Numbers and structural positions of women in a national director interlock network

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- Unpublished work: Alex Stivala, Peng Weng and Alessandro Lomi, 2023.

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- We used the high-performance computing cluster at the Institute of Computing, Università della Svizzera italiana, for all data processing and statistical computations.

- *Conflict of interest disclosure*: I am a direct shareholder in several ASX listed companies, including some specifically mentioned in this work, and their competitor companies. I am also an indirect shareholder in ASX listed companies via the default superannuation fund for Australian university employees.

Outline and contributions

- Substantive:
  - A director interlock network for all (over 2000) companies (rather than the top 200 or 300, as usual practice) listed on the ASX is constructed.
  - Descriptive statistics of the network, companies and directors.
  - Based on the theoretical framework of Kanter (1977) we examine the relative proportion of women and test a “token woman” hypothesis proposed by recent work including Evtushenko & Gastner (2020).
  - We move beyond simple counting (binomial distribution null model) and examine the structural position of women using network centrality measures, ERGM and ALAAM.
- Methods innovations:
  - Open-source software for ERGM estimation, simulation and GoF for large bipartite networks is developed, and demonstrated on the ASX network, and a much larger (approx. 350 000 node) international director interlock network.
  - Open-source software for ALAAM estimation, simulation and GoF for large bipartite networks is developed, and used for testing the structural position of women in the ASX director interlock network.

A “token woman” hypothesis (Evtushenko & Gastner 2020)

- *“The probability that a woman joins the board has been shown to be negatively correlated with the number of women currently on the board and to increase when a woman departs the board [15]. The underlying assumption is that* ***companies tend to recruit “token women” (i.e. exactly one per board) from a limited pool of female candidates*** *[10,35].”*
- “***In this hypothesis, a woman is only added when there is currently no other woman on the board*** *[15,35]. With exactly one woman, the board satisfies a minimum criterion of diversity that reduces external pressure for greater female representation without seriously threatening the power of the “old-boys network”.* ***If the token woman hypothesis is true, there would be a higher proportion of boards with exactly one female board member than in the null model***.”

10. Dezső , C.L., Ross, D.G., Uribe, J.: Is there an implicit quota on women in top management? A large-sample statistical analysis. Strategic Manag. J. 37(1), 98–115 (2016)

15.Farrell, K.A., Hersch, P.L.: Additions to corporate boards: the effect of gender. J. Corp. Finance 11(1-2), 85–106 (2005)

35. Strydom, M., Yong, H.H.A.: The token woman. In: 25th Australasian Finance and Banking Conference (2012), available at http://dx.doi.org/10.2139/ssrn.2136737

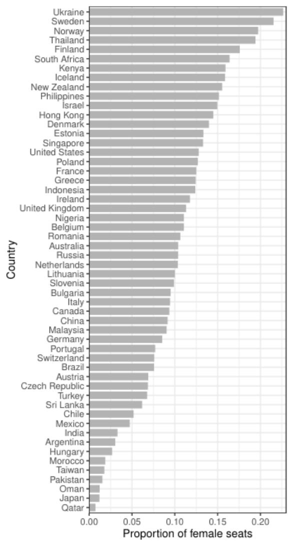


Fig. 3. Proportion of female seats by country.

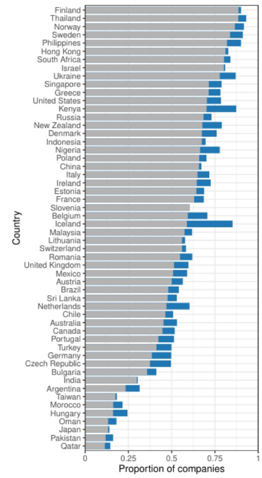


Fig. 4. Observed and predicted proportions of companies with at least one woman on their boards by country. The observed proportion is shown in grey. The predicted proportion is the combination of the grey and the blue bar. The prediction is calculated under the assumption that seats are taken by both genders independently given the observed proportion of female seats in each country (see text). The prediction is higher than the observed proportion in all cases except Slovenia, where the prediction is only slightly lower.

Evtushenko, A., Gastner, M.T. (2020). Beyond Fortune 500: Women in a Global Network of Directors. In: Cherifi, H., Gaito, S., Mendes, J., Moro, E., Rocha, L. (eds) Complex Networks and Their Applications VIII. COMPLEX NETWORKS 2019. Studies in Computational Intelligence, vol 882. Springer, Cham. https://doi.org/10.1007/978-3-030-36683-4_47

“This implies that women are generally more clustered than expected if they were distributed randomly, contradicting the token woman hypothesis.”

Data is from Financial Times database, Sept. 2016:

38. Thomson Reuters Corporation: Profiles and lists of directors of publicly traded companies. https://markets.ft.com/data/equities/results (2016), retrieved on 17 September 2016

Data source

- Data on the directors of all ASX listed companies from the Connect 4 Boardroom database (14 Sept., 2022; accessed via Swinburne subscription by Peng Wang).
- This is a Thomson Reuters commercial product, aggregating open source data from company annual reports, announcements to the ASX, etc.
- It includes director country, gender and age.
- I joined this with other open source data directly from the ASX (company directory [5 Oct. 2022], foreign entity report [Sept. 2022]) to get more company information: GICS industry group, listing date, market capitalization, foreign country incorporation.

Descriptive statistics

- Of the 9971 people, 1899 (19%) are women.
- Of the 13452 positions, 2784 (21%) are occupied by women.
- The proportion of companies with exactly one woman is 30%.
- The proportion of companies with at least one woman is 66%.

Table 4: Summary statistics of the director countries.

Country	N
Australia	8363
United States	512
New Zealand	285
United Kingdom	152
Canada	85
Singapore	82
China	80
Hong Kong	63
South Africa	49
(Other)	300

Table 5: Frequency of company countries of incorporation.

Country	N
Australia	1932
New Zealand	59
United States	20
Canada	14
Bermuda	10
United Kingdom	10
Singapore	8
Israel	6
Hong Kong	5
(Other)	23

Table 6: Frequency of company industry groups.

GICS industry group	N
Materials	790
Energy	145
Software and Services	144
Diversified Financials	100
Health Care Equipment and Services	91
Pharmaceuticals Biotechnology and Life Sciences	90
Capital Goods	81
Real Estate	76
(Other)	459
NA	111

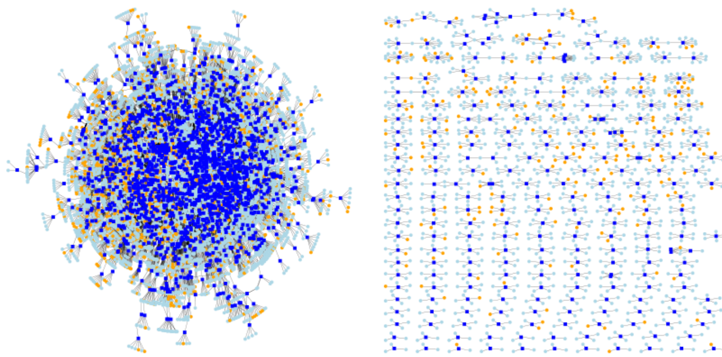


Figure 1: Visualization of the director interlock two-mode network. Companies are shown as blue squares, and directors as circles. Male directors are light blue and female directors orange. Visualization created using igraph (Csárdi and Nepusz, 2006) with layout by stress majorization (Gansner et al., 2004) implemented in the graphlayouts (Schoch, 2020) package in R.

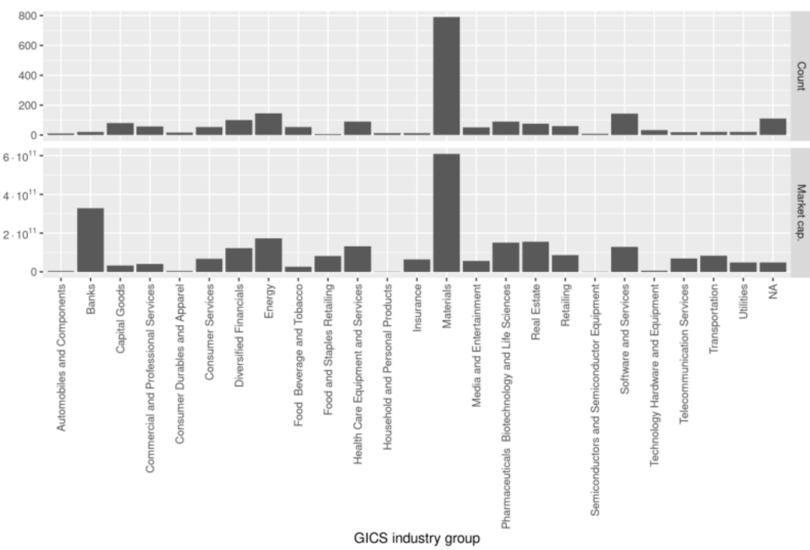
Table 1: Summary statistics of the bipartite direct interlock network, and of its one-mode projections.

Network	N	Components	Giant component %	Mean degree	Density	Clustering coefficient	Assortativity coefficient	Mean path length
bipartite	12058	212	86	2.23	0.0006464	—	-0.56418	12.39
person	9971	212	86	8.04	0.0008064	0.54785	0.02015	6.44
company	2087	212	88	6.10	0.0029246	0.61654	0.76826	5.68

Note degree in the bipartite network includes both modes (for people, number of boards they sit on, for companies, board size), so mean not meaningful. Negative assortativity indicates board size is negatively correlated with number of boards its members are on (large boards tend to have people who sit on few boards; small boards tend to have people who sit on many boards).

This is the only time we consider one-mode projections; all network statistics and models use the original two-mode (bipartite) network.

Frequency and total market capitalization of GICS industry groups



Board size distribution

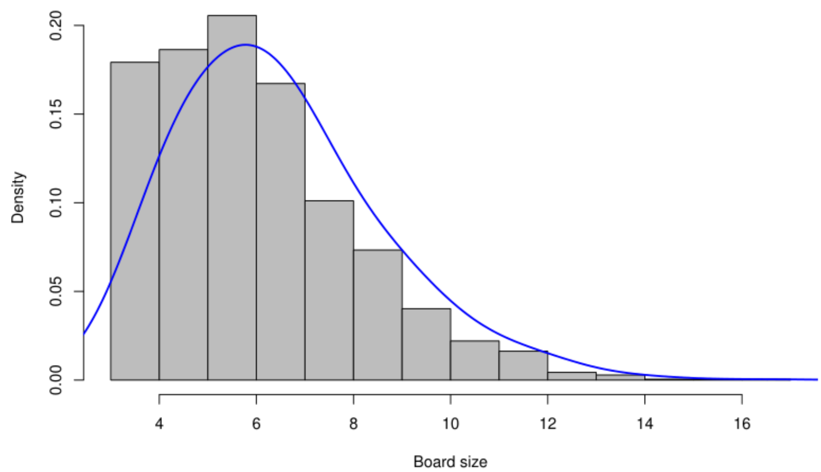
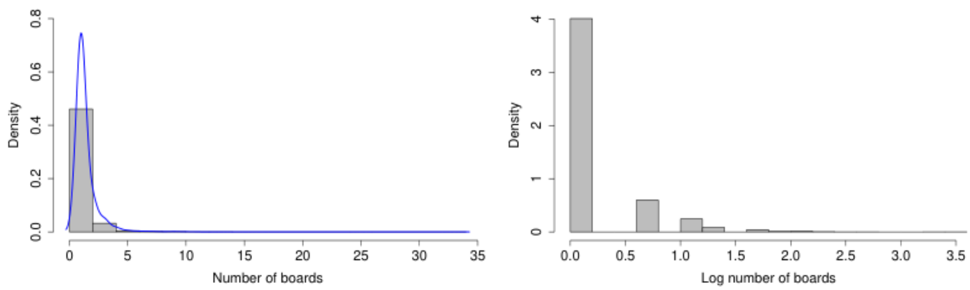


Figure 3: Board size distribution. The definition of a company “board” here is not limited to directors as legally defined but includes company secretaries and senior executives.

Distribution of the number of boards per director



Market capitalization distribution

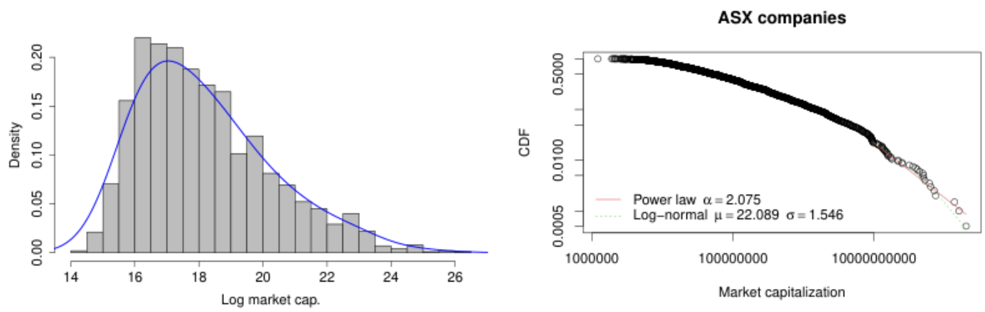


Figure 6: Left: histogram and kernel density estimate of the logarithm of market capitalization of the companies. Right: Empirical cumulative density function (CDF), and power law and log-normal distributions fitted to the market capitalization distribution using the methods of Clauset et al. (2009); Vuong (1989) implemented in the poweRlaw package (Gillespie, 2015). The tail of the distribution ($x_{min} = 9.87 \times 10^9$) is consistent with both a power law and log-normal distribution, and neither can be preferred over the other.

Distributions of the number of women per board and proportion of women per board

Skewed Sex Ratios and Token Women

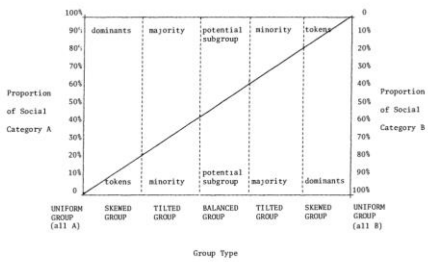


FIG. 1.—Group types as defined by proportional representation of two social categories in a membership.

Kanter (1977), p. 967

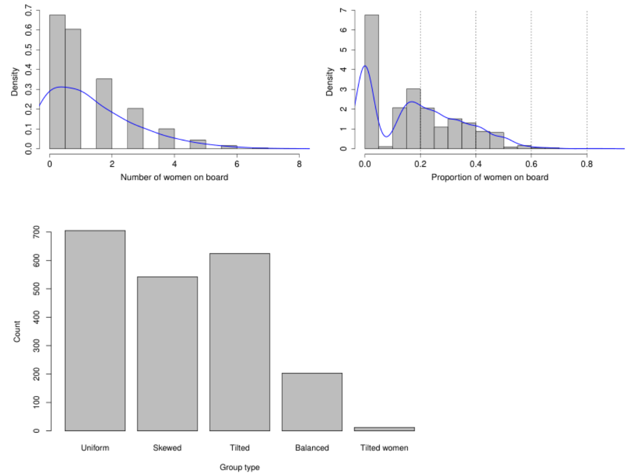


Figure 7: Distributions of the number of women per board and proportion of women per board. Dotted vertical lines on the top right plot show the divisions into group types defined by the proportion of women, according to the scheme of Kanter (1977). The bar plot at the bottom shows the counts of each of the group types. There are no instances of boards with more than 80% women (no Skewed or Uniform women groups).

Age distribution of directors by gender

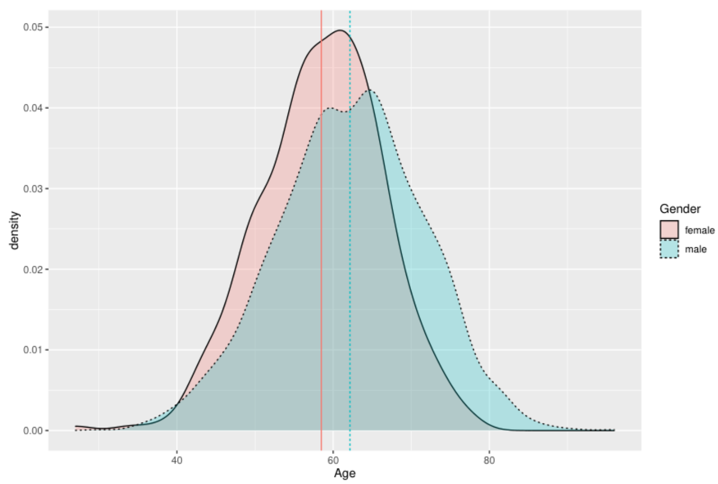
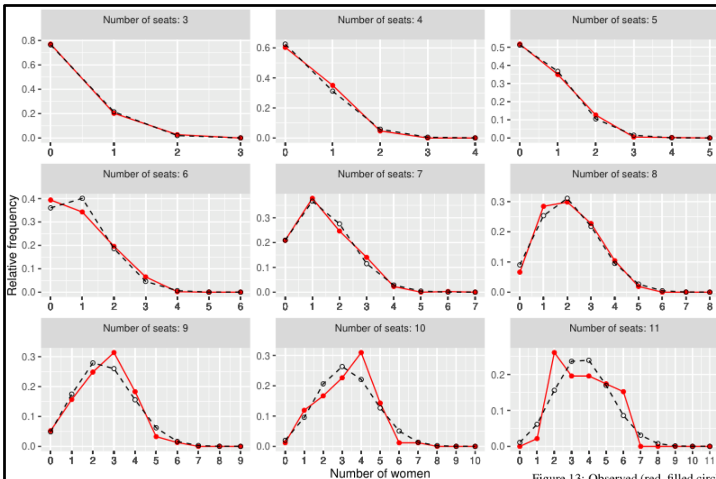


Figure 8: Age distribution of directors by gender. The means are shown by vertical lines. The mean age for women is 58.48 and for men is 62.15. The null hypothesis that the means are equal is rejected by Welch's t-test ($p < 0.001$).



- If the “token woman” hypothesis were true, we would expect an over-representation of boards with exactly one woman.
- But when we use the binomial distribution as the null model (separately for each board size, since we saw proportion of women is correlated with board size),
- There is no significant difference between observed and expected relative frequencies of boards with exactly one woman,
- Except in the case of boards of size 6, where the observed relative frequency of boards with exactly one woman is *lower* than expected.

Figure 13: Observed (red, filled circles, solid lines) and expected (black, empty circles, dashed lines) relative frequencies of each number of women on each board size from three to eleven. The expected relative frequencies are under the binomial null model. This is the binomial distribution probability mass function (PMF) for each board size n, $\Pr(X = k) = \binom{n}{k} p_n^k (1 - p_n)^{n-k}$, where $k \in \{0, 1, \ldots, n\}$ and p_n is the observed relative frequency of women on boards of size n. The sample sizes are too small to reliably use Pearson's χ^2 test, however it can be observed that the fits appear to quite good, at least until the board sizes get to be large, for which the data is increasingly sparse. For the particular case of exactly one woman on a board, we use the exact binomial test to test the null hypothesis that the observed relative frequency is equal to that expected under the null model, and we cannot reject this at the conventional 0.05 significance level in any case except that of a board of six seats, where the observed relative frequency 0.34 is significantly less than the expected 0.40 ($p < 0.05$). Because these are discrete distributions, only the points are meaningful, the lines are provided only as a visual aid.

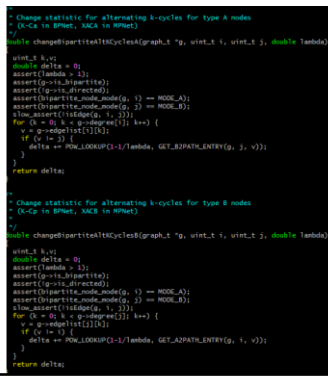
Under the binomial distribution null model, the proportion of companies with exactly one woman is expected to be 36%. Under the Evtushenko and Gastner (2020) null model, the proportion of companies with at least one woman is expected to be 75%. The observed figures are 30% and 66%, respectively. Hence this provides no evidence for the “token woman” hypothesis. However because the proportion (and not just number) of women on a board is positively correlated with the board size (see Fig. 11), it is more useful to fit models conditional on board size (Fig. 13), which shows that the binomial distribution null model provides no evidence for (or against) the “token woman” hypothesis, except in the case of boards with six seats, in which the observed data has statistically significantly fewer boards with exactly one woman than expected, providing evidence against the “token woman” hypothesis in this case. It is notable that this is for boards of size six, as this is the modal (and median) board size.

Moving beyond counting

- So far, we have just looked at counts (or proportions) of women in the network.
- But what about their structural positions?
  - Are women more, or less, central in the network than men?
  - Do women tend to be associated with particular industries, or larger or smaller companies?
- We will use some more advanced models to answer these questions.

Software for large bipartite ERGM and ALAAM

- ERGM: https://github.com/stivalaa/EstimNetDirected
- ALAAM: https://github.com/stivalaa/ALAAMEE



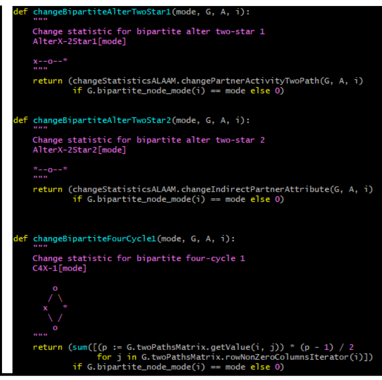


Table 7: ERGM parameter estimates for the bipartite director interlock network.

Effect	Model 1	Model 2	Model 3	Model 4
Edge	−2.135 (−2.352,−1.918)	−2.100 (−2.289,−1.911)	−1.923 (−2.121,−1.726)	−4.248 (−4.333,−4.162)
BipartiteAltStarsA ($\lambda = 1.1$)	−4.579 (−5.525,−3.633)	−5.115 (−6.196,−4.035)	−5.115 (−6.267,−3.963)	−5.157 (−6.471,−3.843)
BipartiteAltStarsB ($\lambda = 5$)	−0.361 (−0.916,0.193)	−0.069 (−1.038,0.900)	−0.072 (−1.102,0.957)	−0.399 (−1.413,0.614)
BipartiteAltKCyclesB ($\lambda = 5$)	0.015 (−0.134,0.165)	−0.290 (−0.608,0.028)	−0.312 (−0.643,0.019)	−0.096 (−0.416,0.224)
BipartiteActivityA female	—	0.007 (−0.649,0.664)	0.225 (−0.528,0.977)	0.259 (−0.606,1.124)
BipartiteContinuousActivityA age	—	0.012 (0.006,0.018)	0.012 (0.006,0.018)	0.012 (0.005,0.019)
BipartiteActivityA notAustralia	—	0.263 (−0.246,0.773)	0.272 (−0.246,0.789)	0.868 (0.669,1.066)
BipartiteTwoPathMatchingA country	—	0.319 (0.194,0.445)	0.321 (0.196,0.445)	0.108 (−0.054,0.270)
BipartiteTwoPathMatchingA gender	—	−0.129 (−0.284,0.026)	−0.125 (−0.290,0.040)	−0.110 (−0.302,0.082)
BipartiteActivityB industryGroup.Materials	—	—	−0.149 (−0.537,0.240)	−0.179 (−0.638,0.280)
BinaryPairInteraction gender.F industryGroup.Materials	—	—	−0.669 (−1.448,0.110)	−0.620 (−1.505,0.266)
BipartiteActivityB industryGroup.Banks	—	—	—	0.445 (−1.323,2.212)
BinaryPairInteraction gender.F industryGroup.Banks	—	—	—	0.515 (−2.054,3.084)
BipartiteActivityB notAustralia	—	—	—	1.889 (0.829,2.949)
BinaryPairInteraction gender.F notAustralia	—	—	—	0.047 (−0.643,0.736)
BipartiteContinuousActivityB ListingYear	—	—	—	0.000 (−0.001,0.001)
BipartiteContinuousActivityB logMarketCap	—	—	—	0.070 (0.010,0.131)
Matching country	—	—	—	2.196 (1.090,3.302)
Converged runs	100	100	100	100
Total runs	100	100	100	100

Mode A is people, mode B is companies.

- Positive BipartiteContinuousActivityA age: Older directors tend to be on more boards.
- Positive BipartiteActivityA notAustralia: Directors resident in countries other than Australia tend to be on more boards.
- Positive BipartiteTwoPathMatchingA country: Directors on a board tend to be from the same country.
- Positive BipartiteActivityB notAustralia: Foreign incorporated company boards tend to have more directors.
- Positive BipartiteContinuousActivityB logMarket Cap: Larger market cap. Is associated with larger boards.
- Positive Matching country: directors tend to be resident in the same country as the country of incorporation of the boards they sit on.
- No significant effects for gender:
    - BipartiteTwoPathMatchingA gender --- gender homophily on boards --- is negative but not significant.
    - BinaryPairInteraction gender.F industryGroup.Materials --- women directors tendency to be on Materials industry group boards --- is negative but not

signif.

- BinaryPairInteraction gender.F industryGroup.Banks --- women directors tendency to be on bank boards --- is positive but not signif.
- BinaryPairInteraction gender.F notAustralia --- women directors tendency to be on foreign incorporated company boards --- is positive but not signif.

ERGM estimation for Evtushenko & Gastner data

Parameter	Estimate	Std Error	
Edge	-10.3903	0.2757	*
BipartiteAltStarsB.5.	0.4660	0.0472	*
IsolateEdges	-0.0864	0.2574	
BipartiteAltStarsA.5.	-2.6763	0.2562	*
BipartiteActivityA_female	0.0511	0.1069	
BipartiteContinuousActivityA_age	0.0053	0.0025	*
BipartiteActivityB_industry.Personal.Goods	0.2082	0.0938	*
BipartiteActivityB_sector.Oil.and.Gas	-0.0118	0.0167	
BinaryPairInteraction_gender.Male_industry.Personal.Goods	-0.3871	0.1560	*
BinaryPairInteraction_gender.Female_sector.Oil.and.Gas	-0.1021	0.1221	
TotalRuns	20		
ConvergedRuns	20		

```
num_Persons =   321869
num_Companies =  34769
```

Mode A is people, mode B is companies.

- Positive BipartiteContinuousActivityA_age: older directors tend to be on more boards (just as for ASX data).
- Positive BipartiteActivityB_industry.Personal.Goods: companies in Personal Goods industry tend to have larger boards.
- Negative BinaryPairInteraction_gender.Male_industry.Personal.Goods: men are less likely to be on boards in Personal goods industry.
- BinaryPairInteraction_gender.Female_sector.Oil.and.Gas (and its control BipartiteActivityB_sector.Oil.and.Gas) are both negative but not significant. (BipartiteActivityA_female is positive but not significant).

Table 8: ALAAM parameter estimates for the bipartite director interlock network.

Effect	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	
bipartiteDensityA	−1.359 (0.031)	−1.715 (0.074)	−1.770 (0.086)	−1.888 (0.099)	−3.830 (0.510)	−1.749 (0.084)	
bipartiteActivityA	—	—	−0.977 (0.311)	−0.960 (0.319)	0.501 (0.483)	−0.974 (0.326)	
bipartiteEgoTwoStarA	—	—	0.028 (0.024)	0.051 (0.026)	−0.084 (0.035)	0.031 (0.025)	
bipartiteEgoThreeStarA	—	—	−0.004 (0.002)	−0.006 (0.002)	0.003 (0.003)	−0.004 (0.002)	
bipartiteAlterTwoStar1A	—	—	0.183 (0.017)	0.189 (0.018)	0.118 (0.023)	0.183 (0.018)	x--o--*
bipartiteAlterTwoStar2A	—	—	−0.136 (0.031)	−0.137 (0.030)	−0.140 (0.031)	−0.141 (0.033)	*--o--*
bipartiteFourCycle1A	—	—	−0.010 (0.022)	−0.026 (0.020)	−0.027 (0.021)	−0.008 (0.022)	
bipartiteFourCycle2A	—	—	−0.018 (0.051)	−0.009 (0.046)	0.004 (0.048)	−0.020 (0.049)	
Ego age	−0.008 (0.001)	−0.011 (0.001)	−0.014 (0.001)	−0.014 (0.001)	−0.014 (0.001)	−0.014 (0.001)	
Ego notAustralia	0.285 (0.065)	0.235 (0.096)	0.173 (0.092)	0.175 (0.095)	0.154 (0.095)	0.179 (0.092)	
Alter industryGroup.Materials	—	−0.320 (0.042)	−0.268 (0.052)	−0.262 (0.049)	−0.271 (0.050)	−0.275 (0.050)	
Alter industryGroup.Banks	—	0.443 (0.160)	0.160 (0.177)	0.152 (0.186)	0.182 (0.179)	0.168 (0.187)	
Alter logMarketCap	—	0.068 (0.005)	0.040 (0.007)	0.041 (0.008)	0.038 (0.007)	0.040 (0.007)	
Alter ListingYear	—	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)	
Alter notAustralia	—	0.257 (0.082)	0.196 (0.089)	0.182 (0.091)	0.203 (0.087)	0.211 (0.087)	
Mismatching country	—	−0.124 (0.080)	−0.178 (0.082)	−0.181 (0.086)	−0.170 (0.082)	−0.178 (0.084)	
Ego betweenness.scaled	0.185 (0.033)	0.017 (0.049)	—	−0.164 (0.077)	—	—	
Ego birank.scaled	—	—	—	—	−1.772 (0.431)	—	
Ego harmonic.cent.scaled	—	—	—	—	—	0.041 (0.034)	

- Negative bipartiteAlterTwoStar2A suggests that there is a significant tendency against a board having two women; a tendency *against* "contagion" (multiple women on same board). In conjunction with positive bipartiteAlterTwoStar1A might be considered evidence *for* the "token woman" hypothesis: there is a tendency towards a board having a woman, but against having an additional woman.
- Negative Ego age: women directors tend to be younger than male directors (just as in descriptive statistics).
- Negative Alter industryGroup.Materials: Women directors less likely to be on boards in Materials industry group (note: includes mining).
- Positive Alter industryGroup.Banks (only signif. In Model 1): Women directors more likely to be on bank boards.
- Positive Alter logMarketCap: Women directors tend to be on boards of companies with larger market capitalization.
- Positive Alter notAustralia: Women directors are more likely to be on boards of foreign incorporated companies.
- Negative Mismatching country: Women directors tend not to be on boards with directors of a different nationality.

Note that Ego betweenness is positive and signif. In Model 1 (no structural effects), consistent with descriptive statistics (in hidden bonus slides) that mean betweenness centrality is higher for women than men; however in Model 4 (includes structural effects), is becomes negative and signif: once we control for these structures (including those just described suggesting support for "token woman" hypothesis) women are associated with *less* central positions (with betweenness centrality mesasure).

For BiRank centrality, women are also associated with less central positions (Model 5, Ego.birank negative and signif.); this is also the case with simple descriptive statistics (median and mean are both lower for women than for men ($p < 0.001$ Wilcoxon rank sum test with continuity correction [hidden bonus slides]).

ALAAM "outcome" binary variable is female on mode A (directors; mode B is companies). The values in parentheses are the estimated standard errors. Values in light gray are not statistically significant at the conventional 0.05 significance level. The models were estimated by stochastic approximation with the ALAAMEE software. Centrality measures were centered around their means and scaled by their standard deviations when used as nodal attributes in the ALAAM estimation.

Conclusions (1)

- We constructed a director interlock network for all companies listed on the ASX, and examined descriptive statistics related to the distribution of women directors.
- Using the binomial distribution null model, we find no evidence for the “token woman” hypothesis in Australian listed companies.
  - For boards of size six (the modal and median size) only, this model provides evidence *against* the hypothesis.
- We estimated bipartite ERGM models for the Australian listed company director interlock network (2 087 companies, 9 971 directors), and the Evtushenko & Gastner (2020) international director interlock network (321 869 directors, 34 769 companies).
  - Most parameters related to gender were not statistically significant.
  - But in the international director network, men are less likely to be on boards in Personal goods industry.

Conclusions (2)

- We estimated bipartite ALAAM models (dependent variable: female on director node) for the ASX director interlock network.
  - These models suggest there is a tendency towards a board having a woman, but against having an additional woman: evidence for the token woman hypothesis.
  - Also confirms several hypotheses about the structural positions of women in the Australian listed company director interlock network:
    - Female directors tend to be younger than male directors.
    - Female directors are less likely to be on boards in Materials industry group.
    - Female directors more likely to be on bank boards.
    - Female directors tend to be on boards of companies with larger market capitalization.
    - Female directors are more likely to be on boards of foreign incorporated companies.
    - Female directors are associated with less central positions in the director interlock network.

Slides and software availability

- This is unpublished work (as of June 2023).
- Some more details, and references, are in the “hidden bonus slides” after this one.
- I will make these slides available on my website:
  - https://sites.google.com/site/alexdstivala/home/conferences
- The software for large bipartite ERGM and ALAAM estimation is available from:
  - ERGM: https://github.com/stivalaa/EstimNetDirected
  - ALAAM: https://github.com/stivalaa/ALAAMEE
- Unfortunately, data cannot be made publicly available as it contains data from a commercial Thomson-Reuters database.

Hidden bonus slides

Aust. gender equality / diversity guidelines

ASX Corporate Governance Council

Recommendation 1.5

A listed entity should:

(a) have and disclose[29] a diversity policy;

(b) through its board or a committee of the board[30] set measurable objectives for achieving gender diversity in the composition of its board, senior executives and workforce generally; and

If the entity was in the S&P/ASX 300 Index at the commencement of the reporting period, the measurable objective for achieving gender diversity in the composition of its board should be to have not less than 30%[32] of its directors[33] of each gender within a specified period.

ASX Corporate Governance Council *Corporate Governance Principles and Recommendations* 4th Edition February 2019 https://www.asx.com.au/documents/asx-compliance/cgc-principles-and-recommendations-fourth-edn.pdf

Australian Government | Workplace Gender Equality Agency

"The Workplace Gender Equality Act 2012 requires non-public sector employers with 100 or more employees to submit a report to the Workplace Gender Equality Agency."

"Organisations tendering for government contracts may need to satisfy a requirement to be compliant with the *Workplace Gender Equality Act 2012*."

https://www.wgea.gov.au/what-we-do/reporting [accessed 30 Nov 2022]

Board diversity statistics

At the Australian Institute of Company Directors we believe that we have a leadership role to play to improve board gender diversity, both at home and internationally.

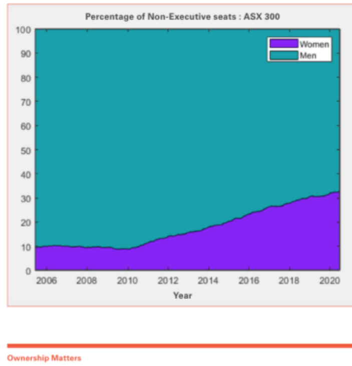
We collect the latest statistics, interviews, opinion pieces and case studies from individuals and companies that are on the path to increasing the gender diversity of their boardrooms and executive pipelines.

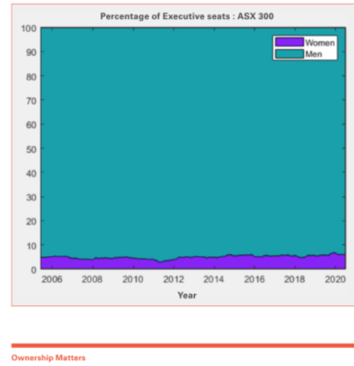
Women on ASX 200 Boards* (at 30 November 2021)

- The latest percentage of women on ASX 200 boards is **34.2%**
- Women comprised **41.8%** of new appointments to ASX 200 boards
- There are no boards in the ASX 200 without women

As at 30 November 2021:

https://www.aicd.com.au/about-aicd/governance-and-policy-leadership/board-diversity/Board-diversity-statistics.html





Ownership Matters (2020) Many are called, few are chosen: an analysis of the composition of ASX 300 boards from 2005–2020. Available from https://ownershipmatters.com.au/media/dlm_uploads/Many-are-called_few-are-chosen-Oct-2020.pdf (accessed 2 November, 2022).

Women in leadership

Latest results from the Agency's 2020-21 dataset show:

- Women hold 17.6% of chair positions and 31.2% of directorships [18], and represent 19.4% of CEOs and 34.5% of key management personnel. [19]
- 22.3% of boards and governing bodies have no female directors. [20] By contrast, only 0.6% had no male directors. [21]

Statistics from the Australian Institute of Company Directors reveal:

- 34.2% of directors in the ASX 200 are women, as of 30 of November 2021. [21]
- Women comprised 41.8% of new appointments to ASX 200 boards as of 30 November 2021. [22]

https://www.wgea.gov.au/publications/gender-equality-workplace-statistics-at-a-glance-2022#women-in-leadership

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JOURNAL

Restricted access | Research article | First published online October 26, 2016

A few good (wo)men? Gender diversity on Australian boards

Maria Strydom, Hue Hwa Au Yong, and Michaela Rankin View all authors and affiliations

Volume 42, Issue 3 | https://doi.org/10.1177/0312896216657579

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Abstract

This article examines the relation between gender diversity and earnings quality for Australian firms from 2005 to 2013. We draw on the work of Kanter, highlighting the importance of the proportion of women on the board when measuring diversity. We show that all-male and skewed boards have lower earnings quality while that of tilted and balanced boards is higher. In addition, a critical mass of women is achieved when some 30% of directors are females. Performance and risk do not influence the relation. We contribute by presenting evidence supporting critical mass theory. Furthermore, our work adds to the recent debate on whether the association between gender diversity and earnings quality is U-shaped, rather than linear. Our results have implications for regulation and practice. We identify the need for a critical mass of women, rather than tokens, to enhance earnings quality.

Some Effects of Proportions on Group Life: Skewed Sex Ratios and Responses to Token Women[1]

Rosabeth Moss Kanter
Yale University and Harvard Law School

Proportions, that is, *relative* numbers of socially and culturally different people in a group, are seen as critical in shaping interaction dynamics, and four group types are identified on the basis of varying proportional compositions. "Skewed" groups contain a large preponderance of one type (the numerical "dominants") over another (the rare "tokens"). A framework is developed for conceptualizing the processes that occur between dominants and tokens. Three perceptual phenomena are associated with tokens: visibility (tokens capture a disproportionate awareness share), polarization (differences between tokens and dominants are exaggerated), and assimilation (tokens' attributes are distorted to fit preexisting generalizations about their social type). Visibility generates performance pressures; polarization leads dominants to heighten their group boundaries; and assimilation leads to the tokens' role entrapment. Illustrations are drawn from a field study in a large industrial corporation. Concepts are extended to tokens of all kinds, and research issues are identified.

Source: American Journal of Sociology , Mar., 1977, Vol. 82, No. 5 (Mar., 1977), pp. 965-990

Note the suggestion of Joecks et al. (2013) confirmed by Strydom et al. (2017) in the Australian context, that there is a "critical mass" (Kanter, 1977) of about 30% women on a board, after which point higher firm performance is achieved.

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'Network contagion' is key to getting healthier numbers of women on company boards

Published: July 11, 2018 4.13pm AEST

When women make up 30% of boards that's when it starts having an impact. Mavis Wong, CC BY-SA

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Female representation of 30% on a company board is the tipping point at which it stops being tokenistic and begins to make a difference on things like innovation.

Norway, France and Sweden have already achieved this target for companies overall. In Australia, the ambition was to do so in 2018. At this stage, that looks unlikely. This suggests it is time to consider more surgical policies to increase female board membership.

Read more: *Company boards are stacked with friends of friends so how can we expect change?*

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https://theconversation.com/network-contagion-is-key-to-getting-healthier-numbers-of-women-on-company-boards-99600

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Company boards are stacked with friends of friends so how can we expect change?

Published: May 4, 2018 6.23am AEST

The use of closed networks in the recruitment and selection of board members creates other problems. BEN MACMAHON/AAP

Author

Dr Sherene Smith
PhD student, RMIT University

Disclosure statement

Dr Sherene Smith does not work for, consult, own shares in or receive funding from any company or organisation that would benefit from this article, and has disclosed no relevant affiliations beyond their academic appointment.

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Social connections drive board appointments and more than two-thirds of directors in the 200 largest public companies are on the board of multiple companies. So whoever replaces ex-AMP chairwoman Catherine Brenner will likely be drawn from a small pool of people.

https://theconversation.com/company-boards-are-stacked-with-friends-of-friends-so-how-can-we-expect-change-95790

International Conference on Complex Networks and Their Applications
↳ COMPLEX NETWORKS 2019: **Complex Networks and Their Applications VIII** pp 586–598

Beyond Fortune 500: Women in a Global Network of Directors

Anna Evtushenko & Michael T. Gastner

Conference paper | First Online: 25 November 2019

Part of the Studies in Computational Intelligence book series (SCI,volume 882)

Abstract

In many countries, the representation of women on corporate boards of directors has become a topic of intense political debate. Social networking plays a crucial role in the appointment to a board so that an informed debate requires knowing where women are located in the network of directors. One way to quantify the network is by studying the links created by serving on the same board and by joint appointments on multiple boards. We analyse a network of ≈**320 000** board members of **36 000** companies traded on stock exchanges all over the world, focusing specifically on the position of women in the network. Women only have ≈9–13% of all seats, but they are not marginalised. Applying metrics from social network analysis, we find that their influence is close to that of men. We do not find evidence to support previous claims that women play the role of "queen bees" that exclude other women from similar positions.

Research | Open Access | Published: 06 July 2022

Net effects: examining strategies for women's inclusion and influence in ASX200 company boards

Deb Verhoeven, Katarzyna Musial, Gerhard Hambusch, Samir Ghannam & Mikhail Shashnov

Applied Network Science **7**, Article number: 48 (2022) | Cite this article

Abstract

Conventional approaches to improving the representation of women on the boards of major companies typically focus on increasing the number of women appointed to these positions. We show that this strategy alone does not improve gender equity. Instead of relying on aggregate statistics ("headcounts") to evaluate women's inclusion, we use network analysis to identify and examine two types of influence in corporate board networks: local influence measured by degree centrality and global influence measured by betweenness centrality and k-core centrality. Comparing board membership data from Australia's largest 200 listed companies in the ASX200 index in 2015 and 2018 respectively, we demonstrate that despite an increase in the number of women holding board seats during this time, their agency in terms of these network measures remains substantively unchanged. We argue that network analysis offers more nuanced approaches to measuring women's inclusion in organizational networks and will facilitate more successful outcomes for gender diversity and equity.

Data cleaning and checking

- I removed the ASX test company TES.
- I verified that all companies have at least 3 directors, as required by the Corporations Act.
- The Connect 4 Boardroom data codes director age as age (rather than year of birth). For 10 occurrences where this had clearly been coded incorrectly as year of birth (e.g., 1965), I subtracted it from 2022 to convert it to age.
- There is a lot of missing data for age (75% missing), but no missing data for gender.
- I selected two prominent companies in the top ten ASX companies (CSL and WBC), and 3 randomly selected companies (TAR, YRL, and SRJ) and manually checked the Connect 4 information against company websites and annual reports.
    - Consistent with the domination of the ASX by mining companies, 2 of these 3 randomly chosen companies are mining companies (and the 3rd is in in the oil & gas sector).

Definition of "director" in this work

- The data is from the Connect 4 Boardroom database (Thomson Reuters).
- The definition of "director" in this data, is not necessarily the same as the legal definition.
- It includes company secretaries, and certain key management personnel.
- People who are legally company directors and secretaries, plus those whose appointments are significant enough that they must be reported to the stock exchange and in annual reports.
  - I claim that this more inclusive definition is more useful for work involving power and influence in the corporate interlock network, as it includes for example CEOs, CFOs, etc. – who may or may not be actual directors (so would in many cases be excluded if only actual directors are included), but who are inarguably powerful and/or influential.
  - Company secretary is more arguable, but under the Corporations Act they are company officers responsible for ensuring the company's legal obligations are met. Company secretaries are responsible for organizing board meetings and liasing with regulators, so it is an important role.
  - This data also means the information is legally required and consistently defined, not relying on statements from company representatives or executives…

Note potential problem with including company secretaries: there are firms that provide corporate governance services, such as providing company secretaries, and so a company secretary from such a firm can end up being the secretary for many firms, and therefore being very central in the network.

But as noted, is an important role. See e.g. Robertson 2018 "THE ROLE OFTHE COMPANY SECRETARY: INFLUENCE, IMPACT AND INTEGRITY" AICD https://www.aicd.com.au/content/dam/aicd/pdf/tools-resources/bookstore/previews/Role-of-Company-Secretary-preview.pdf

Example: TAR

About TAR

Taruga Minerals Limited is a mineral exploration company with a focus on acquiring and developing highly prospective exploration projects in Australia and overseas.

Directors / Senior management

Mr Thomas Line
CEO

Mr David Chapman
Non Exec. Director

Mr Paul Cronin
Non Exec. Director

Mr Gary Steinepreis
Non Exec. Director

Mr Eric de Mori
Non Exec. Director

Secretaries

Mr Dan Smith
Company Secretary

https://www2.asx.com.au/markets/company/tar [accessed 22 Oct. 2022]

COMPANY INFORMATION

TARUGA

ACN	153 868 789	
Directors	Gary Steinepreis	Non-Executive Director
	Paul Cronin	Non-Executive Director
	Eric de Mori	Non-Executive Director
	David Chapman	Non-Executive Director
CEO	Thomas Line	
Company Secretary	Daniel Smith	
Registered Office	Level 8, 99 St Georges Terrace Perth, WA 6000	
	Telephone:	+61 8 9486 4036
	Facsimile:	+61 8 9486 4799
Share Registry	Automic Group Level 2, 267 St Georges Terrace Perth, WA 6000	
	Telephone:	1300 288 664
	Facsimile:	+61 2 8583 3040
Auditor	HLB Mann Judd (WA Partnership) Level 4, 130 Stirling Street Perth, WA 6000	
	Telephone:	+61 8 9227 7500
	Facsimile:	+61 8 9227 7533
Bankers	Westpac Banking Corporation 116 James Street Northbridge Perth, WA 6000	
Securities Exchange Listing		
	Taruga Minerals Limited Shares are listed on the Australian Securities Exchang The home exchange is Perth, Western Australia. ASX Code: TAR	
Website	www.tarugaminerals.com.au	

Taruga Minerals Limited Page 3

TARUGA
ANNUAL REPORT 2022

Example of company secretary issue: Dan Smith works for (in fact is "Commercial Director" of) a firm called Minerva Corporate, which provides company secretarial and other listed company compliance services (https://www.minervacorporate.com.au/). According to his LinkedIn profile (https://au.linkedin.com/in/dan-smith-60a1b930, accessed 29 Nov. 2022), Dan Smith is the secretary of 8 companies and a director of 9 (some of these also secretary). (Note these companies are not all necessarily listed on the ASX). He is a director or secretary of 11 companies in the Connect 4 Boardroom data.

TAR is smaller than a "small cap", perhaps rather a "microcap" or even "nanocap" (or more derogatory, "penny stock") – market cap. approx. $17 million (5 Oct. 2022).

Other things to note: This board is all-male, the CEO is not listed as a director, and there is no Chair identified (under the Corporations Act a board meeting must have a Chair, who must be a director – there need not necessarily be an ongoing elected Chair, the Chair can be elected for a meeting, see s. 248E [replacable rule] Corporations Act (2001) Cth).

Table 2: Summary statistics of the company data. Market capitalization is in (millions of) Australian dollars.

Statistic	N	Mean	St. Dev.	Min	Max
Listing year	2074	2007.391	13.029	1885.000	2022.000
Market cap (millions)	1993	1268.087	8093.617	0.000	202987.400
Log market cap	1992	18.162	2.056	14.013	26.036
Degree centrality	2087	6.446	2.106	3	17
BiRank centrality	2087	0.0004	0.00003	0.0003	0.0004
Betweenness centrality	2087	156209.900	181628.800	1	1961618
Harmonic centrality	2087	850.706	336.117	3	1297

Betweenness centrality (Freeman, 1977, 1978; Brandes, 2001) and harmonic centrality (Marchiori and Latora, 2000) were computed with the igraph (Csárdi and Nepusz, 2006) package in R. BiRank centrality (He et al., 2017) was computed using the birankr (Yang et al., 2020; Aronson and Yang, 2020) package in R. This table was created using the stargazer (Hlavac, 2018) package in R.

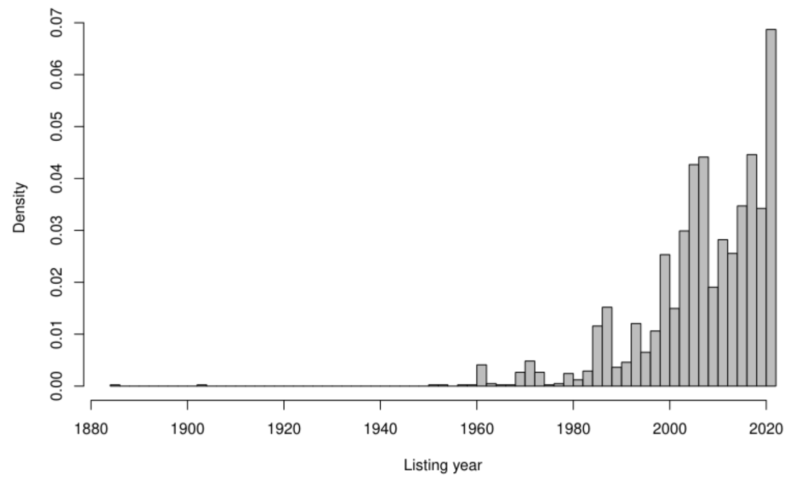
Table 3: Summary statistics of the director data.

Statistic	N	Mean	St. Dev.	Min	Max
Age	2491	61.613	9.168	27.000	96.000
Degree centrality	9971	1.349	1.004	1	33
BiRank centrality	9971	0.0001	0.00004	0.0001	0.001
Betweenness centrality	9971	29174.180	134701.600	0	5924699
Harmonic centrality	9971	768.565	325.553	2.000	1409.794

Betweenness centrality (Freeman, 1977, 1978; Brandes, 2001) and harmonic centrality (Marchiori and Latora, 2000) were computed with the igraph (Csárdi and Nepusz, 2006) package in R. BiRank centrality (He et al., 2017) was computed using the birankr (Yang et al., 2020; Aronson and Yang, 2020) package in R. This table was created using the stargazer (Hlavac, 2018) package in R.

Note there is a lot of missing data for age (75% missing). Importantly, however, there is no missing data for gender.

Listing year distribution



The oldest company is BHP (1885). The second oldest is SOL, Washington H Soul Pattinson (1903), originally a Sydney pharmacy, now an investment company.

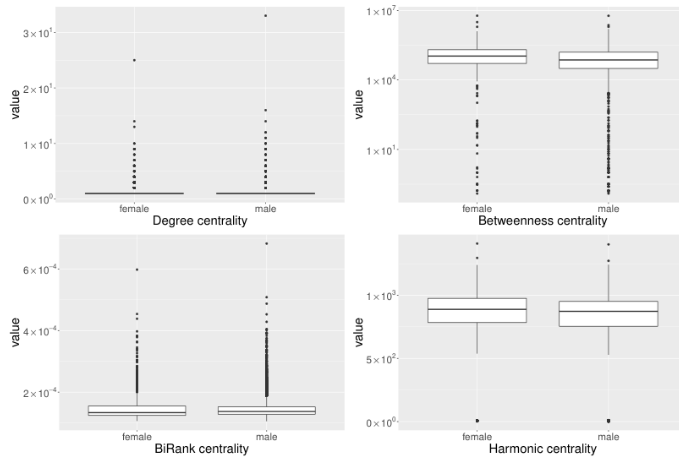


Figure 9: Box plots of centrality of directors by gender. Betweenness centrality is shown on a log scale. Whiskers extend to the most extreme data point within 1.5 times the interquartile range from the box. The null hypothesis that the distributions for the two genders are the same is rejected ($p < 0.001$) for all four centrality measures using the Wilcoxon rank sum test with continuity correction. Mean degree centrality (the number of boards on which a director sits) is higher for women (1.466) than for men (1.322) although in both cases the median is 1. Mean betweenness centrality is higher for women than for men, although in both cases the median is 0. Both mean and median harmonic centrality are higher for women than for men. The exception is BiRank centrality, for which both the median and mean are lower for women than for men.

Evtushenko & Gastner (2020) find that:

“In terms of degree and betweenness centrality statistics, women are doing marginally better than men (Table 2). The distributions of degree and betweenness centrality by gender are not normal but instead seem to follow power laws. We normalise them by log-transforming the data and restricting our sample to the largest component and nodes with the parameter of interest > 0. The two- sample t-test for degree concludes that the marginal difference between men and women is statistically significant (p-value < 0.0001). The difference in the betweenness centrality is not statistically significant at a significance level of 0.05 (p-value 0.068).”

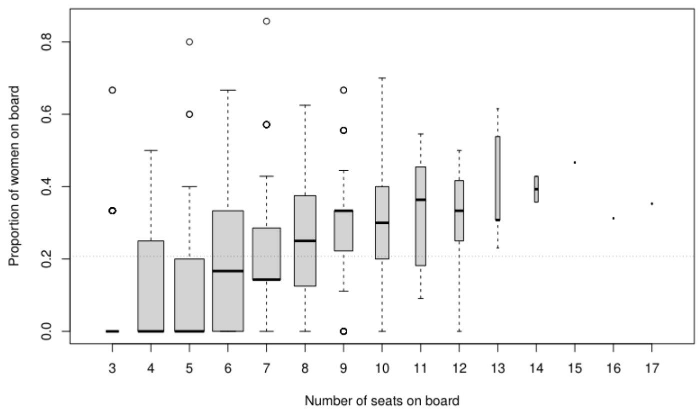


Figure 10: Box plots of the proportion of women on a board, for each board size. Whiskers extend to the most extreme data point within 1.5 times the interquartile range from the box. The dotted horizontal line shows the overall proportion of positions occupied by women. The box widths are proportional to the square root of the number of observations. For boards of size 11 or larger, the data becomes very sparse: there are fewer than 10 data points for each (see also Fig. 3).

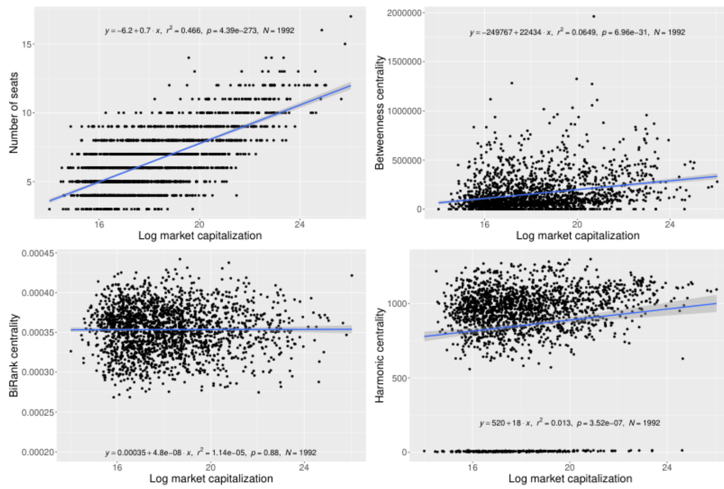
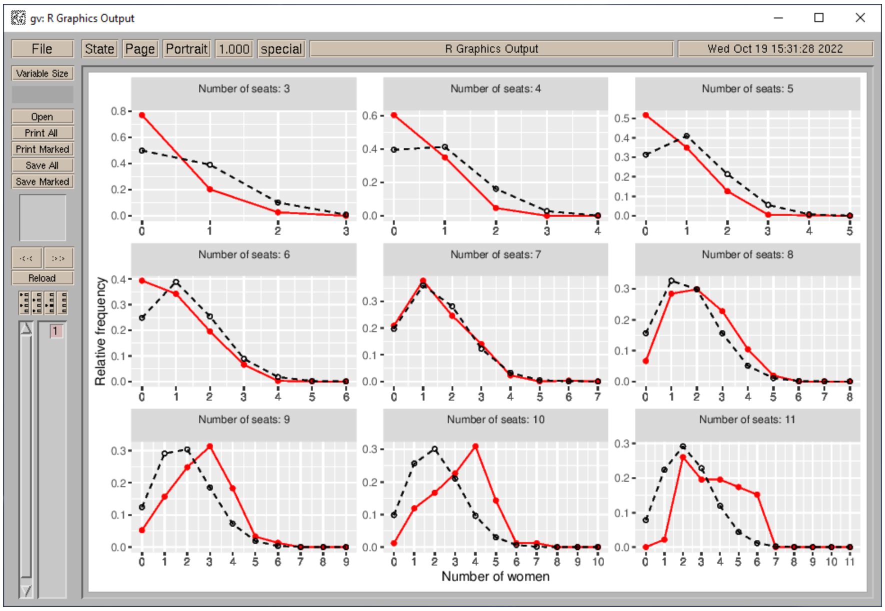
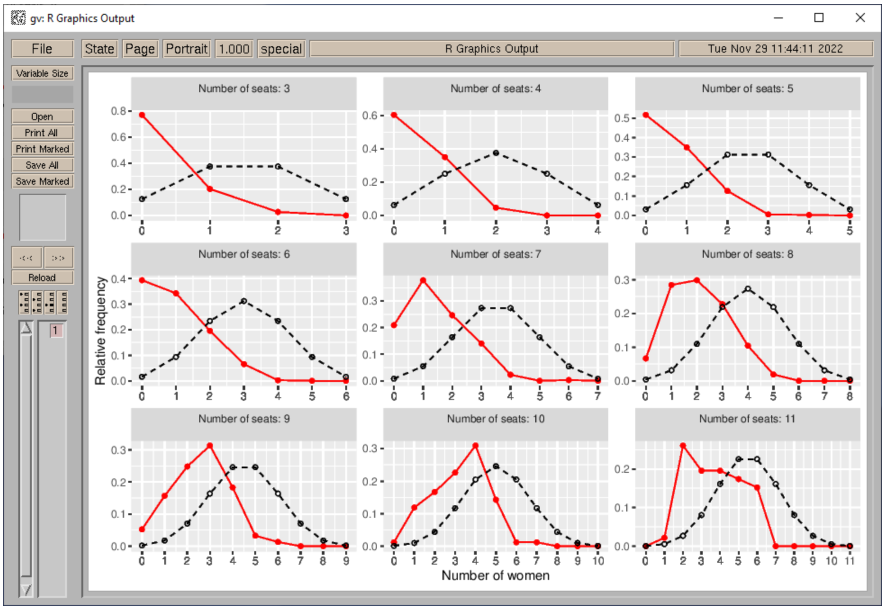


Figure 12: Linear correlations between log market capitalization and centrality measures for companies. The correlation is positive and significant ($p < 0.001$) for all centrality measures other than BiRank, for which the correlation is not statistically significant, and the plot visibly shows a lack of correlation.

Note (top left graph) log market cap is linearly positively correlated with board size (degree of company nodes in bipartite network, i.e. degree centrality).



- This is what happens if we just use the overall relative frequency of women (0.21) for all board sizes, instead of the relative frequency conditional on each board size.
- The fit is good for board size 7, where the relative frequency is close to the overall relative frequency.
- But the fit is worse the further we get from this (lower relative frequencies for smaller boards, higher for larger).



- For completeness, this is what happens if, instead of using the observed relative frequency of women (the MLE for p), we assume it is 0.5
- Now (unsurprisingly, given the observed p = 0.21), the fit is bad
- And for all board sizes except 3 (obs < expected) and 11 (n.s.), the observed relative frequency of boards with exactly one women is significantly higher than expected.

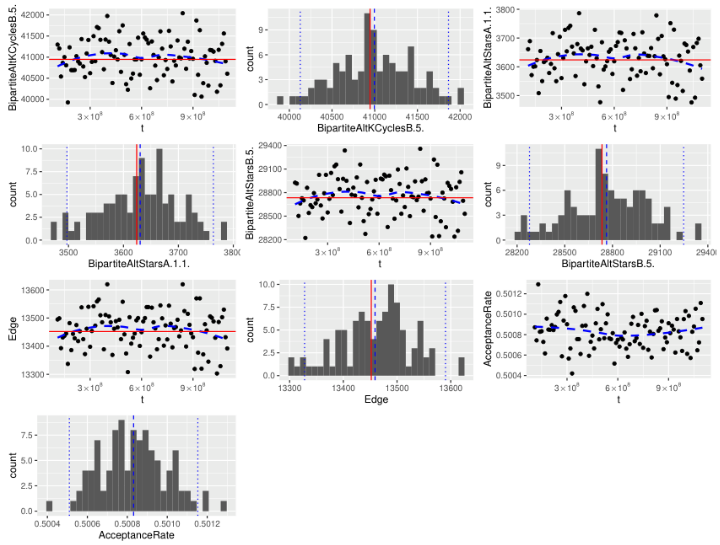


Figure 14: Degeneracy check for Model 1 (Table 7). Trace plots and histograms show statistics of 100 networks simulated from the model. The blue lines on the histograms show mean and 95% confidence interval, and red lines show the observed values.

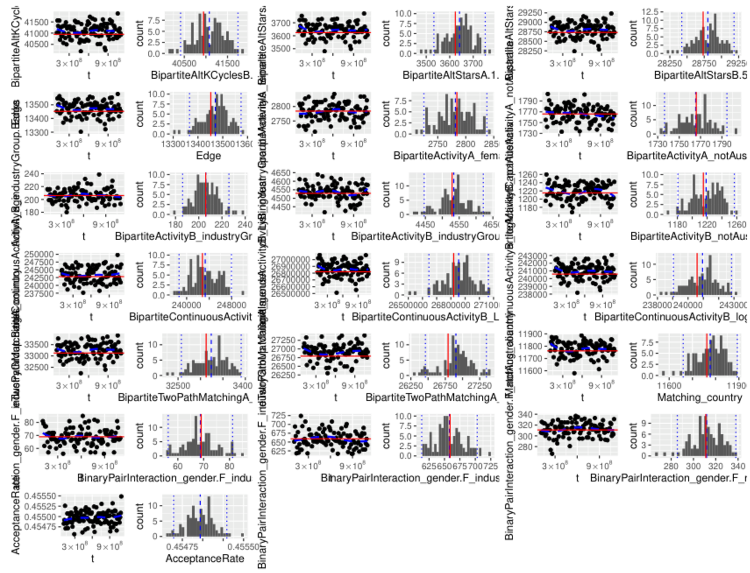


Figure 17: Degeneracy check for Model 4 (Table 7). Trace plots and histograms show statistics of 100 networks simulated from the model. The blue lines on the histograms show mean and 95% confidence interval, and red lines show the observed values.

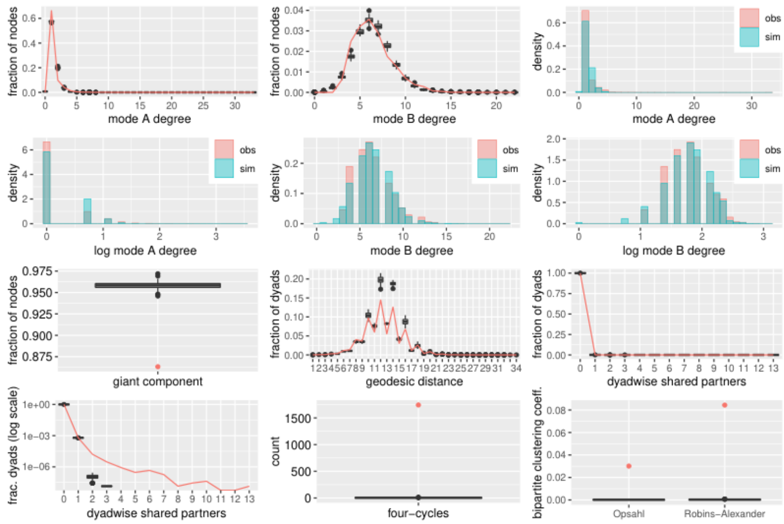
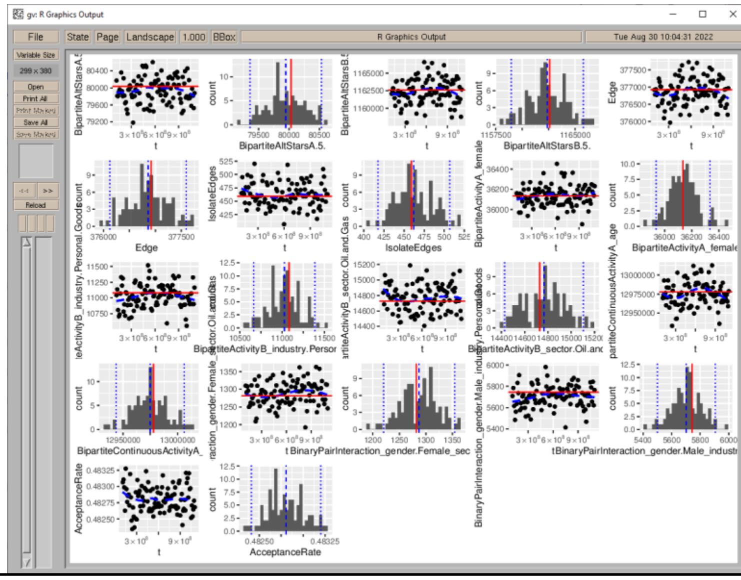
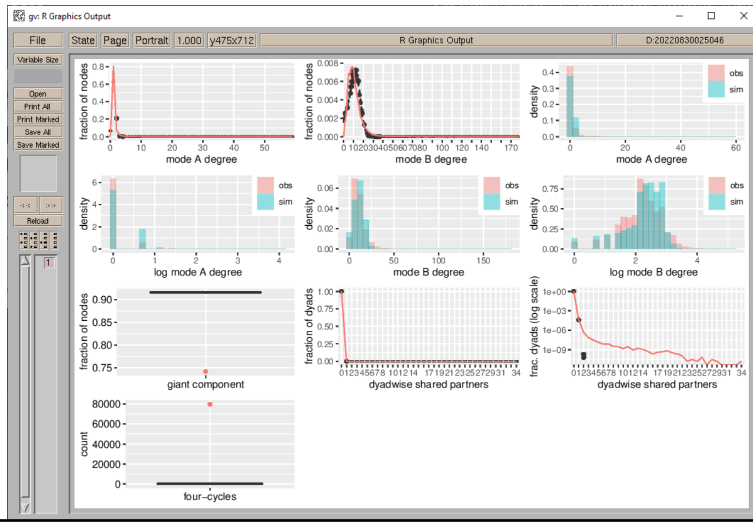


Figure 21: Goodness-of-fit plots for Model 4 (Table 7). The observed network statistics are plotted in red with the statistics of 100 simulated networks plotted as black box plots, and blue on the histograms.

Degeneracy check for ERGM of Evtushenko & Gastner network



GoF for Evtushenko & Gastner network ERGM



Springer Link

Open Access | Published: 05 August 2020

A Man's world? Comparing the structural positions of men and women in an organized criminal network

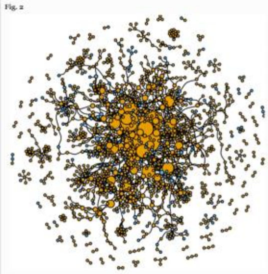
Tomáš Diviák, James A. Coutinho & Alex D. Stivala

Crime, Law and Social Change 74, 547–569 (2020) | Cite this article

Abstract

The crime gender gap is the difference between the levels of participation of men and women in crime, with men responsible for more crime than women. Recent evidence suggests that the crime gender gap is closing, both in crime in general and in organized crime. However, organized crime differs from other forms of criminal activity in that it entails an organizational structure of cooperation among offenders. Assessing whether the gender gap in organized crime is narrowing is not only about the overall levels of involvement of women, but about their roles and positions within the organized criminal structure, because the involvement of women does not mean that they are in influential positions, or that they have power or access to resources important for the commission of organized crime. This paper uses a social network approach to systematically compare the structural positions of men and women in an organized criminal network. We use a dataset collected by Canadian Law Enforcement consisting of 1390 individuals known or suspected to be involved in organized crime, 185 of whom are women. Our analysis provides evidence for an ongoing gender gap in organized crime, with women occupying structural positions that are generally associated with a lack of power. Overall, women are less present in the network, tend to collaborate with other women rather than with men, and are more often in the disadvantageous position of being connected by male intermediaries. Implications for theory and law enforcement practice are discussed.

Fig. 2



Collaboration network visualized with the "graphopt" force-directed layout in igraph. The nodes are coloured according to gender (orange for men, blue for women) and sized proportionally to their betweenness centrality

2. Note that this use is unusual for ALAAM, which is usually used as a model of social influence, because gender does not change with the change of network structure (e.g., an actor does not become a woman by being embedded within structures occupied by many women). We use ALAAM as a network discriminant analysis [65] to distinguish structural differences between positions of men and women. Taking gender as a dependent variable is similar to approach taken by Edling et al. [42], although these authors used standard logistic regression.

Table 6 Results of ALAAM for the collaboration network

From: A Man's world? Comparing the structural positions of men and women in an organized criminal network

Effect	Parameter	Std. Error	
Attribute-Density	−1.668994	0.25009	*
Activity	−0.214388	0.16833	
Star2	0.000161	0.08076	
Star3	0.002306	0.01249	
Contagion	1.159325	0.28113	*
T1	0.004614	0.04561	
T2	0.196052	0.24778	
T3	−1.015396	1.11464	
Setting-Homophily	0.07685	0.21338	
2-Path-Equivalence	0.100845	0.0206	*
Partner-Activity	−0.153155	0.09838	
Partner-Resource	0.092529	0.13832	
Betweenness Centrality	−0.000087	0.00008	

Table 9: ALAAM goodness-of-fit t-ratios for the bipartite director interlock network.

Effect	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Alter-2Star1	**−6.716**	**−2.730**	0.007	0.031	−0.049	0.026
Alter-2Star2	**−8.649**	**−1.302**	0.020	0.028	−0.010	0.010
Alter ListingYear	—	0.047	−0.002	0.012	−0.075	0.040
Three-Star	**8.853**	**4.670**	−0.038	0.046	−0.008	0.013
Two-Star	**3.166**	**2.813**	−0.050	0.044	−0.033	0.029
Ego age	0.059	0.014	−0.014	0.034	−0.021	−0.025
Ego betweenness.scaled	−0.019	0.068	—	0.027	—	—
bipartiteActivityA	—	—	0.004	0.014	−0.074	0.038
bipartiteAlterTwoStar1A	—	—	0.007	0.031	−0.049	0.026
bipartiteAlterTwoStar2A	—	—	0.020	0.028	−0.010	0.010
bipartiteDensityA	0.036	−0.011	0.039	−0.010	−0.041	0.015
bipartiteEgoThreeStarA	—	—	−0.038	0.046	−0.008	0.013
bipartiteEgoTwoStarA	—	—	−0.050	0.044	−0.033	0.029
bipartiteFourCycle1A	—	—	−0.006	0.004	0.026	0.015
bipartiteFourCycle2A	—	—	0.021	0.032	0.033	0.007
Ego birank.scaled	—	—	—	—	−0.029	—
Mismatching country	—	0.040	0.073	−0.050	0.032	0.033
Ego harmonic.cent.scaled	—	—	—	—	—	0.039
Alter industryGroup.Banks	—	−0.034	−0.006	−0.013	−0.088	−0.063
Alter industryGroup.Materials	—	0.069	−0.078	0.038	−0.073	0.008
Alter logMarketCap	—	0.033	0.007	0.025	−0.061	0.032
Ego notAustralia	0.021	0.020	0.031	−0.042	0.008	−0.020
Alter notAustralia	—	−0.000	0.020	−0.015	−0.026	0.004

t-ratio values shown in bold have an absolute value greater than 0.1, indicating poor fit.

Limitations and Future work

- An updated “token women” hypothesis for the Australian context:
  - Given the corporate governance target of 30%, at least for the ASX300,
  - Rather than testing for an over-representation of boards with exactly one woman, instead test for over-representation of boards with only 30% women
    - As this is the minimum amount necessary to reduce external pressure to have more women in Australia.
- *[continued next slide…]*

Note for the updated (30%) hypothesis, we can already see from the graphs for the binomial null model that there is no evidence for this using this method (just by checking the observed and expected for ceil(0.3 * boardsize) in each plot, rather than just 1)

- We have information about whether a person is a Chair of a board, or an executive or non-executive director. We should use this (but have not yet). Based on previous work (some shown here) I hypothesize that:
  - Women are less likely than men to be Chair
  - Women are less likely than men to be executive directors
- This work only examines the proportion and position of women in the interlock network --- it is does not consider effects e.g. on earnings quality, etc.
- It would also be of interest to also include data about which committees (remuneration, audit, risk, etc.) a board member is on. (Suggested by Helen Bird). This data does not seem readily available, however (without a lot of work manually coding it – which for the existing data was done commercially by Thomson Reuters).
- *[continued next slide…]*

More limitations and potential future work

- We only have the director interlock network of ASX listed companies. But the closed social networks from which directors are recruited also often overlap with non-commercial directorships, such as non-profits ("prestigious" private schools, charities, foundations, etc.) and government boards. This data is not apparently easily available to us, however.
- *…[continues next slide]*

These closed social networks also include, for example, as well as the stereotypical "old boys network", family and social connections for example through "exclusive" club memberships:

> *We can see this anecdotally as well. ANZ chairman David Gonski is a mentor to ex-AMP chairwoman Catherine Brenner. Gonski was also chairman of Coca-Cola Amatil when Brenner was appointed to the board in 2008.*
>
> *Meanwhile Brenner's sister-in-law, Maxine Brenner, sits on the boards of Orica Ltd, Origin Ltd and Qantas Airways.*
> *…*
> *My research found that the social identity of candidates is a significant criterion in the selection of Australian company boards. Closed social networks are the primary means of identifying new board members.*

Smith, S. (2018). Company Boards Are Stacked with Friends of Friends so How Can We Expect Change?. *The Conversation*. https://theconversation.com/company-boards-are-stacked-with-friends-of-friends-so-how-can-we-expect-change-95790

In the past, particularly in Melbourne, directors were part of old boy networks and were often on many boards together. Companies like Pacific Dunlop, BHP, ANZ would have interlocking boards where there were mutual advantages across businesses that is banks lending to companies with reputations of board members driving the due diligence procedures. Often board members were members of the same clubs such as the Melbourne Club, Australian Club and Athenaeum Club. (Male Participant 11)

Smith, S. (2018). *Beyond board capital: probing inside the black box of Australian board recruitment and dynamics* (Doctoral dissertation, RMIT University), p. 124

I think in Australia it's messier than in America or in Britain… clubs are relevant, I'm a member of the Australian Club. I know that the people that are members there go through a very elaborate screening process and so if I were choosing a director and one of the candidates was a member of the Australian Club I would say almost certainly honest, cooperative, easy to mix with and so on. There are lots and lots of different circles, there's not a single tight network in Australia. There are scores, hundreds perhaps of little networks, things that will provide people that know about those networks with confidence in other people. (Male Participant 5: 40 years+ experience on various types of boards)

Smith, S. (2018). *Beyond board capital: probing inside the black box of Australian board recruitment and dynamics* (Doctoral dissertation, RMIT University), p 139

Again, information such as club membership is not readily available in a systematic way, requiring (as in this thesis) case studies, interviews, qualitative methods.

There are also other kinds of diversity (beyond gender diversity, and age) that are not considered here, and which we do not have data for, e.g., ethnic identification and socioeconomic class (for example whether someone attended a 'prestigious' private school)

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