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Implicit gender quota in European boardrooms

Hubert Drążkowski, and Joanna Tyrowicz

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Hubert Drążkowski
FAME | GRAPE

Joanna Tyrowicz
University of Warsaw,
University of Regensburg,
IZA and FAME | GRAPE

Abstract

We test for implicit gender quotas in the boardroom. We use novel dataset covering 11 million European corporations over three decades. We find that -- accounting for the pool of available candidates -- gender-blind hiring of women to board positions is highly improbable. Implicit quotas refer to unspoken policies or practices that result in a specific gender composition. Tokenism is one such example: in order to project the reputation of supporting diversity, an organization may prefer to invite a single representative of minority (or representatives of minorities) without endowing them with actual decision power.

Keywords:

gender, board, diversity

JEL Classification

C81, J16, M12, M51, J24

Corresponding author

Joanna Tyrowicz, j.tyrowicz@grape.org.pl

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Foundation of Admirers and Mavens of Economics
Koszykowa 59/7
00-660 Warszawa
Poland

W | grape.org.pl
E | grape@grape.org.pl
TT | GRAPE_ORG
FB | GRAPE.ORG
PH | +48 799 012 202

1 Introduction and motivation

Implicit quotas refer to unspoken policies or practices that result in a specific gender composition. Tokenism is one such example: in order to project the reputation of supporting diversity, an organization may prefer to invite a single representative of minority (or representatives of minorities) without endowing them with actual decision power. A more general phenomenon occurs if the minority is misrepresented relative to the "candidate pool".

A rich body of literature analyzes the prevalence of women in boardrooms of listed companies (see e.g., Harrigan 1981, Farrell and Hersch 2005, Elkinawy and Stater 2011, Matsa and Miller 2011, Gould et al. 2018, Guldiken et al. 2019, Knippen et al. 2019, Kirsch and Wrohlich 2020, Bozhinov et al. 2021, Garcia-Blandon et al. 2023, Schoonjans et al. 2024). The literature is scarce and, for private companies, is typically limited to a single country due to challenges with data availability (see e.g., Matsa and Miller 2013, Kunze and Miller 2017, Smith and Parrotta 2018, Bossler et al. 2020, Maida and Weber 2022)[1]. However, private companies constitute the majority of all companies. Furthermore, typically no legislation mandating gender board quotas was discussed, much less implemented in the case of these firms (see Terjesen et al. 2015, Mateos de Cabo et al. 2022, for an extensive review of mandated gender board quota legislation). This makes private firms particularly useful for studying implicit quotas in board appointments.

In this study, we consider the context of corporate boardrooms and gender diversity. Our paper is an exploratory analysis of the prevalence of the implicit gender quota in the boardrooms of European private companies. We rely on the fact that with large samples, the science of statistics becomes useful in identifying empirical irregularities in the observational data. Specifically, we exploit the fact that, knowing the share of women in the relevant "candidate pool", we can obtain the theoretical frequency for each occurrence in the number of women reported by companies, assuming gender-blind hiring.

2 Methods

First we provide an intuition for the test we employ. Consider a scheme of sampling objects from an urn into pockets. Imagine that there are objects of different shapes and sizes in the urn. These objects are colored with two different paints. If the objects are assigned to pockets color-blind, even if they are organized by their shapes, the colors should appear randomly across the pockets. In our analogy, the shapes in the urns are boardroom candidates that form the "candidate pool" and the color is the gender. One could argue that shape and color are systematically related; however, we consider color to refer to all gender-related traits.

Firms report that a fraction p of board members are women. These women constitute the "candidate pool" for typical firms. Given the fraction p there is no *a priori* reason for why, e.g. most of the firms might have exactly one woman and almost none two, etc. Indeed, if board appointments were gender-blind, the distribution of the number of women in boardrooms would follow a binomial

[1] (Drazkowski et al. 2023) give a cross-country perspective.

distribution, characterized by p. A systematic deviation from that distribution observed in the data would hint at a hiring process that takes gender into account, such as a social norm that enforces the "acceptable" or "desired" number of women on boards. Note that in the case where candidate pool is formed by women in boardrooms the interpretation points into the process being governed by demand side, and not the supply side factors.

Janys (2022) provides a formal test for the implicit gender quota based on this observation. She subsequently applies the tests to the context of hiring women to full professorship positions in the German academia. She she finds a strong implicit quota of two women, with insufficient number of departments reporting fewer women, but also statistically improbable few departments reporting a higher number of women faculty.

We build on this approach to obtain the estimates of implicit gender quota in European boardrooms. Within groups defined by country and year, we observe two phenomena[2]. First, we obtain the share of women on the boards of companies in each group. These values provide p in each group s. Second, we observe the distribution of the number of women in boardrooms of a given group s. Eventually, we test whether the empirical distributions observed in firms are consistent with a distribution characterized by the fraction p_s in each group.

Consider a potential number of women within boards $z \in \{0, 1, ...\}$. For each group s, the share of women in the boardrooms of this group denoted by p_s, yields a binomial distribution. We compute the deviation of the empirical distribution from the theoretical one. Specifically, denote $p_i(z)$ the binomial probability mass function of observing exactly z women on a board given n_i, the total size of the board and p_s, the probability of observing a woman in the boardrooms of firms in the group s. Then, for each z and i, we compute $H_i(z)$, an indicator function that equals 1 if the actual number of women on a board matches z.

The variance σ_i^2 for each probability normalizes the test statistic, which quantifies the aggregate deviation of observed values from expected values, for all firms in the group s. The final statistic, measuring the aggregate deviation of the occurrence of a certain number of women from the probability of observing exactly such a number, normalized by the expected variance, is given by:

$$\text{T statistic:} \quad T_n(z) = \frac{\sum_{i=1}^{n} H_i(z) - p_i(z)}{\sqrt{\sum_{i=1}^{n} \sigma_i^2(z)}}.$$

Asymptotically, under the null of gender-blind board assignment, the T statistic converges to a normal distribution: $T_n(z) \xrightarrow[n \to \infty]{d} T \sim N(0, 1)$. Note that the value of the T statistic does not have an autonomous interpretation. The final computation of $T_n(z)$ and its corresponding $p-value$ assesses whether the deviations between the empirical distribution and the theoretical one are statistically significant. Statistically significant deviations indicate gender-aware hiring in the appointment of women to corporate boards.

The underlying assumption is the independence of hiring decisions across firms, both within and across candidate pools. This assumption is likely satisfied in our context. The hiring of board

[2]Groups defined by country year and industry do not change final results

members can be described as sampling with replacement. This is due to the fact that a person can be a member of multiple boards and the outcomes of previous hiring decisions at a different firm across the whole country should not influence the gender of the next hire in a randomly selected firm. Note that the group s is defined exclusively by country and year. Within each country, in a given year, the appointments to the boardrooms in one company are not directly influenced by the appointments in the other company. Furthermore, in practice, candidates may migrate between the pools (countries in our case), which is an additional reason for why the independence assumption is likely satisfied in our case. Finally, the pool of candidates is not restricted *per se*, because competent individuals leave and join the pool of candidates with their career progress, as well as mobility between industries and countries.

3 Data

We use data for roughly 11,5 million corporations across 29 European countries spanning 1990-2020, in total 54 million observations. This data is based on the registry information provided in Orbis. It is called the Gender Board Diversity Database (GBDD, see Drazkowski et al. 2024, who describe in detail the procedure to extract and harmonize the data). Using detailed registry information, they provide novel heuristics to identify board members among all the individuals reported in Orbis. They also provide linguistic rules for attributing gender to all board members based on names and surnames.

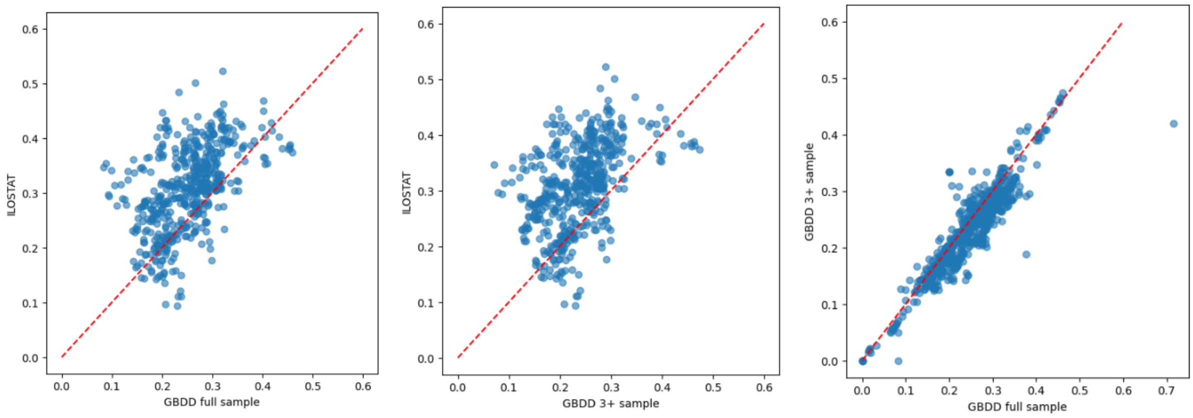
We use the GBDD sample, introducing several restrictions. Like GBDD, we only consider incorporated companies because in all analyzed countries they are legally obliged to have boards. We consider boardrooms with three or more members. We define the groups s by country and year. For empirical estimates of p_s to be smooth and reliable, we drop groups with fewer than ten corporations reporting board members. Eventually we end up with 4.5 million firms, over 21 million unique individuals, and 19 million firm observations for the period 1990-2020. From this sample, we derive 856 country-year groups. On average, in this sample 23% of the individuals are women.

We establish three reference distributions to reflect p_s. First, we use the share of women among board members in each group s in the full GBDD sample of 11.5 million unique firms. Second, we obtain the share of women in the boardroom in our sample with three or more board members, again within groups s defined by country and year. The underlying assumption for these two reference distributions is that if a person was appointed to a boardroom in a company in a given group s, then all firms had the opportunity to appoint that person. Therefore, all board members are in a "candidate pool". Figure 1 in reports the empirical distribution of p_s across groups s in our sample.

Finally, we also use an independent source of data: the distribution of managers from ILOSTAT. We use ISCO classification "senior and middle management", with the reference distribution obtained as the share of women in higher management positions in each country and year. Although our GBDD-based reference distributions look for potential candidates for the board outside the firm (board members in all firms in a given group s), here the underlying assumption is that individuals promoted to management positions in principle could become promoted to the boardroom level. In a similar spirit, Low et al. (2015) use the percentage of women among (lower level) managers as an instrument for board gender diversity.

Figure 1 depicts the raw correlation between the empirical reference distributions for p_s. It shows that for our purposes it is not relevant if we use the full GBDD sample or restrict it to companies with larger boards to obtain the estimates of p_s. These two indicators are closely correlated between countries and over time. Meanwhile, while the correlation remains strong with the ILOSTAT measures, there appears to be some discrepancy between the share of women among managers and the share of women in the boardroom.

Figure 1: Correlations across empirical reference distributions for p_s: share of women in the boardrooms from GBDD (full sample and 3+ sample) and the share of women among managers in labor force surveys (ILOSTAT)



Notes: The data on the share of women in the boardrooms comes from GBDD. The data on the share of women in management positions comes from Labour Market-Related SDG Indicators database. Dashed is the 45° line.

4 Results

We find that gender-blind allocation of women to boards is highly improbable. We show results for three reference distributions p_s: GBDD full sample, GBDD sample used in this study, and ILOSTAT. All estimated T statistics are outside this stripe. Recall that the magnitude of the $T_n(z)$ statistic does not have a direct interpretation, $p - value$ informs if there is a deviation from the gender-blind assignment. We find an excessive probability of corporations with no women in the boardroom and the accompanying shortage of corporations with one woman in the boardroom; see Table 1. These results are consistent across reference distributions.

For subsequent numbers of women, powerful interpretations emerge from comparing the results across reference distributions. The full GBDD sample candidate pool suggests too many corporations with zero and four to six women and too few corporations with one to three women. The candidate pool of sample restricted to three or more board members, the sample used as empirical distribution, shows too few firms with one woman and too many firms with other number of women. The senior and middle management candidate pool form ILOSTAT shows an overrepresentation of firms with no women and an underrepresentation of firms with any women. There is a grand overrepresentation

Table 1: Implicit quota hypothesis testing, and robustness

z number of women	GBDD, full sample		GBDD, 3+ sample		ILOSTAT	
	$T_n(z)$	$p-value$	$T_n(z)$	$p-value$	$T_n(z)$	$p-value$
	(1)	(2)	(3)	(4)	(5)	(6)
0	768.72	0.00	470.95	0.00	1368.69	0.00
1	-660.02	0.00	-631.28	0.00	-640.55	0.00
2	-120.77	0.00	70.27	0.00	-465.25	0.00
3	-11.95	0.00	150.52	0.00	-318.55	0.00
4	68.14	0.00	165.66	0.00	-115.56	0.00
5	45.44	0.00	106.32	0.00	-70.87	0.00
≥6	56.03	0.00	112.54	0.00	-81.51	0.00

Notes: $p-values$ corrected for multiple hypothesis testing with Holm-Bonferroni method.

of firms with no women in all three reference points. Given the candidate pool, we should observe a lot of firms with exactly one woman, but there are too few of such firms observed empirically. These women that constitute the sample are found grouped in firms with at least two women, which should be much less frequent. Moreover, compared to the candidate pool including small boardrooms, there are also too few firms with two or three women, meaning that, relative to bigger boardrooms, there are higher shares of women in smaller boardrooms.

We interpret our results as follows. The average number of women in the boardroom is 23%. Indeed, considering broader spectrum, the low prevalence of women in GBDD is driven by too many corporations with no women at all in the boardroom. This interpretation is corroborated by the analysis based on ILOSTAT reference distribution, that is, the share of women among employees in management positions. These results reveal that, actually, with the exception of zero, all numbers of women are substantially too rare. The promotion from management positions to the boardroom is systematically gender biased, resulting in too few women in the top echelons of the corporations, relative to their position in the management or even in the boardrooms at all. The number of companies that do not report a single woman is excessive by all measures, as is the lack of firms reporting one woman. However, this occurs because women cluster in certain boardrooms in large numbers. Note that this means that excessive prevalence of cases with a high number of women blurs the informative value of the women's share on boards.

This empirical finding raises interesting theoretical questions for future research. On the one hand, the concentration of women in few boardrooms can be at least partially explained by the fact that family members often become involved in the boardroom, especially when gender board quota are mandated (Chevrot 2023, provides direct evidence using registry data from Denmark, demonstrating unusually frequent appointment of wives, daughters, sisters and mothers of the CEOs to the boardrooms in family firms). On the other hand, the phenomenon of clustering of women might be partially explained by the network effects of women knowing more women and referring them more frequently (Brown et al. 2016, Owen et al. 2021, Lalanne and Seabright 2022, von Essen and Smith 2023).

To inspect the robustness of our results, we reiterate the estimation of the T statistic across countries (Table A1 in the Appendix). We find that the excessive probability of no women in boards is a phenomenon universal over time and countries. We also confirm that too few corporations report one woman in their boardroom, with the only exception being Lithuania. For a larger number of women in the boardroom, the results for GBDD sample with three or more board members are broadly confirmed, with a few non-systematic exceptions.

We also study the time dimension of our sample. Specifically, it could be that our results reported in Table 1 are an artifact of the interaction between time and firms. Specifically, a given firm could have too few women early in our sample period and subsequently too many later in our sample period due to p_s changing over time. To address this risk, we report T-statistic independently for each period in our sample. The results reported in Table 2 are analogous to the middle column of Table 1. We show that the excessive number of firms with no women and insufficient number of firms with one woman are a systematic occurrence, repeating in every year of our sample. In other words, in every period of the sample, the observed distribution of the number of women in the boardrooms of private European corporations departs from the gender-blind distribution implied by the share of women among board members in each of the counties.

Table 2: T test statistics over time (3+ sample GBDD)

Years	0	1	2	3	4	5	6
1990	9.47	-13.72		4.00			
1991	12.17	-17.66		5.85			
1992	15.76	-21.44		8.23	6.66	5.31	5.90
1993	12.73	-18.11	4.17			5.95	4.60
1994	12.94	-18.67	5.38			4.69	5.32
1995	14.40	-19.91	4.48			9.24	5.21
1996	16.59	-21.82			6.24	8.40	9.83
1997	20.66	-27.16		3.86	6.59	10.93	12.47
1998	29.21	-38.84	4.23	7.49	12.00	13.02	17.32
1999	41.90	-56.64	9.25	7.18	17.30	14.94	18.17
2000	65.94	-95.13	23.99	10.06	31.28	17.02	26.93
2001	92.29	-134.06	31.84	18.74	51.92	23.03	34.10
2002	113.12	-163.88	37.41	22.47	68.92	29.94	55.32
2003	112.94	-166.91	44.22	18.74	78.06	29.78	57.93
2004	124.98	-184.49	47.69	22.33	83.94	30.98	64.33
2005	123.00	-181.89	48.92	19.13	81.16	27.34	58.06
2006	134.33	-198.30	49.42	29.32	83.13	29.80	56.35
2007	82.88	-118.21	17.48	43.87	28.35	20.22	20.17
2008	87.58	-124.23	17.58	45.57	29.90	21.63	19.74
2009	94.26	-132.84	16.95	48.56	30.64	20.43	18.37
2010	89.80	-124.89	14.42	45.00	31.60	21.59	21.05
2011	94.59	-131.47	14.81	47.96	31.42	21.02	23.47
2012	143.82	-175.75	-5.69	45.18	47.11	42.09	43.65
2013	116.88	-148.21		45.75	33.16	27.39	21.44
2014	115.03	-146.48		46.62	36.02	30.59	18.87
2015	88.92	-116.31	6.34	37.42	26.17	20.77	11.66
2016	87.44	-113.20	6.47	31.34	26.33	23.72	19.44
2017	88.39	-112.38	5.20	28.47	26.00	20.75	23.47
2018	98.78	-122.74	4.46	28.62	23.38	21.95	23.11
2019	120.27	-134.09	-10.46	25.16	25.49	28.40	23.95
2020	66.75	-92.33	16.48	29.27	4.74		

Number of women (z)

Notes: Red tiles mark positive and significant statistic, blue tiles signify negative and significant statistic, insignificant cells left intentionally blank. The $p-values$ are corrected for multiple hypothesis testing with Holm-Bonferroni method.

Recall that the magnitude of the T-statistic does not have an economic interpretation per se. However, there appears to be no meaningful trend towards zero in the reported T-statistic, which hints that the rejection of the null hypothesis is both decisive and does not appear to fade away.

5 Discussion & conclusions

We study gender board diversity in private corporations in Europe. To obtain reference distributions consistent with gender-blind assignment, we use both internal distributions (based on the prevalence of women in the boardroom in our sample) as well as a pool of potential candidates (based on the prevalence of women in management positions). The distributions of the number of women in the boardroom are inconsistent with the gender-blind assignment. Our results can be interpreted as evidence of implicit gender quotas.

Our study improves previous literature and answers their call for better methods for studying implicit quotas phenomenon. In Dezső et al. (2016), the authors analyze management teams of publicly traded US companies and highlight the limitations of using naive regression in this context, which yields biased results. However, their approach does not correct for these biases. They simulate the distribution of women based on the predicted presence of women in top management roles, arguing that the discrepancy between observed and predicted numbers can explain the role of concurrent female presence. They find that simulated data shows higher shares of firms with multiple women compared to real data, which has disproportionately many firms with only one woman. Nevertheless, their analysis is not counterfactual, and the prediction error cannot solely be attributed to the presence of other women in top management, revealing an inherent omitted variable bias. Our study improves upon their analysis in three key ways. First, we rely on more realistic assumption, while their approach contrasts predictions with actual distributions, it only assesses model accuracy rather than providing concrete insights into implicit quotas beyond speculation. Second, our methodology employs hypothesis testing that incorporates uncertainty quantification, offering a more robust analytical framework. Third, our study is based on a significantly larger sample of approximately 19 million observations, compared to their sample of around 31 thousand, enhancing the reliability and generalizability of our findings.

In some respects, our results yield conclusions similar to those of Chang et al. (2019), who study publicly traded (stock-listed) companies in the US. They show evidence for "twokenism": a phenomenon of overrepresentation of corporations with two women in their boardrooms. Our study differs in the sample: we take on European private corporations leveraging novel, unique data (GBDD). We also employ a novel statistical method in the form of hypothesis testing. Thus, we contribute to research on implicit gender board quotas.

Our results prove to be remarkably consistent. Given the share of women in the boardroom, there should be fewer corporations with no women for the process to resemble gender blindness. We also find that there remains to be far fewer women in boardrooms than candidates available in management positions. In fact, there are statistically too few firms with at least one woman and incredibly many with no women at all, if we were to assume that the hiring process has been gender-blind.

The findings in this paper shed light on the phenomenon of tokenism in European corporate boardrooms. We infer whether the observed gender compositions are merely token gestures or reflective of a genuine stride toward gender parity, adjusted for the underlying pool of potential candidate women within the corporate hierarchy. We identify too few firms with only one woman and a massive overrepresentation of firms with no women. We also find women clustering often together in firms adjusted for the underlying pool of candidates.

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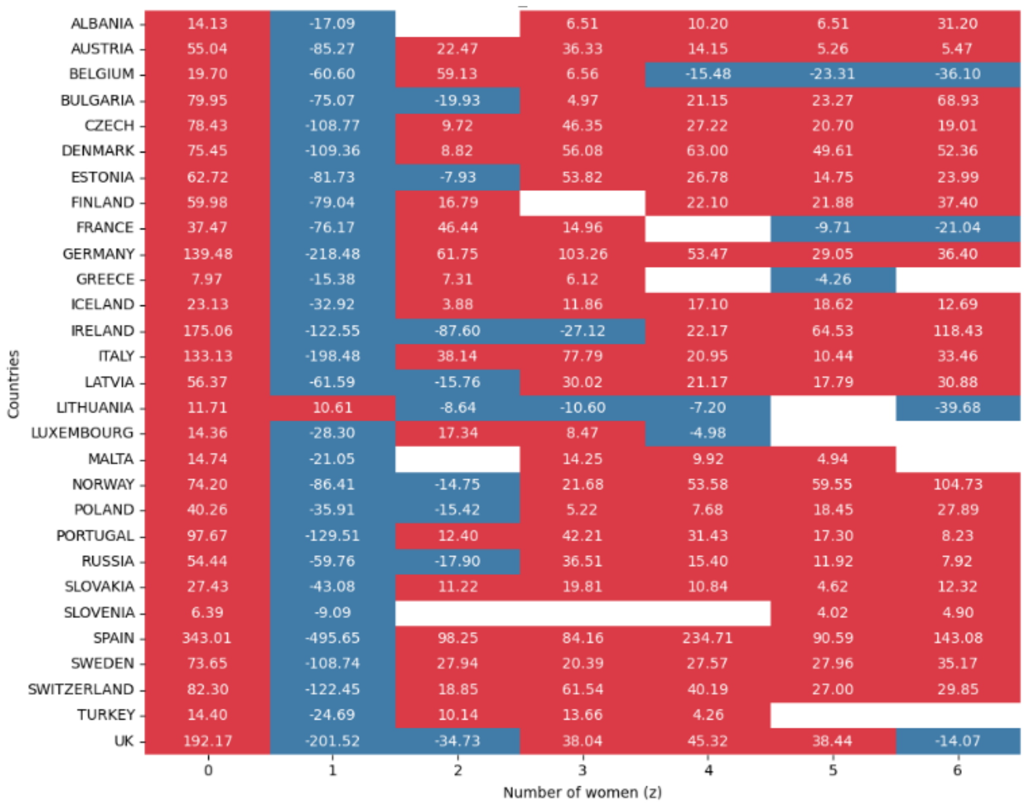
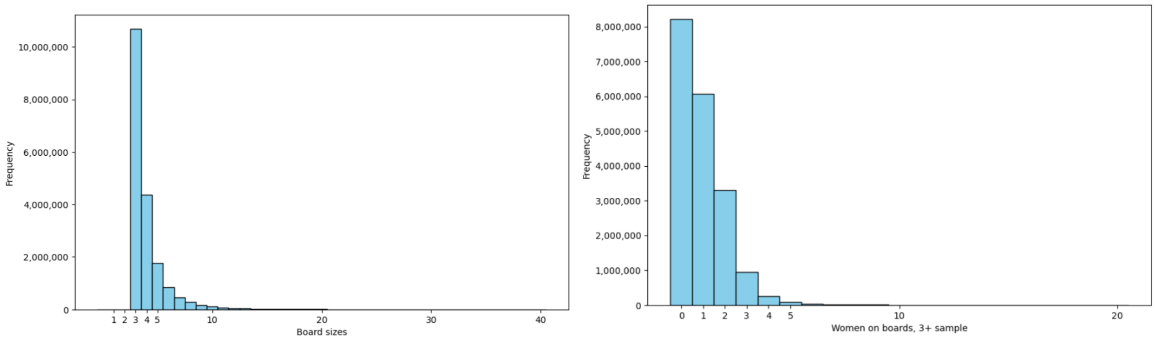
A Additional graphs and tables (online appendix)

Figure A1: T test statistics across countries (3+ sample GBDD)



Notes: Red tiles mark positive and significant statistic, blue tiles signify negative and significant statistic, insignificant cells left intentionally blank. $P - values$ are corrected for multiple hypothesis testing with Holm-Bonferroni method.

Figure A2: The number of firms with certain board sizes and female representation



Note: GBDD raw data tabulation from a subsample with three or more board members