selection-attrition (ASA) cycle (Benjamin Schneider, 1987; Kanter 1977; see Rowley 2013 for a literature review). This may result in women facing career obstacles as they do not fit in due to the male-dominated corporate culture. Thus, women are likely to be in peripheral positions with no opportunities for mentoring and career progression (Rowley 2013). Furthermore, men tend to progress in careers through informal networks, leaving women with formal training programs as their main route for progression. There is evidence in the literature that informal mentorship is far more effective than formal mentorship (Georgia T. Chao, Patm Walz, and Philip D. Gardner 1992; Belle Rose Ragins and John L. Cotton 1999). Thus, if informal networks are male-dominated, women may find it difficult to get promoted. In contrast, the presence of women owners can further the cause of women managers (Sheryl Skaggs, Kevin Stainback and Phyllis Duncan 2012; Wang and Kelan 2013). It is worth noting that there is substantial debate in the literature regarding the availability of mentors for women workers. On one hand, studies show that

women are as likely as men to obtain protégé experience (Belle Rose Ragins 2007; O'Brien, Biga, Kessler and Allen 2010). On the other hand, women may face difficulty in accessing powerful mentors. There are individual, interpersonal, organizational, and societal barriers as well as lack of access to informational networks and also the presence of stereotypes and tokenism that tend to hinder women's access to mentors (Noe 1988, Ragins and Sundstrom 1989). While we were unable to measure these constructs in the current study, we do account for the presence of formal training in the firm in our empirical analysis.

Other factors such as the age of the firm, exporting status, industry and geographical location are also considered to be important for women's experience in the labor market. Older firms may face structural inertia leading to a resistance to change, and hence a reluctance to hire female top managers (Blum, Fields, and Goodman 1994). Younger firms may be less tied to the old traditions and therefore more likely to have a top woman manager (Michael T. Hannan and John Freeman 1984; Dawn Kelly and Terry L. Amburgey 1991). Exporting status of a firm may matter due to the comparative advantage enjoyed by women in exporting sectors of developing countries, and mechanization of tasks that reduces the need for brawns or muscle power (Elson 1996, Seguino 2000, Juhn, Ujhelyi and Villegas-Sanchez 2014).

In addition, there are fairly consistent patterns of segregation of men and women by occupations and industry. Women have traditionally been less active in activities requiring physically demanding work (brawn) and heavy industries vis-à-vis other occupations and industries such as retail (Islam and Amin 2014; Juhn, Ujhelyi and Villegas-Sanchez 2014). We account for several of these factors in our empirical analysis. Women entrepreneurs may also be susceptible to harsher business environment in terms of access to finance and even interference and harassment by government officials (see for example, Amanda Ellis, Claire Manuel and Mark Blackden 2006; Muravyev, Talavera and Schäfer 2009). We account for the business environment

in our empirical analysis by controlling for whether the firm finds access to finance to be a major obstacle and if the firm was inspected by government officials.

Women's presence in management positions may also depend on city size. Women are more likely to progress in their career to top managerial positions in large cities, as the conveniences provided in cities such as better availability of basic services may lead to less time spent on household chores and more on labor market activity (Fafchamps and Shilpi 2005). Furthermore, larger cities entail lower fertility rates, rising aspirations among women and the greater need for cash income due to higher cost of living (Naila Kabeer 2007). These factors tend to push women into the labor market. On the other hand, greater demand for leisure due to higher incomes, higher levels of crime targeted towards women and long commute times in the relatively larger cities may adversely affect women's participation in labor market activity (see for example, Edward L. Glaeser and Bruce Sacerdote 1999; Carl Gaigne and Yves Zenou 2013; Black, Kolesnikova and Taylor 2007). We therefore account for firms located in large vs. small cities in the empirical model.

One area that we do wish to highlight is the relationship between firm size, education, and the gender of the managers. There is substantial work, mostly for developed countries, showing that firms owned and managed by women vs. men tend to be concentrated among the relatively smaller and home-based businesses (Brush, Carter, Gatewood, Greene and Hart 2006; Carter and Shaw 2006, Coleman 2007). This literature is inconclusive with regards to the firm size and gender of the manager relationship. Larger firms, with organizational attributes including formal human resource functions and bureaucracy, may create inertia in integrating management by gender. On the other hand, being large increases the visibility of being under both the public glare and the watch of government regulatory agencies, increasing the pressure to conform to societal expectations (for a review of the literature with both the theoretical and empirical underpinnings, see for example, Huffman, Cohen and Pearlman 2010). Thus, depending on what mechanism

dominates, increasing firm-size may be positively or negatively correlated with the likelihood of having a woman manager. More importantly, the relationship between women's education access and the presence of female top managers may be conditional on the size of the firm. Thus we capture any firm size heterogeneities by separately estimating the relationship between education and presence of women top managers.

We have thus laid out the conceptual framework for the analysis, highlighting the importance of access to education and indicating the scenarios where it may prove important for women obtaining top managerial positions and where it may not. We have also provided a brief discussion of the mechanisms at play for various macro and micro-level factors. The relative importance of the factors remains an empirical question.

3. Data and Main Variables

The main data source we use consists of firm-level surveys for 73 developing countries conducted by the World Bank's Enterprise Surveys between 2007 and 2010.³ A common sampling methodology – stratified random sampling – was followed in all the surveys along with a common questionnaire. The sample for each country was stratified by industry, firm-size, and location within the country. Weights are provided in the survey to ensure that the sample is representative of the non-agricultural private sector of the economy. We focus on the sample of manufacturing firms.⁴ We complement these firm-level surveys with other data sources (listed below) such as World Development Indicators (World Bank), Inter-Parliamentary Union (IPU), etc.

Regression results discussed below are marginal effects obtained from logit estimation with Huber-White robust standard errors and clustered on the country. All marginal effects are

³Sample size in the regressions varies due to missing data.

⁴Enterprise Surveys do not cover the primary sector, mining, and services sectors such as education and health. Data on some of our main variables used in the regressions is missing for the services sectors covered in the survey for some countries.

calculated at the mean value of the explanatory variables. Summary statistics of all the variables used and the correlations for the main explanatory variables are provided in Table 1.

It is important to point out that our results are based on cross-section data. Hence, it is difficult to eliminate all possible endogeneity concerns despite the number of checks performed (discussed below). So, we interpret all our results as correlations or associations, suggestive of a possible underlying causal relationship.

3.1 *Dependent variable*

In the Enterprise Survey, firms were asked if the top manager (main decision maker) is a woman or a man. Using responses to this question, we define our dependent variable as a dummy equal to 1 if the top manager of the firm is a woman and 0 otherwise (*Woman manager*). About 19.5 percent of the firms have a top woman manager in our sample. At the low end, Afghanistan and Cameroon have less than 5 percent women (top) managers; at the high end, over 40 percent of the managers in Honduras and Lesotho are women.

3.2 *Main explanatory variable*

Our main explanatory variable captures the gap between women and men's access to education across countries. To this end, for any given country, we use the average of the ratio of women's to men's enrollment rate in primary, secondary and tertiary education (*Enrollment*). The average is taken over countries and years (described below) for which information is available on either primary, secondary or tertiary enrollment ratios. Our main results are unchanged if we restrict the sample to countries for which information is available on all the three enrollment ratios (see below).

Considering that education is a long-drawn process, it may take substantial time before acquiring education translates into becoming a manager. For this reason, we use lagged values of

our education enrollments variable. We assume twelve years of primary and secondary education, six years of tertiary education and add another ten to fifteen years of necessary work experience before being eligible for a managerial position. This implies a lag of 30 to 35 years for someone starting primary education to become a manager, and a lag of 10-15 years for someone completing tertiary education. So, taking the average of the minimum lag (average of 10 to 15 years) and the maximum lag (average of 30 to 35 years), we get a lag of about 22 years. A lag of 22 years from the time of Enterprise Surveys (2008 as the average year) gives us year 1986. In our baseline specification, we use five-year average values of *Enrollment* as defined above and centered on 1986 (*Enrollment_1986*).⁵

Our estimate of 10-15 years of required work experience does involve some guesswork. Data from Enterprise Surveys shows that the median number of years of experience that the top manager has working in the industry equals 15 years. Note that this does not include work experience acquired in other industries and it includes experience acquired after becoming a manager in the current industry. Hence, actual experience of managers before becoming a manager could be higher or lower than the average of 15 years. To overcome this problem, we also report results use five year average values of *Enrollment* centered on 1981 (*Enrollment_1981*), 1976 (*Enrollment_1976*), 1991 (*Enrollment_1991*) and 1996 (*Enrollment_1996*).

The mean value of *Enrollment_1986* equals 1.004 and the standard deviation is 0.332. Across countries, the variable ranges between 0.22 (Chad) and 2.2 (Dominica).

It is important to note here that we have clubbed together primary, secondary and tertiary education enrollment levels and assumed the same lag (22 years for our baseline specification) for all of them. The reason for doing so is to get an overall measure of access to education for women

⁵ That is, we take the average over 1984 to 1988 values of enrollment ratios for primary, secondary and tertiary education and then take the average over the three resulting ratios. As mentioned above, for some countries, *Enrollment_1986* is computed with data not available for all three education levels. Enrollment levels centered on other years (discussed below) are analogously defined.

vs. men. Nevertheless, one might wonder if our results hold with different and longer lags for primary and secondary education (as these are more distant in the past) and shorter lags for tertiary education. A related question is differences in the strength of the relationship between the likelihood of female top managers and tertiary enrollment level vs. primary and secondary enrollment level in the country.

To answer these questions, we follow the logic of lags discussed above and define three more access to education variables - five-year average values of the ratio of women to men tertiary enrollment rates centered on 1992 (*Tertiary_1992*), and a similar five-year average for primary and secondary education centered on 1983 (*Primary_1983*, *Secondary_1983*). To allow for different lags for primary, secondary and tertiary education, we define *Enrollment1* as the average over *Tertiary_1992*, *Secondary_1983* and *Primary_1983*.⁶ For possible differential effects of tertiary vs. secondary and primary education on the likelihood of female top managers, we use *Tertiary_1992* and the average of *Secondary_1983* and *Primary_1983* (*Pri_Sec_1983*).⁷

3.3 Other explanatory variables

Given the cross-country nature of the data, our main results for the relationship between education enrollment and the likelihood of female top managers in the country could suffer from omitted variable bias. To this end, and in accordance with the conceptual model outlined in section 2, we control for a number of firm-level and country-level variables. Note that since our dependent variable is defined at the firm-level and education enrollment at the country level and sufficiently lagged, reverse causality problem is unlikely, though still possible.

⁶ Note that *Enrollment1* variable is defined for only those countries for which information is available on all three education levels.

⁷ The qualitative nature of the results does not change if we include primary and secondary enrollment rates separately in the regressions.

For firm-level controls, all taken from Enterprise Surveys, we try and capture the presence of women networks and mentorship in firms (inverse of men dominated corporate culture) by accounting for the presence of women owners and the proportion of workers at the firm that are women. For women owners, we use a dummy variable equal to 1 if the firm has one or more woman owner and 0 otherwise (*Woman owner*). For women workers, we define this as the proportion of all full-time permanent workers at the firm that are women (*Women workers*). Although we do not have any direct measures of mentorship, we believe that the presence of more women workers could be a proxy for women dominated firms, and women owners are more likely to act as mentors for future women managers.

We also control for the presence of formal training which is identified in the conceptual model as an important determinant of the presence of women in managerial positions, especially when there are men-dominated informal networks in the firm. To this end, we use a dummy variable equal to 1 if the firm offered formal training to its employees (during the last year) and 0 otherwise (*Formal training*).

As mentioned above, segregation of men and women by occupations and sectors is observed and thus we control for dummy variables indicating the industry to which the firm belongs (Industry fixed effects). There are 11 industries – textiles, leather, garments, food, metals & machinery, electronics, chemicals & pharmaceuticals, wood & furniture, non-metallic and plastic materials, auto & auto components, and other manufacturing.

Next, we control for firm-size as measured by the (log of) total number of full-time employees working at the firm at the end of the previous fiscal year (*Firm size*). Apart from the direct effect of firm-size on women managers discussed above, firm-size can serve an important proxy measure for a number of firm attributes such as tendency to innovate, exporting activity, firm-efficiency and growth (Zoltan J. Acs and David Audretsch 1989; Wesley M. Cohen and

Steven Klepper 1996; Patrizio Pagano and Fabiano Schivardi 2003; Måns Söderbom and Francis Teal 2004; M. Angeles Diaz-Mayans and Rosario Sanchez 2008).

Given the indication that women entrepreneurs are more susceptible to difficulties in obtaining finance as well as inadequate business climate, we also control for a dummy variable equal to 1 if the firm reports access to finance as a major or a very severe obstacle and 0 if it reports the obstacle as no obstacle, minor or moderate obstacle (*Finance obstacle*); and a dummy variable equal to 1 if the firm was inspected by tax officials last year and 0 otherwise (*Inspected*).

The next firm-level control is a dummy variable equal to 1 if the firm is located in a large city and 0 otherwise (*Large city*). Following Enterprise Surveys, a large city is defined as either the capital city or a city with a population of over 1 million. In our sample, about 37 percent of the firms are located in large cities. As indicated in the conceptual model, city size may influence the likelihood of the presence of women manager in a firm.

Our last set of firm-level controls includes (log of) age of the firm (*Age*) and the proportion of a firm's annual sales that are exported (*Exports*). As we argued above, there could be a systematic difference in the likelihood of female top managers across countries depending on the age and export orientation of the firm. .

We also control for some important country-level variables as described in the conceptual model. We first control for (log of) GDP per capita, at constant 2000 US dollars (*Income*). We use average values of the variable over the period 2007 and 2009 taken from World Development Indicators (WDI), World Bank. The variable serves as a useful proxy measure for various aspects of economic development that could be correlated with both women managers and women's access to education.

It is natural to expect that *ceteris paribus*, countries with proportionately more women in the population to have proportionately more women in top management. At the same time, populations with more women could also reflect more favorable attitudes towards female children

and women and this in turn could be correlated with more favorable education enrollment for women. The omitted variable bias problem here is ruled out by our next control which is the (log of) the ratio of women to men in the country's population (*Women population*). We use values of the variable for the year covered by the survey. Data source is WDI.

Next, we consider institutional factors. For culture or social attitudes, we follow the literature and control for the proportion of population that is Catholic, Protestant, Muslim and Other religions. The omitted category in the regressions is Muslim population. We strengthen these controls by adding dummy variables for legal tradition of the country – English, French and Socialist (omitted category is Socialist). Data source is Rafael La Porta, Florencio Lopez-de Silanes, Andrei Shleifer and Robert Vishny 1999.

The last set of country-level controls includes two variables associated with the political structure of countries. These variables are the proportion of seats in lower house of the parliament that are held by women, *Women in Parliament*, taken from Inter Parliamentary Union (IPU) database for the year of the survey; and the rule of law measure from Worldwide Governance Indicators (Daniel Kauffman, Aart Kraay, and Massimo Mastruzzi 2010) for the year of the survey (*Rule of Law*). Justifications for the inclusions of these controls are provided in the conceptual framework.

4. Estimation Results

4.1 Base regression results

Regression results are provided in tables 2-4. These tables contain marginal effects or the change in the probability of a firm having a woman manager when the explanatory variable increases by 1 unit. Throughout, probability of having a top woman manager and the proportion of female top managers in the country will be used interchangeably.

Our baseline estimation results for *Enrollment_1986* are provided in Table 2. They reveal a large and positive relationship between education enrollment and the likelihood of female top managers, statistically significant at the 5 percent level. This holds irrespective of the set of controls used (columns 1-6), although the magnitude of the stated relationship does depend, to some extent, on the controls used. Briefly, without any other controls, a unit increase in the value of education enrollment is associated with 8.4 percentage point increase in the likelihood of top woman managers, significant at the 5 percent level (column 1). In other words, a one standard deviation increase in *Enrollment_1986* is associated with an increase in the proportion of female top managers by 2.8 percentage points; the corresponding increase when we move from the lowest (Chad) to the highest value (Dominica) of *Enrollment_1986* in our sample equals 16.8 percentage points. These are large changes given that the proportion of female top managers in our sample is less than 20 percent.

Table 2 shows that depending on the controls in place, the increase in the proportion of female top managers associated with a unit increase in *Enrollment_1986* ranges narrowly between 7.8 and 10.4 percentage points; it equals 10.3 percentage points with all the controls discussed above in place (column 6).

Regarding controls, some of our conjectures mentioned in the conceptual framework section are confirmed. The likelihood of female top managers decreases significantly (at 1 percent level) as firm-size increases. For the various specifications in Table 2, having a woman owner of the firm vs. no woman owner is associated with an increase in the proportion of female top managers by 29 percentage points; for firm's age, the increase ranges between 13.3 to 16.8 percentage points (depending on controls in place) when we move from the oldest to the youngest firm in our sample. In summary, the likelihood of female top managers is significantly higher (at 1 percent level) for smaller firms, firms that have one or more woman owners, firms with more women workers, and firms that are relatively younger (significant at 5 percent level). However,

macro-level variables for overall development (income level, rule of law), culture (legal origin, religions) and women's presence in parliament are only weakly correlated with the likelihood of female top managers. One reason for this could be that simultaneously controlling for a large number of macro and micro variables may make it difficult to isolate their individual effects on the dependent variable.⁸

4.2. Robustness

4.2.1. *Sample of countries with observations on primary, secondary and tertiary enrollment*

For the specifications in Table 2, restricting the sample to only those countries (maximum of 43 countries) for which data are available on all the three enrollment levels (primary, secondary and tertiary) does not change the qualitative nature of the results discussed above (not shown). That is, the change in the likelihood of female top managers associated with a unit increase in *Enrollment_1986* remains positive and significant (at the 5 level); the increase ranges between a low of 7.6 and 15 percentage points, and equals 14.5 percentage points with all the controls discussed above in place.

4.2.2. *Alternative lags for the education enrollment variable*

Next, we check for alternative lags using *Enrollment_1976*, *Enrollment_1981*, *Enrollment_1991* and *Enrollment_1996* in place of *Enrollment_1986* above. Regression results provided in Table 3 show that the findings discussed above for education enrollment continue to hold with all these alternative lags. This holds irrespective of the set of controls in place.⁹ In fact, with or without the

⁸ We also experimented by using women to men ratio of adult literacy rate (*Literacy rate*) in place of *Enrollment_1986*. Results using literacy rates are qualitatively similar to the ones discussed above for *Enrollment_1986*.

⁹ To conserve on space, results are shown in Table 3 with no controls and all the controls in place. Results for other specifications shown in Table 2 are qualitatively similar and available on request from the authors. The same holds for results in Table 4.

various controls, the positive relationship between education enrollment and the likelihood of female top managers is quantitatively higher with these alternative lags than what we found above for *Enrollment_1986*.

As for the base specification (Table 2), results for the various controls in Table 3 show that the dependent variable is negatively and significantly correlated (at 5 and 10 percent) with the age of the firm and firm-size; and positively and significantly correlated (at 1 percent) with *Woman owner* and *Women workers*. As above, other control variables show no consistent and significant relationship with the dependent variable, although in some specifications, *Inspected* and *Protestant* have significant coefficients.

4.2.3. *Small and medium firms vs. large firms*

Next, we worry how our results may differ for small and medium firms (SMEs) compared with the large firms. Regression results for the sample of SMEs (100 or fewer employees) are provided in columns 1-2 in Table 4 and in columns 3-4 for the large firms.¹⁰

For SMEs, we find a positive and significant (at 5 percent) relationship between education enrollment and the likelihood of female top managers. The estimated marginal effects are quantitatively large. For example, with all the controls discussed above in place, the marginal effect of education enrollment on women managers equals 12.3 percentage points (column 2). The estimate implies that moving from a country with the lowest to the highest value of education enrollment in our sample is associated with an increase in the proportion of female top managers for SMEs by 25 percentage points. This is a large increase given that only 21 percent of SMEs in the sample have a female top manager. In contrast, the relationship between education enrollment and the proportion of female top managers is small and statistically insignificant for the large firms;

¹⁰ The results are qualitatively similar if we use an interaction term in the regressions between *Enrollment_1986* and the dummy for small vs. large firms instead of splitting the sample for small and large firms.

in fact, it is actually negative (but insignificant at 10 percent) with all the controls discussed above in place (column 4).

4.2.4. *Distinguishing between tertiary education and primary and secondary education*

Next, we use different lags for tertiary vis-à-vis primary and secondary education enrollment or *Enrollment1*; and decompose the association of tertiary vs. primary and secondary education enrollment with the likelihood of female top managers.

Regression results for *Enrollment1* are provided in columns 5 and 6 of Table 4. These results are consistent with our findings above in that they show a positive, large and significant (at 1 percent) relationship between education enrollment and the likelihood of female top managers. For example, with all the controls in place, the marginal effect of *Enrollment1* is an increase of 19.9 percentage points in the proportion of female top managers (column 6); this is much higher than what we found above for the same specification for *Enrollment_1986* (column 6, Table 2).

Regression results for tertiary vs. primary and secondary education enrollment rates are provided in columns 7-9 of Table 4. These results show that irrespective of the set of controls, there is a large, positive and statistically significant (at the 1 percent) relationship between tertiary education enrollment and the likelihood of female top managers. The same for primary and secondary education enrollment is also positive but insignificant (at the 10 percent). Quantitatively, the marginal effect or the coefficient value of primary and secondary education enrollment is larger than for tertiary education enrollment without any other controls (column 7), but this difference is reversed when we control for industry fixed effects (column 8) and the other variables (column 9). Also, note that the coefficient value of primary and secondary enrollment is always much lower than the same for tertiary education in Table 4 when changes in these education enrollment variables are measured in terms of their standard deviation units.

Results for the various controls are roughly similar to what we found above. The likelihood of female top managers is positively correlated with having a woman owner (significant at 1 percent), proportion of women workers at the firm (significant at 10 percent for large firms and 1 percent otherwise); and negatively correlated with firm-size (significant at 1 percent in all cases except for large firms). Firm's age, formal training and religious affiliation also show significant (at 10 percent) correlations with the likelihood of female top managers but only in some of the specifications.

4.2.5 Interaction terms

As for SMEs vs. large firms, we experimented with how the relationship between *Enrollment_1986* and *Woman manager* may depend on other firm and country characteristics. To check for these possibilities, we estimated the relationship between *Enrollment_1986* and *Woman manager* separately by splitting the sample for the values taken by the following variables: *Woman owner*, *Formal training*, *English legal origin*, *French legal origin*, *Socialist legal origin*, *Large city*, *Inspected*, exporting vs. non-exporting firms, low-income and lower middle-income vs. the rest (based on WDI definition) and old vs. young firms (based on median age of 16 years in our sample). For the specifications in Table 2, the positive relationship between the likelihood of female top managers and *Enrollment_1986* was found to be noticeably stronger (more positive) for firms that provide formal training vs. the rest, have all male owners vs. the rest, located in small vs. large cities, and old compared with young firms. A similar result was obtained for most of the specifications including the one with all the controls in place for firms that are inspected and the relatively richer countries. While these findings are preliminary, they do suggest a rich potential for future research.

5. Conclusion

Using firm-level data for 73 developing countries, the paper finds that the likelihood of a female top manager in a firm is positively associated with more favorable education enrollment rates in primary, secondary and tertiary education for women relative to men. In addition, the empirical findings in this study have important policy implications as it helps policy makers identify factors that promote women in top positions at private firms. The results also add another dimension to the debate on how closing the gender gap in education can help reduce gender inequality in income levels and job opportunities. Gender disparity in top managerial positions is a relatively under researched area, especially for developing countries. The present paper takes one step towards filling this gap. Our results are interesting for another reason, in that they show a much stronger positive relationship between education enrollment and the likelihood of a female top manager among SMEs than large firms. Hence, our findings contribute to ongoing debate on the cost-benefit calculus of policies aimed at promoting SMEs. We hope that the present paper motivates more research in the area in the future.

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Table 1: Summary statistics and correlations						
	Mean	Standard deviation	Correlations			
			<i>Enrollment_1986</i>	<i>Enrollment 1</i>	<i>Tertiary_1992</i>	<i>Pri_Sec_1983</i>
<i>Woman manager</i>	0.19	0.40				
<i>Enrollment_1986</i>	1.00	0.33	1	0.96	0.86	0.92
<i>Enrollment_1981</i>	0.95	0.27	0.95	0.98	0.92	0.92
<i>Enrollment_1991</i>	0.97	0.21	0.94	0.97	0.90	0.90
<i>Enrollment_1996</i>	1.01	0.26	0.82	0.90	0.92	0.79
<i>Enrollment_1976</i>	0.90	0.28	0.92	0.94	0.89	0.84
<i>Enrollment 1 (various lags)</i>	0.95	0.23	0.96	1	0.94	0.93
<i>Tertiary_1992</i>	0.93	0.38	0.86	0.94	1	0.75
<i>Pri_Sec_1983</i>	0.94	0.19	0.92	0.93	0.75	1
<i>Woman owner</i>	0.40	0.49	-0.06	-0.06	-0.08	-0.02
<i>Women workers</i>	0.36	0.28	0.19	0.21	0.20	0.19
<i>Formal training</i>	0.34	0.47	-0.04	-0.03	-0.11	0.06
<i>Large city</i>	0.37	0.48	-0.34	-0.30	-0.30	-0.25
<i>Age (log values)</i>	2.62	0.83	0.13	0.09	0.03	0.12
<i>Exports</i>	0.12	0.27	0.00	0.02	0.00	0.04
<i>Firm size (log values)</i>	2.99	1.20	0.02	0.01	-0.01	0.03
<i>Women population (log values)</i>	0.03	0.04	0.25	0.32	0.32	0.31
<i>Income (log values)</i>	7.88	1.18	0.48	0.56	0.56	0.49
<i>Women in Parliament</i>	0.16	0.09	0.04	-0.04	-0.02	-0.08
<i>French legal origin</i>	0.40	0.49	-0.13	-0.12	-0.09	-0.17
<i>English legal origin</i>	0.41	0.49	0.05	0.06	0.00	0.13
<i>Catholic</i>	0.42	0.37	0.55	0.62	0.57	0.61
<i>Protestant</i>	0.15	0.17	0.28	0.19	0.22	0.07
<i>Other religions</i>	0.31	0.28	-0.40	-0.46	-0.47	-0.38
<i>Rule of Law</i>	-0.09	0.79	0.33	0.40	0.44	0.32
<i>Inspected</i>	0.55	0.50	0.01	0.01	0.03	-0.01
<i>Finance obstacle</i>	0.43	0.49	-0.02	-0.05	-0.04	-0.05

Table 2: Base regression results (Marginal effects)						
Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
<i>Woman manager</i>						
<i>Enrollment_1986</i>	0.084**	0.089**	0.078**	0.101**	0.104**	0.103**
	(0.012)	(0.011)	(0.025)	(0.017)	(0.022)	(0.022)
<i>Woman Owner</i>			0.292***	0.292***	0.292***	0.290***
			(0.000)	(0.000)	(0.000)	(0.000)
<i>Women workers</i>			0.247***	0.247***	0.247***	0.242***
			(0.000)	(0.000)	(0.000)	(0.000)
<i>Formal Training</i>			0.014	0.017	0.015	0.016
			(0.392)	(0.304)	(0.351)	(0.303)
<i>Large city</i>			0.023	0.022	0.024	0.023
			(0.176)	(0.205)	(0.235)	(0.271)
<i>Age (logs)</i>			-0.025**	-0.024*	-0.025**	-0.025**
			(0.044)	(0.055)	(0.040)	(0.042)
<i>Exports</i>			-0.013	-0.013	-0.017	-0.013
			(0.722)	(0.718)	(0.657)	(0.736)
<i>Firm size</i>			-0.041***	-0.042***	-0.042***	-0.041***
			(0.000)	(0.000)	(0.000)	(0.000)
<i>Women population</i>			-0.231	-0.256	-0.170	-0.187
			(0.268)	(0.259)	(0.478)	(0.445)
<i>Income (logs)</i>				-0.009	-0.011	-0.014
				(0.257)	(0.360)	(0.235)
<i>Women in Parliament</i>				-0.128	-0.135	-0.145*
				(0.133)	(0.112)	(0.087)
<i>French legal origin</i>					0.022	0.014
					(0.529)	(0.696)
<i>English legal origin</i>					0.019	0.012
					(0.581)	(0.731)
<i>Catholic</i>					0.039	0.043
					(0.308)	(0.253)
<i>Protestant</i>					0.099	0.104
					(0.270)	(0.230)
<i>Other religions</i>					0.064	0.058
					(0.161)	(0.208)
<i>Rule of Law</i>					-0.005	-0.005
					(0.775)	(0.797)
<i>Inspected</i>						-0.015
						(0.148)
<i>Finance obstacle</i>						0.004
						(0.681)
Industry fixed effects		Yes	Yes	Yes	Yes	Yes
Observations	16,343	16,343	13,820	13,706	13,619	13,282

p-values in brackets. Significance level is denoted by *** (1%), ** (5%) and * (10%). All regression use Huber-White robust standard errors clustered at the country level. Logit estimation is used.

Table 3: Robustness using alternative lag structures (Marginal effects)

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Woman manager</i>								
<i>Enrollment_1976</i>	0.115*** (0.001)	0.132*** (0.002)						
<i>Enrollment_1981</i>			0.095** (0.015)	0.143*** (0.007)				
<i>Enrollment_1991</i>					0.174*** (0.000)	0.165*** (0.002)		
<i>Enrollment_1996</i>							0.152*** (0.000)	0.104*** (0.001)
<i>Woman Owner</i>		0.300*** (0.000)		0.287*** (0.000)		0.294*** (0.000)		0.287*** (0.000)
<i>Women workers</i>		0.221*** (0.000)		0.221*** (0.000)		0.239*** (0.000)		0.249*** (0.000)
<i>Formal Training</i>		0.012 (0.437)		0.022 (0.132)		0.022 (0.169)		0.006 (0.649)
<i>Large city</i>		0.032 (0.181)		0.030 (0.152)		0.025 (0.239)		0.026 (0.233)
<i>Age (logs)</i>		-0.031** (0.017)		-0.022* (0.069)		-0.024** (0.045)		-0.013* (0.099)
<i>Exports</i>		-0.018 (0.686)		0.019 (0.372)		-0.013 (0.736)		-0.017 (0.666)
<i>Firm size</i>		-0.037*** (0.000)		-0.045*** (0.000)		-0.042*** (0.000)		-0.040*** (0.000)
<i>Women population</i>		-0.271 (0.421)		-0.200 (0.419)		-0.149 (0.510)		-0.143 (0.545)
<i>Income (logs)</i>		-0.014 (0.290)		-0.019 (0.105)		-0.010 (0.348)		-0.014 (0.147)
<i>Women in Parliament</i>		-0.047 (0.626)		-0.034 (0.728)		-0.120 (0.156)		-0.104 (0.239)
<i>French legal origin</i>		0.009 (0.842)		0.030 (0.417)		0.023 (0.507)		0.001 (0.973)
<i>English legal origin</i>		0.011 (0.792)		0.011 (0.751)		0.022 (0.517)		0.004 (0.887)
<i>Catholic</i>		-0.004 (0.935)		0.018 (0.636)		0.026 (0.479)		0.052 (0.149)
<i>Protestant</i>		0.058 (0.538)		0.124 (0.112)		0.124* (0.089)		0.141* (0.061)
<i>Other religions</i>		0.015 (0.824)		0.055 (0.229)		0.054 (0.190)		0.048 (0.256)
<i>Rule of Law</i>		0.001 (0.963)		0.004 (0.845)		-0.013 (0.425)		-0.017 (0.260)
<i>Inspected</i>		-0.029*** (0.006)		-0.016 (0.132)		-0.016 (0.122)		-0.010 (0.327)
<i>Finance obstacle</i>		0.007 (0.532)		0.007 (0.473)		0.008 (0.452)		0.002 (0.838)
Industry fixed effects		Yes		Yes		Yes		Yes
Observations	14,551	12,051	16,147	13,093	16,199	13,153	15,904	13,066

See the note at the bottom of Table 2.

Table 4: Other results (Marginal effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	SME	SME	Large	Large					
Dependent variable: <i>Woman manager</i>									
<i>Enrollment1</i>					0.169*** (0.000)	0.199*** (0.000)			
<i>Tertiary_1992</i>							0.063* (0.099)	0.092*** (0.005)	0.132*** (0.000)
<i>Pri_Sec_1983</i>							0.080 (0.330)	0.073 (0.357)	0.007 (0.913)
<i>Enrollment_1986</i>	0.083** (0.023)	0.123** (0.021)	0.036 (0.265)	-0.031 (0.402)					
<i>Woman Owner</i>		0.316*** (0.000)		0.100*** (0.000)		0.283*** (0.000)			0.281*** (0.000)
<i>Women workers</i>		0.273*** (0.000)		0.054* (0.064)		0.216*** (0.000)			0.220*** (0.000)
<i>Formal Training</i>		0.025 (0.158)		-0.025 (0.305)		0.024* (0.088)			0.045** (0.011)
<i>Large city</i>		0.033 (0.198)		-0.007 (0.568)		0.032 (0.110)			0.007 (0.718)
<i>Age (logs)</i>		-0.027* (0.071)		-0.015* (0.056)		-0.021* (0.068)			-0.022 (0.245)
<i>Exports</i>		-0.022 (0.657)		0.003 (0.904)		0.018 (0.405)			0.022 (0.434)
<i>Firm size</i>		-0.043*** (0.000)		0.002 (0.813)		-0.047*** (0.000)			-0.056*** (0.000)
<i>Women population</i>		-0.251 (0.360)		0.001 (0.998)		-0.195 (0.368)			-0.074 (0.847)
<i>Income (logs)</i>		-0.020 (0.163)		0.011 (0.163)		-0.022** (0.043)			-0.023** (0.024)
<i>Women in Parliament</i>		-0.173* (0.075)		0.045 (0.453)		-0.057 (0.519)			0.051 (0.657)
<i>French legal origin</i>		0.019 (0.645)		-0.034 (0.109)		0.046 (0.154)			0.065 (0.190)
<i>English legal origin</i>		0.021 (0.605)		-0.031 (0.112)		0.027 (0.410)			0.030 (0.540)
<i>Catholic</i>		0.039 (0.407)		0.051* (0.078)		-0.004 (0.897)			-0.017 (0.674)
<i>Protestant</i>		0.113 (0.275)		0.044 (0.496)		0.111 (0.124)			0.050 (0.460)
<i>Other religions</i>		0.050 (0.378)		0.063** (0.025)		0.044 (0.255)			0.020 (0.592)
<i>Rule of Law</i>		-0.001 (0.954)		-0.009 (0.550)		0.007 (0.682)			0.013 (0.560)
<i>Inspected</i>		-0.017 (0.124)		0.003 (0.854)		-0.015 (0.156)			-0.003 (0.775)
<i>Finance obstacle</i>		0.002 (0.857)		0.011 (0.491)		0.006 (0.548)			-0.014 (0.225)
Industry fixed effects	Yes	Yes	Yes	Yes		Yes		Yes	Yes
Observations	11,425	9,289	4,468	3,579	16,066	13,042	10,397	10,391	8,215

See the note at the bottom of Table 2.