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Organization-Level Drivers for Gender Diversity in Management: Empirical Evidence from BRICS Nations

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Abstract: This paper examines the firm-level determinants of the percentage of managers who are women, using data from Brazil, Russia, India, China, and South Africa (BRICS). Using unbalanced panel data for 437 firms in BRICS nations from 2012-2018, I study the effect of a firm's industry, size, age, and its percentage of female directors and employees on its share of female managers, while controlling for firm profitability, financial risk, and state ownership. The results show firms in the financial and consumer discretionary sectors have the highest proportion of women in management, while those in the energy, utilities, and materials sectors have the lowest shares. The results also indicate that for all but the smallest firms, increases in firm size are associated with a decrease in the share of female managers. They suggest a positive correlation between the share of female employees and managers, though the directionality of this relationship is not wholly confined by the data. Finally, the results reveal that the effect of having at least one woman on the board of directors on the share of female managers depends on firm age and potentially size.

Introduction

For decades, the low representation of women in corporate management has been confronted by researchers, policymakers, and investors. Research found countless benefits of female management, including diversity of ideas and stronger communication (Milliken and Martins, 1995), novel leadership styles (Rosener, 1990), decreased firm risk (Carter et al. 2003), and in certain situations, overall increased firm value (Davidson & Burke, 2000). Policymakers in nations such as France, Norway, and Iceland have mandated female representation on boards of directors, and the UK and Canada have moved closer to such legislation (Saeed et al. 2016). Finally, investors have shown an increased interest in supporting female-led companies (La Roche,

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2018). But despite this, the glass ceiling has remained largely intact — women still hold only a quarter of top management positions globally (Pinsker, 2014). Given this mounting pressure for gender diversity and only marginal progress, the question follows: What leads to higher levels of female representation in management?

This question has been an area of growing research in recent years, and has revealed a number of firm-level characteristics that affect the share of women in top management. For example, research show the share of women on the board of directors is affected by industry (Harrigan, 1981; Reibey Institute 2011), firm size (Bertrand and Hallock, 2001; Hillman, 2007), firm-level financial risk (Setiyono and Tarazi, 2014), and organizational age (Kelly & Amburgey 1991, Pfeffer & Salancik 1978). While these studies made important inroads to understanding the determinants of the glass ceiling in many respects, empirical investigations to date have been confined in two significant ways.

First, the vast majority of studies on the determinants of the glass ceiling focus exclusively on data from developed nations (Saeed et al., 2016; de Jonge, 2014). This skewed emphasis presents an important gap in research as roughly 82% of women live in nations outside the purview of these studies (OECD Data). Moreover, research indicates that there may be significant issues in extrapolating from findings in developed countries to developing countries with respect to gender diversity. Indeed, developing nations may have less efficient markets, weaker rule of law, lower political involvement, and more scarce human capital — all of which have the potential to affect the determinants of gender diversity in corporate management (Saeed and Athreye, 2014; Wei and Varela, 2003). Thus, further research is needed on the determinants of corporate gender diversity in emerging markets.

Second, most studies on this topic in the developed world and, to the best of this author's knowledge, all studies on this topic in the developing world focus on a single metric of the glass ceiling: the representation of women on boards of directors. While directorships are often seen as a final frontier for the glass ceiling, they represent only a small fraction of all managerial positions to which women aspire. Understanding what drives female representation at all levels of management for firms in the developing world thus remains an important and unanswered question.

This study seeks to help close these two research gaps by answering the question: For companies in Brazil, Russia, India, China, and South Africa (BRICS), what firm-level factors affect the percentage of all managers who are female? More specifically, I seek to understand how a firm's industry, its share of female employees and directors, its age, and its size all affect the proportion of managers that are women. This central research question is examined using unbalanced panel data for 437 firms across BRICS nations from 2012-2018.

The results show that industry, firm size, and the share of female employees and directors are all directly correlated with the share of female managers. In particular, firms in the financial and consumer discretionary sectors have the highest share of female managers, while those in the energy, utilities, and materials sectors have the lowest shares. For most firms, size is negatively correlated with gender diversity. Finally, while the share of female employees has a positive effect on the share of female managers, the effect of female directors depends on a firm's age and potentially its size. These findings have important implications for policy and research. Most centrally they contribute to an understanding of the determinants of a largely novel, and broader metric of the glass ceiling using data from countries that are typically left out of research on women's corporate advancement.

Literature Review

An extensive amount of literature has centered on female representation in corporate management. An important part of this research has been exploring the effect of female corporate leadership — whether it be gender diversity in CEOs, boards of directors, or middle management — on various metrics of firm performance. Though slow to arrive, studies have broadly come to a consensus that female management leads to higher firm value, lower financial and operational risk, and generally improves corporate governance (Carter et al. 2003, Adams & Ferreira 2009, Davidson 2000, Agrawal 2001). This evidence that female managers lead to greater firm success, along with broader ethical motivations, has more recently led researchers to study what factors can increase the share of female managers. This paper focuses on this latter question, and seeks to understand how we can achieve a higher proportion of women in management.

Broadly speaking, research on this topic falls along two categories: individual and organizational drivers of female advancement (Terjesen & Singh 2008). Studies at the individual level aim to understand how factors which differ from person to person (e.g. education, work experience) affect rates of promotion, and the degree to which these factors vary between men and women. As examples, Westphal & Milton (2000) studied the ways in which the strength of a female executive's professional network affects her probability of being appointed to a Fortune 500 board of directors (BODs); Burgess & Tharenou 2002, Hillman 2002, and Kesner 1988 examine the effect of education and work experience on appointment to BOD's in US companies; finally, Chênevert & Tremblay's (1998) paper looks at the explanatory power of human capital, socioeconomic origin, family context, and individual motivations for the career success of male and female Canadian managers, and concludes individual factors do "not fully explain the male-female differential in the levels of career success observed"

(26). This finding from Chênevert & Tremblay (1998) points towards a broader limitation of individual-level studies, which is while they may be able to suggest behaviors and characteristics that allow particular women to ascend the corporate ladder, they do not explain the broader picture of why certain firms have stronger gender diversity than others.

To answer this question, one must turn to the area that constitutes the focus of this paper: organizational determinants of gender diversity in corporate leadership. This area has been a subject of more limited research, and has focused almost entirely on determinants for female representation on the board of directors of firms in developed nations (Saeed et al., 2017). Hillman et al (2007) and Hyland (2002) look at organizational determinants of gender diversity on the board of directors for US firms, Cook (2014) completes a similar analysis but for Fortune 500 firms, Mateos de Cabo et al. (2012) does so for firms in the EU, Singh et al (2001) and Brammer et al (2009) analyze this question for UK firms, and Lucas-Perez et al. (2014) focus on Spanish firms. Compared to this wealth of research on firms in developed countries, there has been a dearth of equivalent studies using data on firms in developing markets. Emerging markets have significantly different corporate, political, and economic structures which may make it difficult to generalize from findings on determinants of gender diversity in developed countries to those in developing nations (de Jonge, 2014; Terjesen and Singh 2008). To the best of this author's knowledge, there are only three exceptions to this lack of research on organizational determinants in developing nations. First, Du (2014) studies the impact of Confucianism on board gender diversity amongst Chinese firms, controlling for time and regional fixed effects. Second, de Jonge (2014) examines firms in India and China, and finds that organizational size and industry have a significant effect on female representation on boards of directors. Finally, Saeed et al (2016) finds that board gender diversity is positively related to firm size and state ownership, but inversely related to risk for firms in BRICS countries.

Given the background, this paper makes three primary contributions to existing literature. First, and most significantly, it uses a metric of the glass ceiling that is broader than the conventional focus on boards of directors, and heretofore unexplored in research. Most research in developed countries, and all research in emerging countries has focused exclusively on determinants of female representation on firms' BOD. While female directors are an influential group in firms, they represent only a small fraction of all women in management at these firms. This paper instead focuses on ascertaining the determinants for the share of female managers at all levels of the corporate structure.

Second, a major contribution of this research is purely descriptive. Unlike past literature on drivers of gender diversity in emerging economies, this paper uses a dataset which includes not only information on the share of female managers, but also

on the share of female employees and directors. This enables rare analysis on how various metrics of corporate gender diversity vary across countries, time, and sector.

Finally, I add to the very limited research on organization determinants of female corporate advancement in emerging economies, as this will be only the second paper to have analyzed this question using data across all five BRICS nations, after Saeed et al. It is also worth noting that by studying panel data from 2012-2018, this paper updates the findings of Saeed et al. 2016, which used older panel data from 2005-2012.

In terms of methodology, this paper follows closely to the approaches established by studies in both the developing and developed world that focus on determinants of the glass ceiling. Following Saeed et al. (2016), De Jonge (2014), and McCormick Hyland (2002) I perform fixed and random effects regressions using unbalanced panel data on 437 firms. Improving on the methodology of Saeed et al. (2016), I control not only for time fixed effects, but also sector and country level fixed effects. Additionally, I use a series of controls that have been established by eight separate papers (described in the Data & Methodology section). These controls and fixed effects enable effective isolation of the relationship between the dependent variable (proportion of women in management) and the series of independent variables described below.

Hypothesis Development

Industry

A review of the relevant empirical literature shows industry sector has a strong relationship with measures of corporate gender equality. Studies of firms in the US (US GAO 2010, Harrigan 1981), Australian (Reibey Institute 2011) and Forbes 500 (Forbes Insights 2012) find that finance, healthcare, and consumer discretionary sectors have, on average, a more proportionate share of female to male directors. In an emerging market context, de Jonge (2014) finds support for her hypothesis that in India and China, firms in the "financial services, consumer discretionary and healthcare sectors had a higher mean proportion of women directors than firms from other industry sectors." Given that papers in the developed and developing world find greater gender equity on the boards of directors for financial, consumer discretionary, and healthcare sectors, this paper hypothesizes that these sectors will also perform above average for an alternative measure of gender diversity — the proportion of female managers.

> Hypothesis 1: Firms in financial, consumer discretionary, and healthcare sectors will have a higher rate of female participation in management than the average across all industries.

Female Employees

Perhaps surprisingly, the relationship between the share of female employees and the share of female managers has been a subject of some debate in recent literature. On one hand, Burke (1997) argues that promotion to higher levels depends on the pool of candidates. From this, it follows that the larger the share of female employees, the larger the pool of female candidates for promotion, and the greater the share of female managers. However, Bilimoria (2006) contends that the structural barriers to women's promotion, as well as quota systems for diversity hiring may be influential enough that even a larger pool of female candidates does not translate into a greater share of women in upper management. In order to contribute to the arbitration between these contesting positions, this paper tests the following hypothesis:

> Hypothesis 2: The share of female employees will be positively correlated with share of female managers.

Firm Size

The relationship between firm size and women in management has been a focus of much debate in recent literature. On the one hand, a study of US executives found that firms which employed a higher number of women in management positions were, on average, 35-40% smaller than the broader sample size (Bertrand and Hallock, 2001). This result was constant irrespective of whether size was measured by workforce size, sales, or assets. The paper theorizes this is because smaller firms have fewer low-level jobs to which women could be "relegated." On the other hand, two studies of firms in developed and emerging economies found a positive correlation between organizational size and female representation on boards of directors. In a developed context, Hillman's (2007) study of 1,000 US firms finds that "the proportion of women on the board of a company was positively correlated with" the company's market capitalization. This confirms DiMaggio and Powell's (1985) theory, which argues that larger firms face more societal pressure to conform to expectations of gender diversity on boards. In a developing context, De Jonge's (2014) study of firms in India and China analyzes the relationship between market capitalization and female directors and finds a statistically significant positive correlation. In testing an alternative metric of the glass ceiling for all BRICS nations, this paper thus extends these findings from Hillman (2007), DiMaggio and Powell (1985), and De Jonge (2014) to predict the following hypothesis:

> Hypothesis 3: Female participation in management will be positively correlated with market capitalization.

Organizational age

A number of theoretical and empirical papers suggest that the strength of an organization's glass ceiling may be, in part, a result of its age (measured by years since incorporation). In terms of theory, the concept of structural inertia predicts that older organizations will be more reticent to alter core aspects of their business practice, such as management style and hiring and promoting practices — factors which are likely to affect corporate gender diversity (Kelly & Amburgey 1991, Pfeffer & Salancik 1978). At a more individual level, managers in older organizations are also likely to have profited from existing corporate structures, and so have a vested interest in maintaining those structures (Kelly & Amburgey, 1991). Empirical research on firms in developed nations appears to confirm this theory — Baron, Mittman, and Newman (1991) found that older organizations promoted fewer women into management, and Blum et al. (1994) shows a negative relationship between firm age and the number of women in management. This paper thus tests whether or not this relationship holds true in the context of emerging markets.

> Hypothesis 4: The age of an organization will be negatively correlated with female participation in management.

Female Directors

Though a significant amount of research and effort has focused on getting women into top corporate leadership positions, especially the board of directors, it remains unclear whether or not advances for women at the top translate downwards to help women in lower management positions. Indeed Smith (2000) describes what she labels the "Queen Bee Syndrome" — "that older women in powerful positions may resent their younger colleagues and sometimes deliberately hold them back" (Terjesen and Singh, 2008). It may also be that firms with higher female representation on the board are more complacent with regards to gender diversity at lower levels of management. Terjesen and Singh (2008) find some empirical support for these positions, in that countries with a longer history of women in politics are less likely to have women on corporate boards of directors. Following a convention established by De Jonge (2014), Hillman (2007), Sealy et al. (2009), Cooke & Saini (2010), this paper studies women's representation in the boardroom through a binary variable that takes one if there is at least one woman on the board of directors and zero otherwise. This binarization is a result of the fact that many countries and firms have quota systems that mandate at least one woman on the board of directors, which leads to a wealth of firms with at least one woman on the board, but a paucity of variation beyond this (De Jonge, 2014). In order to explore the relationship between the presence of at least one woman on

the board and the share of women in management, this paper posits the following hypothesis:

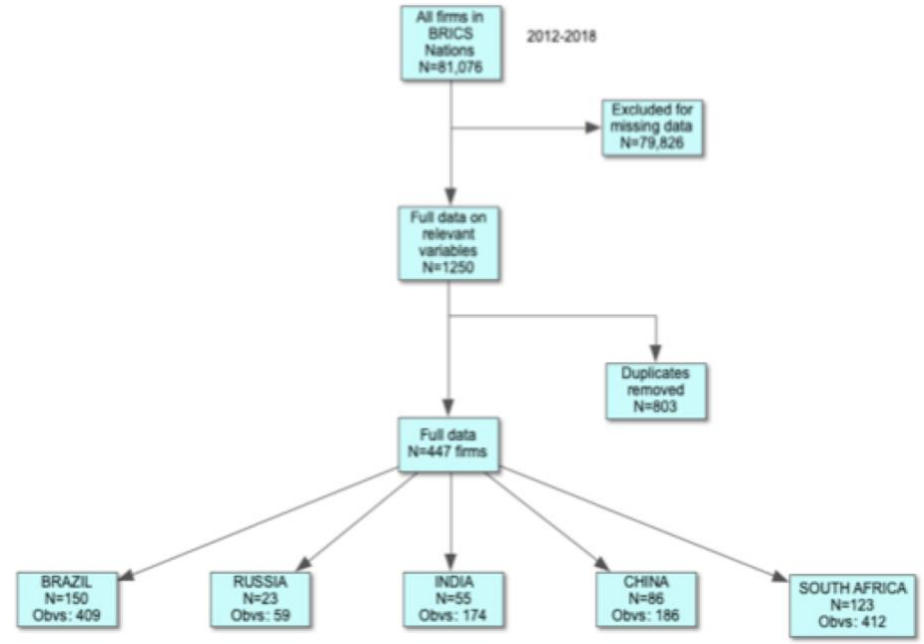
> Hypothesis 5: The presence of at least one woman on the board of directors will be negatively correlated with the share of female managers

Data & Methodology

Data Collection

Information on firm characteristics and metrics of corporate gender diversity were compiled from Bloomberg Ltd. In the few cases where additional data was needed, namely on organizational age, it was retrieved from the firm's website. The data selection procedure was as follows: I began with a list of all publicly and privately traded companies in BRICS nations in a given year. From this, any firms which lacked annual data on the share of female managers or any of the independent variables were excluded. This process was repeated for annual data from 2012-2018. After initial data collection, companies which had duplicate data were excluded. This resulted in unbalanced panel data from 2012-2018 for a total of 437 unique firms; 150 in Brazil, 55 in India, 86 in China, 23 in Russia, and 123 in South Africa. Across six years, this leads to a total of 1,240 observations; 409 in Brazil, 59 in Russia, 174 in India, 186 in China, and 412 in South Africa.

Figure 1
Methodology for data selection



Model & Variable Definition

To test the hypotheses of this paper, the following regression is estimated

$$\text{Female Managers} = f(\text{Female Employees, Female Director, Firm Size, Age, Female Director} \times \text{Age, Female Director} \times \text{Market Capitalization, Controls, Errors})$$

The dependent variable, Female Managers, is determined by number of female managers divided by the total number of managers for a firm in a given year. Regarding the explanatory variables, Female Employees is measured by the number of female employees divided by the total number of employees at the company. Following De Jonge (2014), female directors is listed as a continuous variable in descriptive statistics, but for multivariate analysis it is transformed into a binary variable that takes one if there is at least one woman on the board of directors and zero otherwise. This binarization follows from the fact that many firms and nations have a quota system for corporate gender diversity that mandates there be at least one woman on the board (De Jonge, 2014). Firm size is determined by the natural logarithm of market

capitalization; the natural logarithm is used in order to make the coefficients more easily interpretable, and to facilitate comparison across a wide variety of firms. Graphical analysis suggests that firm size may be related to female managers exponentially, and so the square of the natural logarithm of market capitalization is also tested. Finally, age is measured by the number of years since the firm was incorporated.

Two interaction terms are included based on graphical analysis and previous literature. More specifically, the presence of a female director on the board is interacted with age and market capitalization. These interaction terms are primarily inspired by Mateos de Cabo et al. (2012), which finds that both age and firm size are correlated with the presence of a woman on the board of directors. The authors speculate that size and age may affect broader metrics of gender diversity, specifically through their effect on female directorships. Based on this, I speculated the relationship between the share of female managers and female directors may be affected by these factors. Graphical analysis of the data used in this paper supported this speculation, as margins plots showed both variables had an effect on the relationship. For these reasons, both interaction terms were included in some of the regressions.

In the core regression, this paper uses random effects to control for year, firm, country and sector fixed effects. In line with the methodology of de Jonge (2014), industry is coded for by the Global Industry Classification Standard (GICS), which classifies firms by ten industry sectors, 24 industry groups, 68 industries, and 154 sub-industries. Given the limited number of total companies in the sample, this study used only the eleven industry sectors. In addition to these controls, three firm-specific, time-variant controls are used in this paper. First, profitability is controlled for via the firm's free cash flow and return on assets, as it has been shown to correlate with a firm's gender diversity (Lucas-Perez et al., 2014). Free cash flow is re-scaled by dividing it by the market capitalization, in order to develop a metric more comparable across different firms. Second, in line with Mateos de Cabo et al. (2012), Hillman (2007), and Setiyono & Tarazi (2014), firm-level financial risk is also controlled for via the debt-to-assets ratio as it is often associated with gender diversity. Finally, a number of studies have found a correlation between the degree of state ownership over a firm, and that firm's representation of women in upper management (Marquis & Qian, 2013, Sealy et al. 2009, Cooke & Saini, 2010). This paper thus controls for state ownership, which is measured by the percentage of shares that are owned by the government.

In all regressions, four models were used to understand the interrelations of the groups of variables (i.e. variables of interest, controls, interaction terms). In the first model, the dependent variable was regressed only on the independent variables of interest. In model two, it was regressed on the variables of interest as well as the controls. In the third model, it was regressed on the variables of interest and the interaction terms.

Finally, in the fourth model it was regressed on the variables of interest, controls, interaction terms. The discrepancies and consistencies across these regressions are discussed in the Results section below.

Robustness Tests

Several robustness tests were run in order to check the validity of the results found in the core random effects regression. First, the correlation matrix in Table 1 shows there are no extreme correlations between the independent variables used, indicating that multicollinearity is likely not a concern in this paper. Second, in addition to the random effects regression, three other regressions were run. The results from these alternate regressions are shown in **Table X** and their implications are discussed in the Results section.

First, due to inconsistent results for the Hausman specification test across the four models, a fixed effects regression was also run. All results are consistent with those found in the random effects regression, save for the fact that age has a statistically significant effect on female managers for models three and four in the fixed effects regression but does not have a statistically significant effect for the random effects regression.

Second, following Ahern and Dittmar (2012) and Martín-Ugedo and Minguez-Vera (2014), I test the robustness of my results to an alternative measure of the proportion of women. Specifically, I create a dummy variable that takes one if the share of female managers is above the average for the sample, and zero if it is below the average. Since this dummy variable is the dependent variable, I run a logistic regression. The results in this regression vary more significantly from those in the fixed and random effects models, and these inconsistencies are discussed in the Results section below.

Finally, a concern was that the independent variables and the share of female managers are jointly determined. For example, just as the share of female employees may affect the share of female managers, it may be that the share of female managers affects the share of female employees. This could contribute to an issue of endogeneity. In order to control for this endogeneity bias, I follow Saeed et al. (2016) and Arellano and Bond (1991) and use the first-difference generalized method of moments estimator (GMM). In this method, each independent variable is instrumented with its one-year lag. This estimator is suited to the data first because it is a panel set with relatively low number of years (under 20 years) and a fairly large set of individual firms (over 400) and second because the GMM enables autocorrelation and heteroskedacity within firms, both of which are present in this sample.

Table 1
Basic descriptive statistics and correlation matrix

Correlation Matrix	Observations	Mean	S.d.	min	max	Female Managers	Female Employees	Female Directors	Market Capitalization (Logarithm)	(Market capitalization)^2 (Logarithm)	Age	Free cash flow / Market Capitalization	Debt to Assets Ratio	State Ownership	Return on Assets
Female Managers	1240	19.5807	12.24069	0	80	1.0000									
Female Employees	1240	32.72512	19.64573	0.38	86	0.5345*	1.0000								
Female Directors	1240	11.85459	12.01447	0	100	0.0781*	0.1694*	1.0000							
Market Capitalization (Logarithm)	1240	21.903	1.792378	15.92114	28.40034	-0.0660*	0.1316*	-0.0029	1.0000						
(Market capitalization)^2 (Logarithm)		482.9516	78.78321	253.4827	806.5792	-0.0682*	0.1299*	-0.0055	0.9983*	1.0000					
Age	1240	38.375	23.99863	3	127	0.0278	-0.0944*	0.2276*	-0.0215	-0.0197	1.0000				
Free cash flow / Market Capitalization	1240	.0603771	.3614579	-1.606262	3.602711	0.0965*	0.1142*	-0.0553	0.0396	0.0382	0.0296	1.0000			
Debt to Assets Ratio	1240	24.65206	17.62917	0	80.2076	-0.0816*	-0.0924*	-0.1697*	-0.0101	-0.0122	-0.1505*	-0.0533	1.0000		
State Ownership	1240	10.74332	24.44608	0	100	-0.0242	-0.1062*	-0.0697*	0.0658*	0.0666*	-0.0417	0.0257	0.0810*	1.0000	
Return on Assets	1240	5.216421	8.72648	-42.49976	50.36546	0.0687*	0.1552*	0.0763*	0.1648*	0.1566*	0.0389	0.0599*	-0.3621*	-0.0376	1.0000

Results

Descriptive analysis

Table 1 presents the basic descriptive statistics for all variables used in this paper. The descriptive statistics indicate the dataset used paper is largely in line with that of previous studies, namely with respect to female directors, state ownership, ROA, and firm age. First, on female directors, Saeed et al (2016) finds that on average 8% of directors in BRIC nations are female. Saeed's value is slightly lower than the 11% that this paper reports, but the difference may be explained by the fact that this paper includes data on South Africa, which has much stronger female corporate representation than other BRICS nations. Second, on state ownership, De Jonge's (2014) dataset has an average state ownership of 11.8%, which is roughly equivalent to the 10.7% captured here. Third, the ROA in Saeed et al's (2016) study was 4.78, to which mine is roughly similar at 5.21. The marginally increased ROA may be a result of the fact that Saeed's time scale included the Great Recession, whereas this paper examines data during a growth period (2012-2018). Finally, with an average firm age

of 38, this dataset skews slightly older than the firms in Saeed et al's (2016) study, which are on average 26 years old.

Table 2
Variation in metrics of the glass ceiling by country

Country	N	Female Employees	Female Managers	Female Directors
Brazil	409	30.30	21.25	6.55
		(17.09)	(10.45)	(11.63)
Russia	59	35.82	18.77	8.40
		(16.90)	(8.65)	(8.54)
India	174	14.39	5.21	10.13
		(12.42)	(4.47)	(8.85)
China	186	36.89	19.70	8.62
		(12.85)	(10.20)	(9.11)
South Africa	412	40.55	24.05	19.80
		(21.80)	(12.93)	(11.01)

Standard deviations in parentheses

Table 2 presents the sample size and average proportion of female employees, managers, and directors for each of the BRICS nations. In terms of range, there is a fairly significant spread between emerging economies for all three metrics; there is a 26 percentage point range for employment, 18 point range for management, and a 13 point range for directorships. This may provide broader support for Terjesen and Singh's (2008) finding country-level factors predict gender diversity in the boardroom, as it extends the influence of national factors beyond directorships and into gender diversity in employment and management. At a national level, South Africa is the clear leader in the group, and performs best on all three metrics. India presents an interesting case as it performs worst of the five nations for gender diversity in employment and management, but is the second best for directorships. This is likely because in 2003 India passed a law mandating a one-woman quota for board of directors (Oxford Human Rights Hub). This indicates some efficacy of the law in bringing India up to par with other emerging economies but, as will be developed later,

also suggests that gender equity in the board room may not always translate downwards to improve the share of female employees or managers.

Table 3
Variation in metrics of the glass ceiling by year

Years:	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Female Employees	31.83362	33.28637	33.09868	32.30606	31.64141	34.15623	33.57177
	(19.91)	(20.78)	(20.86)	(19.70)	(19.07)	(18.50)	(17.24)
Female Managers	20.11716	19.71168	19.30029	19.45491	19.02134	19.96167	19.52947
	(12.75)	(11.29)	(12.72)	(12.88)	(11.57)	(12.22)	(12.35)
Female Directors	10.3145	10.32819	10.90417	11.81308	12.58588	13.50288	16.14436
	(10.69)	(11.43)	(9.87)	(10.26)	(14.82)	(14.02)	(12.06)

Standard deviations in parentheses

Table 3 presents the annual performance of gender diversity for the sample firms over from 2012-2018. The table reveals a 56% increase in female representation in the board room over the time period studied. This represents a significant advance, but improvements in the other two metrics have been more modest. Over the past seven years, the percentage of female employees has increased by only 5% and female representation in management has decreased by 2%. This may indicate that more effort needs to be focused on improvements in women's equality at lower levels of the corporate ladder.

Table 4
Variation in metrics of the glass ceiling by sector

Sector	N	Female Employees	Female Managers	Female Directors
Energy	63	17.63	14.00	9.40
		(10.82)	(9.25)	(7.60)
Materials	285	14.43	12.78	12.38
		(8.78)	(8.32)	(12.69)
Industrials	128	34.04	16.58	9.32
		(15.15)	(8.49)	(12.19)
Consumer discretionary	145	49.22	31.39	12.91
		(20.23)	(15.79)	(14.56)
Consumer staples	90	44.51	21.61	19.27
		(14.85)	(9.01)	(13.67)
Health care	11	66.51	14.03	13.23
		(22.41)	(4.81)	(13.14)
Financials	208	49.47	25.97	14.28
		(15.51)	(12.05)	(9.27)
Information technology	77	32.74	11.53	11.19
		(5.29)	(6.14)	(10.20)
Communication services	49	42.63	15.11	11.58
		(8.43)	(10.67)	(10.14)
Utilities	156	19.06	20.99	6.04
		(7.44)	(7.70)	(10.21)
Real estate	28	44.64	24.22	10.49
		(8.17)	(17.17)	(8.53)

Standard deviations in parentheses

Table 4 provides the averages for female representation in employees, management, and directors across the 11 GICS sectors. The findings from the table do not disprove Hypothesis 1: that financial, consumer discretionary, and healthcare sectors will have a higher average percentage of female managers than other industries. For the financial and consumer discretionary sectors, the share of women in management is statistically significantly ($p<.0001$) greater than the average across all sectors. However, for the healthcare sector the share of women in management is statistically significantly lower than the universal average ($p<.05$); though it should be noted that the dataset only includes 11 observations for firms in the healthcare sector. Due to this small sample size, it is not possible to conclude that the findings are representative of the broader sector. Hypothesis one is thus confirmed for financial and consumer discretionary sectors, but neither proven nor disproven for the healthcare sector. This finding partially confirms and extends those of Harrigan (1981), the Reibey Institute (2011), Forbes Insights (2012), and De Jonge (2014) — all of which describe these three

industries as especially progressive in terms of gender diversity in the boardroom — to a novel metric of the glass ceiling.

It is also worth noting the nature of the range of gender diversity across sectors. At the base of the corporate pyramid, there is significant variation across sectors, but as one moves up in the pyramid that sector variation disappears. At the employee level the range is 52.07, at the managerial level the range is 19.8, and at the director level the range is 13.2. This finding suggests a speculative refinement of Grosvold's (2011) finding that "industries develop distinct cultural and cognitive characteristics that may influence a number of firm behaviors" including those regarding gender diversity (537). While industry-specific gender characteristics are clearly present at the lower levels of the corporate pyramid, they are more limited at higher levels. This may indicate that industry culture has greater explanatory power for gender diversity at the employment level than at the managerial and directorship levels.

Table 5

Core random effects regression

	Model	(1)	(2)	(3)	(4)
Variables of Interest	Female employees	0.257***	0.259***	0.250***	0.252***
		(7.70)	(7.75)	(7.51)	(7.55)
	Female Directors (binary)	-0.0101	-0.285	-17.36**	-17.53**
		(-0.48)	(-0.56)	(-3.24)	(-3.26)
	Market Capitalization (Logarithm)	6.884*	6.959*	6.929*	7.006*
		(2.45)	(2.48)	(2.48)	(2.51)
	(Market Capitalization)^2 (Logarithm)	-0.177**	-0.180**	-0.185**	-0.189**
		(-2.75)	(-2.80)	(-2.89)	(-2.94)
	Age	-0.0366	-0.0313	-0.0552	-0.0508
		(-0.60)	(-0.51)	(-0.90)	(-0.83)
Controls	Free cash flow / Market Capitalization		0.217		0.218
			(0.50)		(0.51)
	Debt to Assets Ratio		-0.0239		-0.0221
			(-1.23)		(-1.14)
	State Ownership		0.0137		0.0158
			(0.78)		(0.90)
	Return on assets		0.0152		0.00945
			(0.53)		(0.33)
	Year, Firm, Country, and Sector fixed effects:	Yes	Yes	Yes	Yes
Interaction Terms	Female Directors ## Age			0.652**	0.667**
				(2.66)	(2.71)
	Female Directors ## Market Capitalization			0.0814**	0.0789**
				(3.28)	(3.16)
	Constant	-50.61	-50.19	-45.79	-45.64
		(-1.62)	(-1.61)	(-1.48)	(-1.47)
	N	1240	1240	1240	1240
	R-squared	0.4846	0.4846	0.4924	0.4926

Standard errors in parentheses

* p<0.05 ** p<0.01 *** p<0.001

Table 6
Robustness checks

		Fixed Effects				Logistic Estimator				GMM Estimator			
	Model	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**
Variables of Interest	Female employees	0.335***	0.345***	0.292***	0.301***	0.0468***	0.0471***	0.0468***	0.0472***	0.0794	0.0699*	0.0615	0.0427
		-0.0704	-0.0707	-0.0703	-0.0707	-12.67	-12.46	-12.7	-12.49	-1.81	-2.23	-1.54	-1.06
	Female Directors (binary)	0.228	0.338	-15.94**	-15.93**	-0.532***	-0.458***	-8.951***	-9.443***	-0.303	-0.0437	-20.66*	-20.38*
		-0.555	-0.56	-5.809	-5.868	(-3.93)	(-3.30)	(-5.20)	(-5.28)	(-0.40)	(-0.07)	(-2.36)	(-2.36)
	Market Capitalization (Logarithm)	10.29**	10.89**	10.62**	11.05**	0.482	0.521	0.997	1.141	8.137	11.39*	13.11*	12.85*
		-3.762	-3.789	-3.719	-3.748	-0.8	-0.83	-1.53	-1.66	-1.41	-2.44	(-2.51)	(-2.35)
	(Market Capitalization)^2 (Logarithm)	-0.266**	-0.285**	-0.281**	-0.295***	-0.0154	-0.0166	-0.0328*	-0.0369*	-0.207	-0.279*	-0.274*	-0.270*
		-0.088	-0.089	-0.0871	-0.0882	(-1.12)	(-1.16)	(-2.17)	(-2.32)	(-1.53)	(-2.51)	-2.23	-2.11
Controls	Age	0.0000912	-0.000375	-0.106*	-0.102*	0.00775**	0.00736**	0.0125*	0.0130*	-0.0149	-0.0345	0.0496	0.0394
		-0.0318	-0.0322	-0.0419	-0.0422	-2.84	-2.64	-2.13	-2.14	(-0.46)	(-1.84)	-1.31	-1.02
	Free cash flow / Market Capitalization		0.279		0.217		0.597**		0.642**		0.616		0.12
			-0.442		-0.441		-2.89		-3.01		-1.23		-0.15
	Debt to Assets Ratio		-0.0464		-0.0408		-0.00314		-0.0025		0.014		-0.0173
			-0.0254		-0.0251		(-0.80)		(-0.62)		-0.69		(-0.54)
	State Ownership		0.0107		0.00874		0.0102***		0.0110***		0.0253		-0.0191
			-0.0455		-0.0453		-3.97		-4.17		-1.29		(-0.68)
	Return on Assets		0.00346		-0.00405		-0.00577		-0.00436		-0.0182		0.0461
			-0.0323		-0.032		(-0.71)		(-0.53)		(-0.42)		-0.81
	Female Managers (Lag)									0.695***	0.789***	0.689***	0.679***
										-10.08	-13.82	-12.07	-11.68
	Year and Firm Fixed Effects	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes
Interaction Terms	Female Directors ## Age			0.105***	0.101***			0.393***	0.420***			1.000*	0.948*
				-0.0281	-0.0285			-5.01	-5.16			-2.4	-2.28
	Female Directors ## Market Capitalization			0.577*	0.588*			-0.0042	-0.00502			-0.022	-0.00723
				-0.267	-0.27			(-0.64)	(-0.74)			(-0.62)	(-0.18)
	Constant	-88.40*	-91.57*	-83.61*	-86.31*	-4.57	-4.937	-7.684	-9.025	0	-111.4*	157.5**	155.3**
		-40.53	-40.61	-40.08	-40.18	(-0.69)	(-0.72)	(-1.09)	(-1.22)	(.)	(-2.29)	-2.82	-2.67
	N	1240	1240	1240	1240	1240	1240	1240	1240	739	739	739	739
	R^2	0.2941	0.2926	0.2869	0.2883	0.124	0.14	0.14	0.157				

Standard errors in parentheses
* p<0.05 ** p<0.01 *** p<0.001

Multivariate Analysis

Descriptive results thus provide a confirmation of the validity of the data, as well as an indication for how the glass ceiling differs over time and across countries. It also partially confirms Hypothesis 1, as it indicates financial and consumer discretionary industries perform better than all others in terms of gender diversity. The remaining hypotheses demand multivariate testing, and so the remainder of this section provides the findings for each hypothesis from the various regressions run.

Hypothesis 2

Hypothesis 2 predicted that the proportion of female employees would be positively correlated with the share of female managers. The data largely supports this, as it shows a positive correlation statistically significant ($p<.001$) and robust across all four models in the random effects, fixed effects, and logistic estimators. The strength of the correlation was relatively large and consistent for the random and fixed effects models, ranging from a 0.250 to 0.345 percent increase in the share of female managers for every percentage point increase in female employees. However, this effect drops by roughly an order of magnitude in the logistic regression. Finally, it is worth noting that when using the GMM estimator, female employees has a statistically significant ($p<.05$) effect on female managers only in model two, which includes the variables of interest and controls. This suggests a potential limitation to the finding, as endogeneity may be affecting the results in other estimations. With this caveat noted, my findings broadly support the theoretical work of Burke (1997), as they suggest the share of female managers does depend on the size of the pool of candidates, proxied by the share of female employees.

Hypothesis 3

Hypothesis 3 posited that female participation in management would be positively correlated with market capitalization. This hypothesis is neither confirmed nor denied, but instead a more nuanced relationship between the variables is found. Graphical analysis of these variables revealed a non-linear relationship between market capitalization and the share of female managers, and so the squared form of market capitalization was added to the regression. Both the linear and squared forms were found to be statistically significant ($p<.01$), and this result is robust for models two through four across the fixed effects, random effects, and GMM estimator regressions. While neither form of market capitalization is statistically significant for the logistic regression, this is more likely a result of idiosyncrasies resulting from the binary dependent variable than from any source of potential bias.

It is important to note that across the fixed effects, random effects, and GMM estimator regressions, the linear form is positive while the squared form is negative. This indicates that there is a positive relationship between market capitalization and female participation in management up until the natural logarithm of market capitalization is equal to 19.34, which corresponds to roughly the 10th percentile for firm size in the sample (author's calculations). Thereafter there is a negative relationship between size and female management. This result thus neither confirms nor denies the hypotheses, but reveals a more nuanced relationship: for the 10th percentile of smallest firms, growth in market capitalization greatly improves gender diversity in management, but for all larger firms it marginally reduces the share of female managers.

This finding potentially explains the contradiction between Bertrand and Hallock's (2001) paper, which studies US firms and finds a negative correlation between firm size and the share of women in management, and those of Hillman (2007) and De Jonge (2014), which come to the opposite conclusion using data from the US, China, and India. At least in emerging markets, it may be that the relationship between firm size and gender diversity depends on a threshold size, such that growth in market capitalization improves the share of female managers until a certain point, and thereafter decreases it. Understanding what drives this inflection at the threshold size requires further theoretical research, but one explanation may be that smaller firms depend on ESG[2] policies such as gender diversity in order to gain legitimacy, but once they attain a certain size, they are considered legitimate and so neglect these diversity policies (Giuliani 2014).

Hypothesis 4

Hypothesis 4 predicted a negative correlation between female managers and firm age. With two exceptions, firm age alone does not have a statistically significant effect on the proportion of female managers; this is consistent across the GMM, random, and fixed effects regressions. The first exception to this is that in the random and fixed effects estimations, age appears to affect the share of female managers through the female directors variable. That is, age affects the relationship between female directors and female managers. The nature of this effect is described under hypothesis 5 below. The second exception is that in the logistic regression, age has a small, though statistically significant ($p<.001$) positive effect on female managers. Understanding why the logistic estimation varies in this way constitutes a potentially intriguing area for future research, however it is not pursued here. Given that age alone is not

[2] ESG refers to environmental, social, and governance factors. It is roughly equivalent to corporate social responsibility.

consistently significant, I conclude that it does not directly affect the share of women in management.

Hypothesis 5

Hypothesis 5 predicted a negative correlation between female managers and the presence of at least one woman on the firm's board of directors. My findings neither confirm nor deny this hypothesis, but instead reveal that the effect of a female director on the share of female managers depends on firm size, and potentially firm age. When the presence of a female director is included alone, as is the case in models one and two, the effect on female managers is inconsistent and statistically insignificant.[3] Thus models one and two do not confirm or reject the hypothesis.

However, these apparently insignificant results conceal a more nuanced relationship. In models three and four, two interaction terms are added: one that interacts female directors with age, and another with market capitalization. First, the interaction term between female directors and age is statistically significant ($p<.05$) across all estimation methods, and its addition also makes the variable for female directors statistically significant ($p<.05$) across all estimation methods. This indicates a more dynamic relationship between age, female directors, and female managers. In order to disentangle and interpret this relationship, I develop a margins plot, shown in Figure 2. I created a factor variable from the age of the company by inspecting a density plot and separating according to natural clusters of company age. There are 4 levels of firm age, 0-25, 26-50, 51-75, >75. The graph shows that for the oldest companies, the presence of at least one woman on the board of directors markedly improves the share of women in management. However, for the youngest companies, having a woman on the board of directors induces the opposite effect — it reduces the percentage of women in management. For the two middle groups of firms, aged 25-75, the effect of having a woman on the board was not significantly different from zero. In short, the effect of a female director depends on the age of the company: for older companies it improves the share of female managers, for younger companies it decreases the share of female managers.

The second interaction term was added in order to understand how the effect of female directors on female managers differs depending on the firm's market capitalization. This term was statistically significant ($p<.05$) for the fixed and random effects models, but was not significant for the GMM or Logistic estimators, indicating

[3] This statistical insignificance is robust across the fixed effects, random effects, and GMM estimator model. Though as with age, the logistic regression finds a statistically significant ($p<.001$) effect.

potential endogeneity bias and thus signaling for a lower level of confidence in the results. Nonetheless, the nature of the effect of market capitalization on the relationship between female directors and female managers is shown in Figure 3. I again created a factor variable from the company's market capitalization, but here due to the normal distribution of the variable, did so based on quartiles. There are four groups ranked by firm size: 1st to 25th percentile, 26th to 50th percentile, 51st to 75th percentile, and 75th to 99th percentile. From this, the same pattern emerged: for the largest companies, the presence of a female director increases the share of female managers. Inversely, for the smallest companies, the presence of a female director decreases the share of female managers. Thus, the effect of a female director on the share of female managers may depend not only on firm age, but also on firm size.

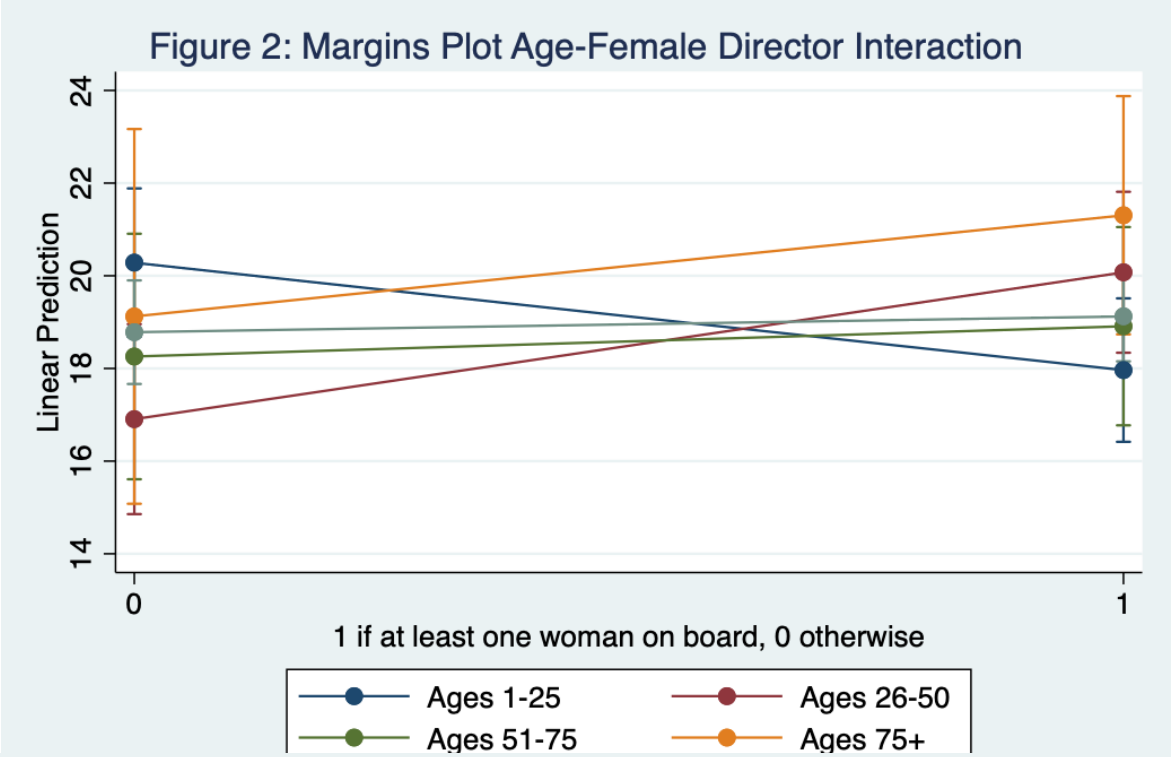


Figure 2: Margins Plot Age-Female Director Interaction
Linear Prediction
14
16
18
20
22
24
0
1
1 if at least one woman on board, 0 otherwise
Ages 1-25
Ages 26-50
Ages 51-75
Ages 75+

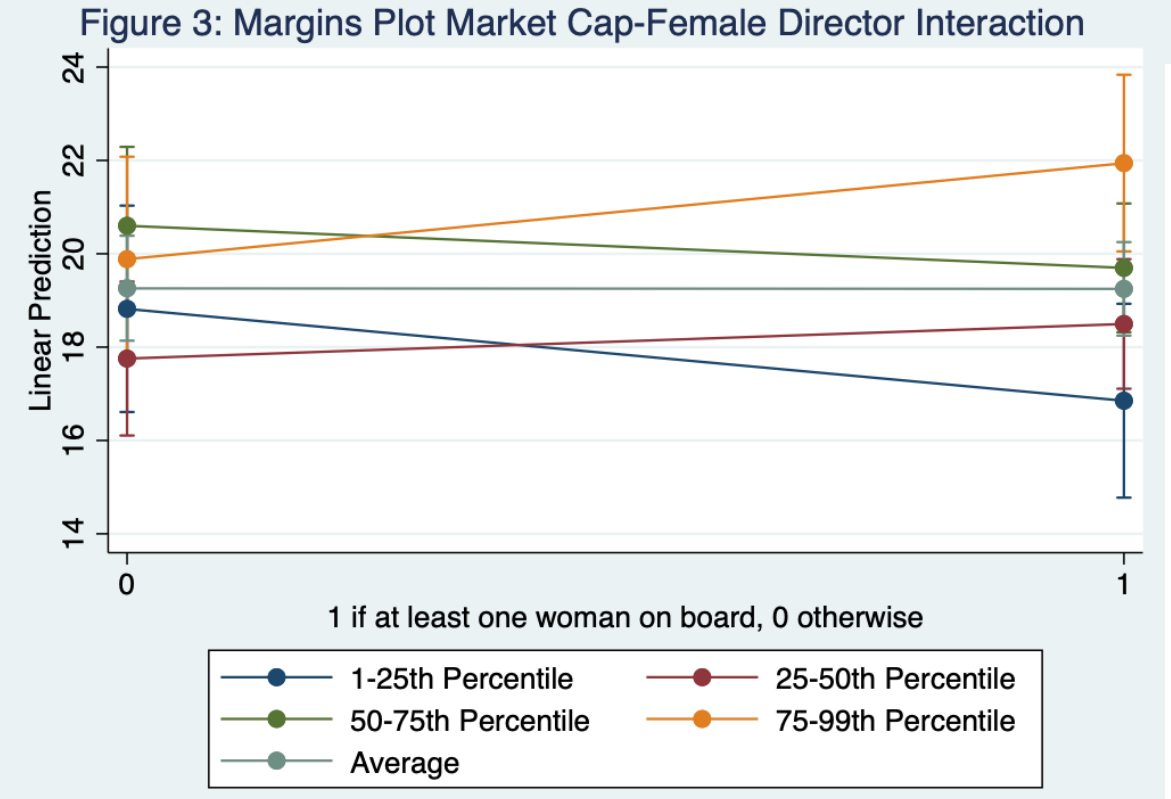


Figure 3: Margins Plot Market Cap-Female Director Interaction
Linear Prediction
14
16
18
20
22
24
0
1
1 if at least one woman on board, 0 otherwise
1-25th Percentile
25-50th Percentile
50-75th Percentile
75-99th Percentile
Average

Discussion

Summary

I have presented an investigation of the determinants of the share of female managers at all levels of corporations in developing economies. Across the five hypotheses I found a number of predictive factors as well as several surprising non-associations. Hypothesis 1 predicted a higher share of female employees, managers, and directors for financial, consumer discretionary, and healthcare sectors. The data largely supported this, showing that financial and consumer discretionary sectors had the highest share of female managers of any industry. However, there was not sufficient data to make a conclusion regarding the healthcare sector.

Hypothesis 2 was confirmed by the data, as there is a statistically significant and robust positive correlation between the share of female employees and the share of female managers. However, it should be noted this result was not statistically significant in the GMM estimator, indicating that endogeneity bias may be present.

Hypothesis 3 was neither confirmed nor rejected, as analysis instead showed that for the smallest 10% of firms, market capitalization is positively correlated with female managers, while for all larger firms, it is negatively correlated.

Regarding hypothesis 4 — that firm age decreases the share of female managers — I found that age does not have a direct effect on managerial gender diversity, but rather affects it through female directors.

This leads into the findings on hypothesis 5. The effect of a female director on the share of female managers depends on the age of the firm, and potentially its size. For the oldest and largest firms, the presence of a female director improves the share of female managers. But for the youngest and smallest firms, it has the inverse effect: a female director decreases the proportion of female managers.

Limitations

In terms of external validity, the data likely show some selection bias in going from the total 81,076 companies in BRICS nations listed by the Bloomberg Ltd. database down to the 447 firms with available data used in the study. While firms with low levels of female management are included in the dataset — 33 observations in the sample show no female managers whatsoever — it may be many of the worst performing companies do not collect this data in the first place and are therefore underrepresented

in the dataset. The overall picture may not even measure up to these relatively modest levels of female participation in management. Additionally, many of the comparisons are under-powered. That is, the confidence intervals around some differences were wide so that clinically important differences may not have achieved statistical significance. Larger studies and more complete data collection would help mitigate these shortcomings.

In terms of internal validity, a major concern was endogeneity bias. Though most of my results are consistent when using the GMM estimator (which controls for endogeneity bias) there are two exceptions. First, the relationship between the share of female employees and the share of female managers is not statistically significant when using the GMM estimator, and this may indicate that there is simultaneous causality bias amongst the variables. Second, the interaction term between firm age and the presence of at least one woman on the board of directors is also not significant in the GMM estimator. This suggests that there may be endogeneity bias affecting this variable in the fixed and random effects regression. As such, further research is needed to disentangle the relationship between female employees and female managers, and the relationship between age, female directors, and female managers.

Policy Implications

These findings have a number of implications for policymakers and organizations seeking to reduce the strength of the glass ceiling in emerging markets. The first implication is directional — through its descriptive results, this paper makes clear the areas in most need of improvement. The sectors with the worst representation of women in management are energy, utilities, and materials. With only two exceptions,[4] the averages for female representation in employment, management, and directorships are statistically significantly ($p<.05$) lower in each of these sectors than the average for the entire dataset. The worst country for gender equality in employment and management is India, while Brazil has the lowest share of female directors. Finally, these findings indicate that while female representation on boards of directors has improved by 56% over the past seven years, the share of female managers has decreased by 2.92% over the same period and the share of female employees has increased by only 5.46%. This suggests an increased focus on lower levels of corporate advancement may be necessary. As policymakers and communities in emerging

[4] The average share of female directors in the materials sector is not statistically significantly lower from the overall average share of female directors; the average share of female managers in the utilities sector is not statistically significantly lower from the overall average share of female managers.

markets set goals for improvements in the glass ceiling, this paper recommends a focus on these areas.

The second implication is that policies to improve gender diversity should vary based on company age and potentially size. For the smallest and youngest firms, it may be beneficial to relax quota systems for female representation in the board room. This follows primarily from the finding that amongst firms aged 0-25 years and with a market capitalization below $996,000,000, the presence of at least one woman on the board of directors is associated with a decrease in the share of female managers. Additional support for this position comes from the finding that for firms with a market capitalization below $291,000,000, growth in firm size is likely to bring about improvements in women's representation in management. As such, natural firm growth may be able to achieve the intended improvements in gender diversity without external intervention. Conversely, my findings suggest it is especially imperative to enforce gender diversity policies on the largest and oldest companies. For all companies with a market capitalization above $291,000,000, increases in firm size are associated with a decrease in gender diversity in management. Further, for firms aged over 75 years and with a market capitalization exceeding $10,500,000,000, the presence of at least one woman on the board of directors markedly improves the share of women in management. In short, legal and corporate policies for gender diversity in the boardroom may be relaxed for small and young firms, but enforced more stringently on larger and older firms.

Areas for Further Research

The findings from this paper may also guide future studies in a number of ways. As noted in the limitations, a study on this topic with a larger sample size may be able to correct for selection bias and for low power of comparisons that decreased the external validity of this paper's findings. With regards to internal validity, more research is needed in order to understand the directionality of the relationship between female managers and female employees, as well as to disentangle the relationship between age, female directors, and female managers.

Additionally, further theoretical work is needed to understand why firm size and age affect the determinants of gender diversity in management. Currently, theory explains why the share of female directors may be positively correlated with firm size (Cooke & Saini, 2010; Gregory et al., 2009) and negatively correlated with firm age (Kelly & Amburgey, 1991). However, deeper analysis is needed in order to understand why market capitalization is positively correlated with female managers for the smallest firms, but negatively correlated for all larger firms, and to understand why the presence

of a female director decreases the percentage of female managers for younger and smaller firms, but increases it for larger and older firms.

Finally, this paper provides significant support for the influence of organizational-level factors on the share of women in management, and some support for national-level factors. With a consistent R-squared of roughly 0.49 in the random effects model, firm-level factors had a relatively large amount of explanatory power with regards to the percentage of managers that are female. This indicates that future papers seeking to understand the determinants of the share of female managers may benefit from a focus on firm characteristics. However, organization-level variables clearly do not explain all of the variance in the share of female managers across firms and countries. This paper provides some support for country-level determinants of gender diversity management, based on the wide variation in the share female managers across the BRICS nations studied. In this way it supports Terjesen and Singh's (2008) speculation that national factors may affect metrics of the glass ceiling other than the share of female directors.

Conclusion

Attempts to dismantle the glass ceiling depend on a thorough understanding of its determinants. To this end, much research has focused on the drivers of the glass ceiling in the developed world, and particularly on what factors affect the number of women on the board of directors. However, there is more limited research on this topic that uses evidence from the developing world, and even less that focuses on what firm characteristics affect the share of women in management more broadly. This study helps to close this gap in the literature by studying the firm-level factors that affect the percentage of managers that are women, using evidence from firms in BRICS nations. The findings suggest that industry, firm size, and the proportion of female employees and directors all directly affect the share of female managers in a firm. More specifically, the results identify the industries performing best and worst for this metric of gender diversity, they reveal a non-linear relationship between firm size and women in management, and find that the effect of a woman on the board of directors depends on a firm's age and potentially its size. These conclusions help to disentangle the relationship between firm characteristics and the strength of the glass ceiling, and in so doing, hope to contribute to its shattering.

-x-

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