Women on boards in finance and STEM industries

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Women on Boards in Finance and STEM Industries[†]

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Relative to their share in the population, women are less likely to have a science or engineering degree and are less likely to be employed as scientists or engineers (CEOSE 2015). For academia there is evidence that women are underrepresented at all academic levels. For example, even though women earn roughly half the doctorates in science and engineering in the United States, they comprise only 21 percent of full science professors and 5 percent of full engineering professors (Shen 2013). There is also evidence that female academics in science are less likely to be invited to join corporate scientific advisory boards (McCook 2013). But to our knowledge, there is no evidence that the underrepresentation of women in STEM occupations persists at higher levels of the corporate hierarchy. We provide such evidence in this paper.

Using a comprehensive sample of board data for listed firms in 20 countries from 2001–2010, we show that the fraction of women on the board (Board diversity) is lower for firms in the STEM and Finance sectors (STEM&F) than in the non-STEM sector. This finding is robust to controlling for firm and country characteristics and country and year fixed effects. On average, STEM&F firms have 1.8 percent fewer women on boards than non-STEM firms. Relative to the sample mean of 7.56 percent, this represents an economically significant leadership gap in STEM&F fields. Women are most underrepresented on the boards in the natural resources and mining; manufacturing; and financial activities sectors.

Our results connect two policy debates that are usually conducted separately: the debate about women's underrepresentation in STEM fields and the debate about women's underrepresentation on corporate boards. The fact that women are less represented on corporate boards in STEM&F fields suggests that women's underrepresentation in STEM occupations may get worse at higher levels of the corporate hierarchy. Similar to the findings for academic positions (Shen 2013), there may be biases or impediments to work-life balance that make it harder for women to achieve leadership positions in STEM&F sectors. This means that to solve the underrepresentation problem in STEM&F occupations, it may not be enough to simply encourage entry of women into these fields. More must be done to ensure they do not have reasons to exit the industry.

Recognizing that women's underrepresentation on boards varies by sector is also important for the policy movement that aims to increase corporate board diversity. The EU recently approved a draft law that sets an objective of 40 percent female nonexecutive directors on boards of listed companies across the 28 member states of the EU (European Commission 2012). Our results suggest that it will be more difficult for firms in STEM&F sectors to achieve these objectives. It is also plausible that diversity will have a greater impact (positive or negative) on firms in the STEM&F sectors than in other sectors. More generally, given that the underrepresentation of women on boards in STEM&F firms is likely due to the persistent underrepresentation of women in STEM&F fields, it is unlikely that board diversity targets can solve the problems leading to women's underrepresentation on boards in these sectors. Policymakers interested in increasing board diversity may need to join forces with those who worry about the retention of women in STEM fields.

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I. Data

Our data is from Adams and Kirchmaier (2015a). Their sample consists of data on boards of listed companies in 20 countries for the years 2001–2010. Countries in the sample are from Europe, the Commonwealth, and the United States. Adams and Kirchmaier combine director data from Boardex with financial data from CapitalIQ and country-level data from Euromonitor, the OECD family database, the World Economic Forum, and the World Value Survey, among others. To ensure their country-level coverage is representative, they restrict their sample to country-years in which Boardex covers more than 70 percent of total market capitalization in that country and year and drop countries with low coverage and countries that are likely to be outliers with respect to women on boards. As a result, not all countries have ten years of data in the sample.

Adams and Kirchmaier (2015a) drop financial firms, but we retain them. Our final sample consists of an unbalanced panel of 44,254 firm-year observations on more than 8,000 listed firms in 20 countries.

The dataset is complete with respect to gender and non-executive director (NED) and executive director (ED) classifications. In countries with a dual board system (Austria, Germany, Denmark, Netherlands), we classify supervisory board members as NEDs and management board members as EDs. Board size is the sum of the sizes of the supervisory and management boards.

We define STEM industries as industries in which a large share of employees are in STEM occupations. To determine which industries fall into this category, we first obtain a list of occupations that require education in science, technology, engineering, and mathematics disciplines from O*NET (2015). We match these STEM occupations to the 2012 Bureau of Labor Statistics (BLS) National Employment Matrix by Industry. For each industry, the Employment Matrix indicates the percent of employees from each occupation. We sum the percentages for all STEM occupations to obtain the percent of employees in STEM occupations in each industry. We then average these percentages across industries in each of ten industry super sectors as defined by the BLS (2015). We define the top five super sectors by share of STEM employees as STEM sectors. These are: financial activities, with 7.16 percent STEM employees on average; natural resources and mining (10.75 percent STEM employees); manufacturing (15.1 percent STEM employees); professional and business services (21.78 percent STEM employees); and information (21.8 percent STEM employees). Non-STEM sectors are: leisure and hospitality; trade, transportation, and utilities; educational and health services; other services; and construction.[1]

We match the super sector classification to our sample firms using NAICS codes from CapitalIQ. To highlight that the finance sector is STEM-intensive even though it is not traditionally considered a STEM sector, we label firms in the top five STEM sectors as STEM&F firms.

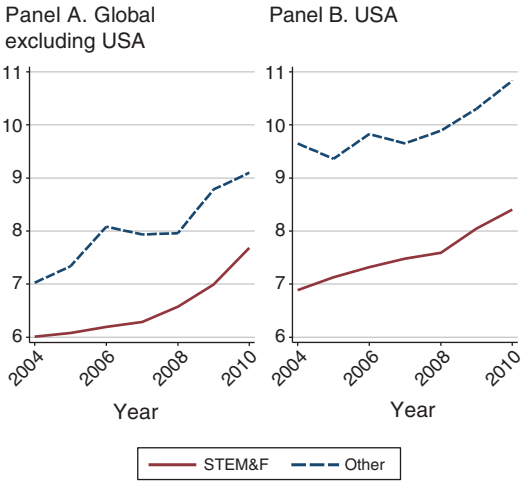

Figure 1. Average Percentage of Women on the Board in STEM&F and other Sectors

Notes: Figure 1 shows the average percentage of women on the board of more than 8,000 listed firms in 20 countries from 2001–2010. The averages are stratified by STEM&F (solid line) and other sectors (dashed line). STEM&F sectors are the top five out of ten super sectors ranked according to the percentage of employees who are in STEM occupations. Super sectors are defined using BLS (2015). STEM occupations are from O*NET (2015). The firm-level data is from Adams and Kirchmaier (2015a).

[1] Adams and Kirchmaier (2015a, b, and c) provide more details on sample characteristics.

TABLE 1—FRACTION OF WOMEN ON THE BOARDS OF FIRMS IN STEM&F AND OTHER SECTORS

	(1)	(2)	(3)	(4)
STEM&F	−0.018***		−0.018***	
	[−6.72]		[−6.79]	
STEM&F − Finance		−0.016***		−0.016***
		[−4.76]		[−4.77]
STEM&F − Information		−0.010***		−0.010***
		[−2.66]		[−2.65]
STEM&F − Manufacturing		−0.019***		−0.019***
		[−6.71]		[−6.66]
STEM&F − Resources		−0.041***		−0.043***
		[−11.75]		[−12.03]
STEM&F − Professional services		−0.006		−0.006
		[−1.25]		[−1.32]
log(Assets)	0.006***	0.006***	0.006***	0.006***
	[10.01]	[10.04]	[9.96]	[10.01]
Female full-time economic participation (lagged)	0.370***	0.317***	−0.185	−0.191
	[7.74]	[6.55]	[−1.54]	[−1.57]
Corporate governance code	0.008***	0.007**	0.011***	0.011***
	[2.89]	[2.46]	[4.96]	[5.18]
Quota for state-owned companies	0.009	0.012	0.057**	0.057**
	[0.98]	[1.26]	[2.10]	[2.13]
Gender wage gap	0.523***	0.525***		
	[5.31]	[5.34]		
Codetermination	−0.012*	−0.008		
	[−1.83]	[−1.31]		
Traditional versus secular values	0.015***	0.012***		
	[3.60]	[3.09]		
Survival versus self-expression values	0.004	0.010		
	[0.44]	[1.29]		
Country fixed effects	No	No	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
R^2	0.123	0.130	0.126	0.134
Adj. R^2	0.122	0.129	0.126	0.133

Notes: This table shows regressions of Board diversity on a STEM&F dummy and STEM&F subsector dummies and controls. The sample consists of 44,254 firm-year observations in 20 countries in Europe, the Commonwealth, and the United States. All regressions include year fixed effects and the following controls which are excluded for the sake of brevity: Fraction of women in higher education (lagged), Birth rate (lagged), Tax & social security (lagged), Tenure, Board size, Independence, Family firm, GNI/capita (lagged), and ROE. The sample is from Adams and Kirchmaier (2015a). Board diversity measures the number of women over Board size. The STEM&F dummy is constructed using data from O*NET (2015) and BLS (2015). Assets is the book value of total assets (in billions of USD) for non-US firms converted into USD at market prices at the end of the reporting period. Female full-time economic participation is full-time female employment over full-time employment per year and country, lagged by ten years. Codetermination is a dummy variable. Gender wage gap is the average gender pay gap score of the World Economic Forum for the years available in 2006 to 2010. Traditional versus Secular and Survival versus Self-expression measure cultural dimensions and are based on Inglehart and Welzel (2005). Corporate governance code is a dummy indicating whether gender balance was explicitly stated in the governance code for that year and country. Quota for state-owned companies is a dummy variable identifying whether for a given year and country a formal board quota was in place for state-owned companies. More variable details are in Adams and Kirchmaier (2015a, b). Robust standard errors are clustered at the firm level, with corresponding *t*-statistics shown in brackets.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

II. Board Diversity in STEM Sectors

In Figure 1 we show the average fraction of women on boards over time stratified by STEM&F and non-STEM sectors. Because the United States is overrepresented in the sample in terms of number of firms, we plot the data for non-US countries and the United States separately. Boardex has representative coverage for the United States starting in 2004, so we plot our data from 2004 onwards.

Both panels of Figure 1 show that women are less represented on the boards of firms in the STEM&F sectors than in other firms. The difference between non-STEM and STEM&F firms is greater in the United States, although the average fraction of female directors is higher for both types of firms in the United States. The figure also shows that the gap between non-STEM and STEM&F firms does not seem to be narrowing over time.

In Table 1 we examine whether the differences between non-STEM and STEM&F firms in Figure 1 are driven by differences in firm or country characteristics. For example, systematic differences in firm size between STEM&F and other firms could explain differences in their board diversity. Similarly, the occurrence of large natural resource sectors in conjunction with low gender equality in some countries could explain the pattern in Figure 1.

We regress the fraction of women on the board (Board diversity) at the firm level on firm characteristics such as log(Assets) as a proxy for firm size, ROE as a measure of performance, Board size, Board Independence, and a Family firm dummy. Following Adams and Kirchmaier (2015a), we include amongst others a measure of female full-time labor force participation (Female full-time economic participation) lagged by ten years, a measure of the gender wage gap from the World Economic Forum, GNI/Capita, measures of culture (Traditional/Secular and Survival/Self-expression) and time varying dummies for policies with respect to gender (Corporate governance code, Quota for state-owned companies) and Codetermination. In columns 1 and 2, we include year fixed effects. In columns 3 and 4 we also include country fixed effects. Standard errors are clustered at the firm level.

In columns 1 and 3, the primary variable of interest is STEM&F, a dummy indicating firms are in STEM&F sectors. In columns 2 and 4, we disaggregate STEM&F into five sector dummies. The results in columns 1 and 3 show that the pattern in Figure 1 is robust to controlling for firm and country characteristics. On average, Board diversity is lower by 1.8 percent in STEM&F firms. Diversity is lowest in natural resources and mining (by 4.3 percent); manufacturing (by 1.9 percent); and financial activities (by 1.6 percent).

II. Conclusion

The underrepresentation of women in STEM&F fields has long-term consequences for corporate leadership. An obvious question is: Does it matter? It should matter to policymakers concerned about women's underrepresentation on boards. It should also matter to policymakers concerned about women's underrepresentation in STEM fields. It may matter to firms in STEM&F sectors. While it is unclear that all firms benefit from more boardroom gender diversity, clearly some firms will. With the right people on the board, diversity can lead to more creativity and greater innovation—important characteristics for firms in STEM&F sectors.

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