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

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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.

Keywords: Gender equity, Social network analysis, Company boards, ASX200

Introduction

In December 2019, to widespread acclamation, and following a concerted four-year campaign to increase gender diversity on Australian corporate boards, women reached 30 percent of board positions of the 200 largest companies listed on the Australian Stock Exchange (ASX), which are the constituents of the Standard & Poors (S&P) ASX200 stock market index. Chair of "30% Club Australia" Nicola Wakefield Evans cautioned against premature celebrations, stating "[w]hile this is a significant step in our journey, it's important to remember that 30 percent is the floor, not the ceiling" (Australian Associated Press 2019).

This paper suggests that if 30 percent is "the floor" for women's appointments to ASX200 boards then there may be value in understanding how men and women tread these "floor boards" differently. Our research diverges from previous studies that are based on the position that balancing the number of men and women statistically is a synonym for social or political equity. In these studies, the merits of statistical targets or quotas are debated as an exclusive strategy for ensuring women's equity on boards. Our

research proceeds by questioning whether statistical participation rates or “headcounts” are the only, or even best, measure for understanding the distribution of power or influence in network settings such as corporate boards. Women for example, might occupy 30 percent of board positions but that number may not reflect the extent to which they are able to exert influence. Longstanding concerns over “tokenism” are one manifestation of this distinction between appointment levels and power (Elstad and Ladegard 2012; Kanter 1977; Konrad et al. 2008).

By using social network analysis (SNA), we reveal how different kinds of agency within a network operate in different ways for men and women. We test three approaches to understanding gendered relationships in ASX200 board member networks based on an evaluation of betweenness, degree and k-core centrality, respectively. We draw several provocations from our analysis: (i) Strategies to produce gender equity based on statistical equivalences (“just add women and stir”) may be ineffectual in and of themselves. (ii) Reducing the number of men in a network does not necessarily reduce the power of men in the network. (iii) Increasing the number of women in a network does not necessarily reduce the power of men in the network.

Our findings suggest greater nuance is required to understand the persistence of male domination in board composition. It also suggests that—as gender inequality is the result of unequal social relations—simply focusing on “the numbers” as a strategy for remediation will most likely be ineffective. Instead, we need to examine in detail the egression, composition and arrangement of gendered social networks within ASX200 Boards and canvass possible solutions based on this relational analysis. Our social network data analysis supports previous studies that argue in addition to increasing the number of women on boards there must be an emphasis on ensuring parity in terms of agency, or “substantive gender diversity”, once women are appointed (European Commission 2019; Nili 2019).

In recent years, several countries around the world have mandated the implementation of gender quotas for corporate boards seeking to reduce gender inequality. As long ago as December 2003, Norway passed a law requiring 40% representation of each gender on the board of directors of public limited liability companies. Following Norway’s lead, Belgium, France, Germany, Iceland, India, Israel, Italy, and Spain have all passed similar reforms. In 2013, the European parliament voted in favour of requiring at least 40% women board members in about 5000 listed companies in the European Union by 2020. In 2014, the German government passed legislation requiring 30% women on corporate boards by 2016, or else the seat would be left vacant. Despite this intervention, women only comprise 14% of seats on DAX-listed companies (Deutscher Aktien Index, or DAX, is Germany’s stock market index consisting of the 40 largest companies) and as a result, in 2020, German government intervention was further strengthened with the announcement of additional mandatory quotas (Goodley 2020).

In contrast, Australia, the UK, and the US have implemented a “soft regulatory intervention” policy. In Australia for example, the ASX Corporate Governance Principles and Recommendations rely on a voluntary code in which listed companies are encouraged to disclose in detail their gender diversity policy. If an ASX-listed firm has not adopted a gender diversity policy, it is required to provide an explanation as to why adopting such policy is inappropriate to the circumstance of the firm. Other industry bodies, such as

the Australian Institute of Company Directors (AICD), set a (non-enforceable) target of 30 percent of ASX200 company board seats to be held by women directors by the end of 2018 and the Business Council of Australia set an even more ambitious 50 percent target (30% Club 2019; Milman 2013).

The logic behind these otherwise distinct policies for quotas or targets is the same. Qualified women are harmed by a lack of access to networks to help them climb the corporate ladder, and quotas or targets can provide an impetus to break this cycle. It is expected that, as a result of these policies, successfully appointed women will be better placed to “network in” other women, as well as simultaneously reshape the views of powerful men by redressing gender stereotypes. The glaring limitation of these arguments is that the onus for producing change is placed on the very people who are pointedly outside the system of decision-making and not in a position to intercede—women. Therefore, it is not surprising that gender equity in these environments remains elusive. Even when women are appointed to boards, they are rarely appointed to influential positions within boards. For example, a 2020 census of Fortune 500 companies in the U.S. found that women held only 21.2% of corporate board seats and comprised only 5.8% of CEO (Chief Executive Officer) positions in those companies (Catalyst 2020). In Europe, despite being 45% of the labor force only 22.7% of board members of the largest publicly listed companies are women: 6.5% of the CEOs are women, and 6.7% are Chairs (European Commission 2019).

The objective of this research is to analyze and better understand the gap between the statistical gains made by women on company boards and their apparent lack of influence. To explore this problem, we undertake a comparative social network analysis of ASX200 board directors across the three-year period between 2015 when a significant push for increasing the number of women in the sector to 30% was initiated and 2018, when this achievement was unlocked. Our intention is to understand the relative agency of women and men in board networks in order to produce a more nuanced view of social equity interventions in these settings. Our work is distinguished from the study of “interlocking directorates” or “board interlock networks” which measure and make explicit the relationships between elite firms in terms of “board networks” rather than the “director networks” we examine in this article (Davis and Greve 1997; Davis et al. 2003; Mariolis 1975).

Literature review

Existing research on gender inequality in board directorates has principally been concerned with the pre-existing barriers to women’s professional advancement. These obstacles include workplace discrimination, inequitable family obligations that slow career progress, and a lack of mentors (Athey et al. 2000; Bertrand et al. 2010; Goldin and Rouse 2000; Matsa and Miller 2011). Using network analysis, we introduce an additional explanation for the under-representation of women in corporate leadership positions based on the characteristics of board member networks themselves. To the best of our knowledge no prior studies have investigated the changes to board networks following the adoption of gender quotas or targets. The closest finding to date is an early 2018 network visualisation produced by Gilding et al. (2018). However, the authors themselves suggest that a visualisation at one point of time provides limited insight. Similarly,

Hawarden and Marsland (2011) offer analysis on the location of women directors in board affiliation networks, but they do not examine the changes in network influence or the agency of women in these networks over time. Instead, the most prevalent research papers on women on corporate boards tend to focus on either the interdependence between organisational gender diversity and board structures or the existing benefits, issues and methods of promotion of women on boards (Burke 2000; Holst and Wrohlich 2019a, 2019b; Leitch 2014; Mattis 2000; Van der Laan et al. 2018).

A significant number of gender-focussed organizational network studies highlight the manifold value of women having other women in their professional networks. These studies demonstrate that when women have more women in their network, they report less gender discrimination, more family and organizational support, smaller gender pay gaps and, in certain fields like science, technology, engineering, and mathematics (STEM), better retention among women employees (Beaman et al. 2009; Cohen and Broschak 2013; Dasgupta et al. 2015; Dennehy and Dasgupta 2017; Ely 1995; Etzkowitz et al. 2000; Etzkowitz et al. 1994; Foley et al. 2006; Konrad et al. 2010; Phillips 2005; Sandberg 2013; Shin 2012; Vinnicombe et al. 2000; Yang et al. 2019). In addition, the presence of women in organisational networks enables other women to reach leadership positions. For example, Yang et al. (2019) demonstrate that network centrality significantly predicts women's promotion to leadership positions. They find that women with a network centrality in the top quartile and a women-dominated inner circle have an expected job placement level that is 2.5 times greater than women with low centrality and a male-dominated inner circle. Beaman et al. (2009) find that appointing women leaders weakens stereotypes about gender roles in the public and domestic spheres and eliminates the negative bias in how women leaders' effectiveness is perceived among men. This enables other women to progress to leadership positions.

Sacks and Maatwk (2018) specifically analyze the perceived role and value of women's networks in helping women gain a board position. This study scrutinizes women-director networks from a qualitative perspective, as does the work of Murphy and Greenberg (2018) who analyze network access for women pursuing major non-profit board positions. Similarly, Gero and Garrity (2018), explore the emergence of networks of women directors, and study the positive role of women-to-women relationships in Fortune 1000 companies. Bushell (2015) applies qualitative methodology to explore how differences between social capital of men and women shape the lack of women on British boardrooms.

Much of the existing literature explores the correlation between gender diversity on boards and firm performance and conforms to the meritocratic values that underpin contemporary economics scholarship. Employing quantitative methods, different researchers provide different observations (Blanding 2021; Chapple and Humphrey 2013; Chauhan and Dey 2017; Green and Homroy 2017; Miller and del Carmen Triana 2009). Blanding (2021) argues that gender and racial diversity on boards improves a firm's performance and drives innovation. Conversely, Chapple and Humphrey (2013) find no evidence for this statement, adding that there is weak evidence of negative correlation. Miller and del Carmen Triana (2009) explore not the correlation itself but the mediators of "board diversity-firm performance" relationships.

There are also some qualitative studies that explore the interconnection between gender diversity on boards and the social responsibility of a company, the role of executive search firms in gender inequality on boards, and the ways in which women directors exercise their leadership and women directors' experiences (Cikaliuk et al. 2018; Ramirez 2018; Roo and Tilt 2016; Srinivasan and George 2018; Vasilias and Adams 2018). Many studies are centered on the debate over quotas and their effect on the promotion of women on corporate boards (Carrasco and Francoeur 2018; Holst and Wrohlick 2019a, 2019b; Kramer and Butler 2018; Muriungi 2018; Taylor et al. 2018). Daily et al. (2000) examine a range of these existing studies to ascertain why respective scholars arrived at different conclusions while studying the progress and advancement of women on boards and highlight some weaknesses of the various approaches.

Finally, there is a small, discrete body of research on gender equity, diversity and inclusion in ASX200 companies. Australian studies on the impact of equity quotas come to a range of different conclusions: from endorsing quota mechanisms as the most effective tool to get more women on boards, to emphasizing some side effects of this approach, to denying its usefulness at all (Australian Institute of Company Directors 2018; Taylor et al. 2018). Burgess and Tharenou (2000) analyze women's appointments to Australian boards by assessing the relative importance of a broad range of factors. Conroy (2000) provides data on public sector board membership and draws some comparisons with private sector boards in Australia, as well as overseas data. Ross-Smith and Bridge (2008) review the status of women's representation on corporate boards of ASX200 companies. They provide background data on women in the Australian workforce and management and discuss the implications of relatively static numbers of women in the CEO and senior executive pipeline. Taylor et al. (2018) scrutinize the current Australian policy position of "soft regulatory intervention" for increasing women in corporate leadership positions and canvass the potential benefits of mandatory gender quota legislation. Most pertinently, Handley et al. (2017) analyze data on ASX200 boards' new appointments in 2013 and 2014 to explore which strategies women have used to access Australian corporate leadership positions in contrast to the pathways taken by men.

In the Australian setting, where the nomination of directors is principally made by incumbent directors rather than shareholders, there is a strong bias to 'in pool' appointments on corporate boards, making network studies particularly relevant. A report on Australia's 300 largest companies listed on the ASX, represented by the S&P ASX300 index, found that since 2005 nearly 40% of all board vacancies have been filled by directors with an existing appointment (Ownership Matters 2020). An "in progress" 2018 research project which employs network analysis to examine gender inequality in ASX200 companies suggests that cross-appointments ('network contagion') may, in fact, hold the key to increasing the number of women directors across the sector (Gilding et al. 2018). The authors note that these company directors form a classic network, with 172 out of 200 companies creating one "giant" component, linked together through shared directors. They examine which variables and factors are most likely to increase the number of women board members and conclude "the only significant predictor that boards will reach the 30% target is that they have a director who sits on another board that has already done so."

But has the increase in women's appointments to the largest Australian companies' boards resulted, as was hoped, in additional gains for other women, as CEOs for instance? The short answer is no. In ASX300 companies, despite the gender mix of non-executive directors changing significantly between 2005 and 2020 (women occupying 9.6% of seats in 2005 to 33.1% in 2020) the number of executive directors (typically Chief Executive Officers and Chief Financial Officers) who are women has remained stagnant at 6% (Ownership Matters 2020).

Data and method

Our sample consists of all directors present on the boards of ASX200 companies at two points in time. To identify these directors, we use data obtained from the *BoardEx* database collected by Management Diagnostic Limited. This database documents the employment history of all directors in our sample.

To analyze network structures based on relations between network members, this study focuses on two networks of ASX200 directors: the first network contains all directors on ASX200 company boards in 2015 and the second network contains all directors on ASX200 company boards in 2018. As the composition of the ASX200 changes over time (e.g. when constituent companies join or leave the ASX200 index), some of the companies that are part of the ASX200 index in 2015 are not part of the index in 2018, and vice versa. The 2015 network (as of 30 June) includes 1,200 unique executive and non-executive directors and the 2018 network (as of 31 December) comprises 1,168 unique directors (executive and non-executive), representing a decrease in network size of 32 members. 655 (55%) directors are present in both networks. The difference between the 2015 network and the 2018 network is explained by 545 directors that left the network and 513 directors that joined the network. While this results in a difference between the 2015 sample and the 2018 sample of approximately 30%, our approach guarantees that each sample represents the universe of the largest 200 listed companies in Australia in its respective year.

Formally, the analyzed networks are directed, unweighted networks where a link is defined as a connection from a Chair of a given board to a member of that board. If the link exists, it is given value 1 and otherwise it is set to 0. Provided that board Chairs establish relations with other network members via membership on one or more boards at a point in time and across time, we analyze network structures and network power of members based on 2015 and/or 2018 board occupation.

Our analysis proceeds in two steps. First, we use this data to compare director networks in 2015 ASX200 companies with 2018 ASX200 companies, a period used widely by Australian regulators and industry bodies to measure recent improvements in board gender balance (Australian Institute of Company Directors 2018). To explore changes in the ASX200 board networks over time we compare the two networks using both (i) conventional statistical measures to understand the gender composition of ASX200 companies, as well as (ii) network measures, including degree centrality, betweenness centrality and k-core centrality to understand the respective influence of women and men within the network of directors. Second, we consider three additional year-end ASX200 director network snapshots for 2015, 2016 and 2017, for which we track directors of

companies listed at the most recent date in our sample, i.e. directors of companies listed end-of-year 2018.

To determine whether the growing number of women and decreasing number of men on Australian boards affected the position and power of each gender on ASX200 boards, we compare the positions of men and women with a given range of node degree centrality (ND), betweenness centrality (BC) and k -core centrality (KC). These three measures combined show the extent to which a given node can influence the network both locally (ND) and globally (BC in combination with KC). Node degree is calculated as the number of a person's relationships while betweenness centrality indicates the number of times a person acts as a bridge along the shortest path between two other nodes. K -core centrality indicates whether a node is located in the core or periphery of a network. To assess the coreness of a node, the k -core of a graph needs to be calculated as a maximal subgraph in which each node has at least degree k . The coreness of a node (KC) is k if it belongs to the k -core but not to the $(k+1)$ -core. In social networks, people with a higher level of ND are perceived as being better connected and having strong positions in their immediate neighborhood. People with a higher level of BC are seen as those with more systemic power as they have the most influence over the flow of information in the network (Cook et al. 1983). Similarly, people with high KC (located in the core of a network) are seen as those who can influence behavior in the network more than those on periphery. K -core measure at the graph level also enables us to investigate the network's engagement level but this analysis is out of scope of this article. For the purposes of our analysis, directors with both high levels of ND and BC are the most powerful. For example, prior research finds that directors with high degree, betweenness, closeness and eigenvector centrality have better career prospects, are less likely to experience turnover and are more likely to obtain future board seats (Intintoli et al. 2018).

Model and results

Analysis of board directors as a network

To examine the effectiveness of adding women to boards of ASX200 companies we extract two networks from the board membership data. The June 2015 network consists of 1200 nodes and 1776 edges. The December 2018 network consists of 1168 nodes and 1741 edges. For both networks the nodes are the members of the boards and relationships are created from board Chairs to all other board members sitting on the same board. This enables us to model one aspect of board power relationships by identifying the connection of a board Chair to all other directors. The resulting directed networks in Figs. 3, 4, 5, and 6 show the internal connections within the boards and the connections between directors on different boards.

Board composition

We investigate the gender breakdown of directors between 2015 and 2018 by analyzing levels and changes in the number of (1) unique directors and (2) director positions (calculating directors that sit on 1–5 different boards).

Table 1 shows that the total number of directors remains relatively stable over time with 1200 unique directors in June 2015 and 1168 in 2018. In addition, there has not been a dramatic change in the number of director positions between 2015 and 2018. In

Table 1 Number of directors with one or more board seats (2015 and 2018)

Number of boards	2015		2018	
	Number of women	Number of men	Number of women	Number of men
1 Board	145	849	205	736
2 Boards	32	111	55	106
3 Boards	23	33	30	25
4 Boards	3	2	8	2
5 Boards	1	1	0	1
Total (Unique)	204 (17.0%)	996 (83.0%)	298 (25.5%)	870 (74.5%)
Total (Positions)	295 (20.0%)	1183 (80.0%)	437 (29.7%)	1036 (70.3%)

June 2015 the number of positions was 1478 and in December 2018 it was 1473. There has, however, been a change in the distribution of gender across both unique directors and director positions. Between June 2015 and December 2018, we observe that the number of unique women increased by 94 and unique men decreased by 126. In addition, we observe that the number of directorships held by women increased by 142 and by men decreased by 147 between June 2015 and December 2018.

Figures 1 and 2 present the percentage gender breakdown of the number of directors (Fig. 1) and director positions or seats (Fig. 2) between 2015 and 2018. When looking at the percentage of director seats by gender (note: one person can sit on more than one board) the relative number of seats occupied by women directors increases and the number occupied by men decreases. As measured by unique directors in the network the participation of women on boards increases from 17.0 to 25.5% (Table 1 and Fig. 1).

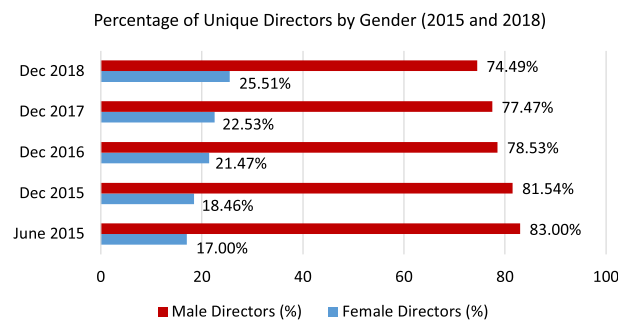


Fig. 1 Percentage of Unique Directors by Gender (2015 and 2018)

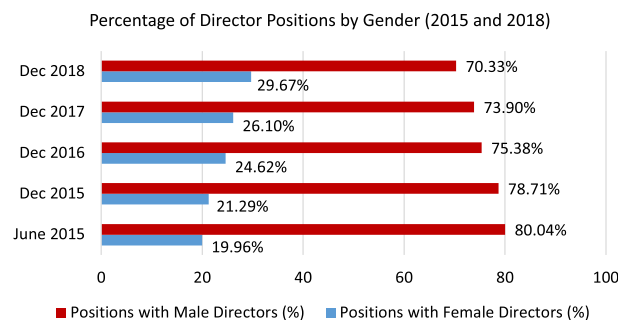


Fig. 2 Percentage of Director Positions by Gender (2015 and 2018)

In terms of director positions, almost 30% of all directorship positions in December 2018 were held by women as opposed to nearly 20% in June 2015 (Fig. 2). Overall, both the percentage of unique directors who are women and the percentage of director positions held by women increases compared to number of and positions held by men. These statistical results appear to indicate a wholly positive change in the direction of more balanced corporate boards. But is it?

A simple way to measure gendered power or influence on boards is to examine the number of Chairs by gender and the relations from Chair to board members by gender. On boards where women were Chairs the average number of women directors increased between 2015 and 2018 from 0.93 to 2.21. Given the growth of women in the overall network for 2018 it is not surprising there was also an increase in the average number of women directors when a man was Chair (from 1.44 to 2.11). However, although the ratio of women directors to women Chairs is noticeably higher, the overall significance of this correlation is in part offset in the overall network by a small decrease in the total number of women Chairs between 2015 (15 women Chairs) and 2018 (14 women Chairs).

Node degree centrality, betweenness centrality and K-core centrality for the full network

We begin our network analysis by looking at the number of men and women with a given range of node degree centrality (ND) and betweenness centrality (BC). These two measures provide additional insight about the function of each node that goes beyond the picture painted by aggregated statistics (e.g. the overall number of women vs men). By examining in detail these two measures (node degree and betweenness) we can ascertain whether the increased number of women in the network produces a corresponding change in the balance of power between men and women.

Figures 3 and 4 show how the directors' node degree centrality changes between 2015 and 2018.

Figures 5 and 6 show how betweenness centrality changed from 2015 to 2018. Red nodes represent men and blue nodes represent women.

As demonstrated in the comparative visualizations of both node degree and betweenness centralities in Figs. 3, 4, 5, 6, the majority of nodes with high values are men. In terms of degree, slightly more balance is evident than in the case of betweenness and although we can see quite few nodes with large degree the rest of the network is not far behind. However, in the case of betweenness it is clear that there are few very powerful men (both in 2015 and 2018) and the rest of the network members have very limited power.

Table 2 demonstrates that as the number of women over the years increased so did the percentage of women with low node degrees (from 91.67% in 2015 to 94.30% in 2018). This means that the increasing number of women in the network has not translated into them being better connected. At the most connected level, in both 2015 and 2018, there is only one woman with a node degree above 20 (Margaret Jackson in 2015 and Catherine Livingstone in 2018). On the other hand, although the number of men dropped by 126, the percentage of well-connected men (i.e. men with more than 10 connections) increased from 6.13% in 2015 to 7.36% in 2018 and correspondingly the percentage of poorly-connected men decreased from 84.54% in 2015 to 82.53% in 2018. So, as we observed in the case of the betweenness centrality, node degree centrality measurements

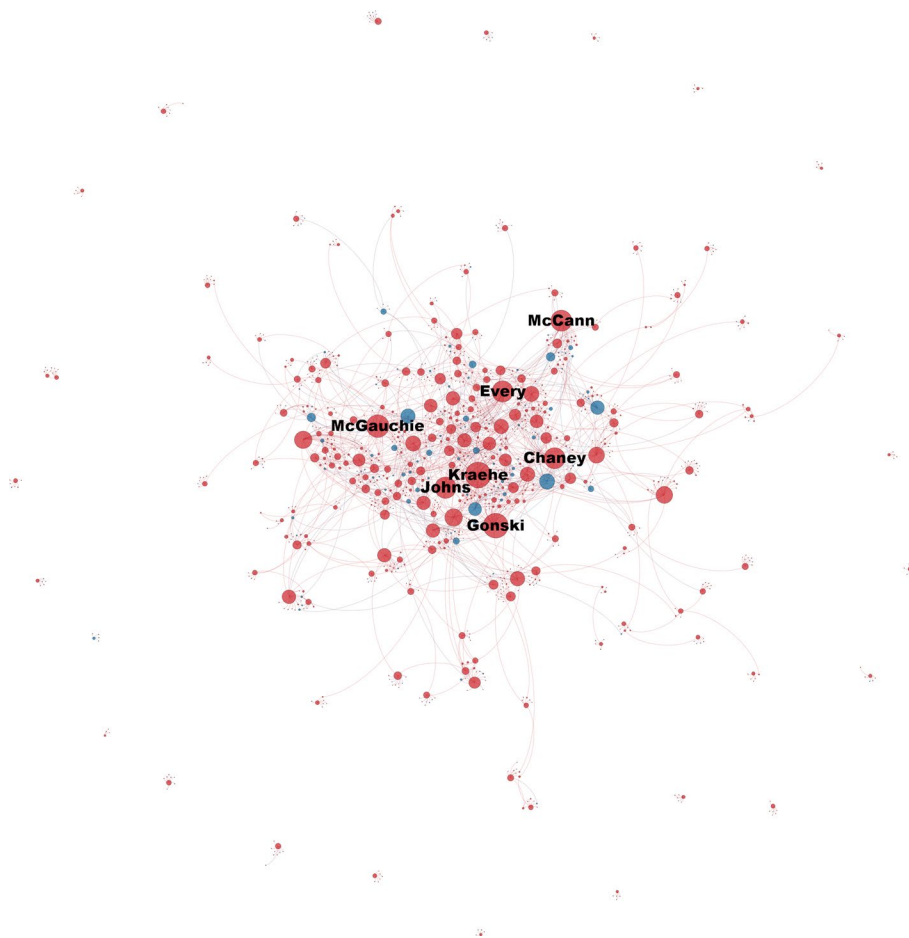


Fig. 3 Network Graph: Node Degree Centrality (2015) Network data visualizations use the Gephi OpenOrd, no overlap layout algorithm. Nodes are scaled based on the value of the corresponding metric (degree or betweenness centrality). The higher the centrality value, the larger the node. Clockwise edges connect board Chairs to board directors (the Chair is the source for each edge and the director is the target). Red nodes represent men, blue nodes represent women

also show that connectivity has not markedly changed and if anything, women are less connected in 2018 than they were three years earlier.

There is an interesting effect that can be observed when comparing the full dataset from 2015 and 2018 in relation to betweenness centrality (Table 3). Although the number of women increases with time (204 in June 2015 and 298 in December 2018), the percentage of women with a betweenness centrality larger than 0 actually decreases (from 6.86% in 2015 to 4.70% in 2018). This means that although there are more women in the network, they are not necessarily more powerful ($BC > 0$ for 14 women in both 2015 and 2018). As for men, in 2018 there were 126 fewer men in the network than in 2015 but the number of men with $BC > 0$ only decreased marginally from 105 to 98. In fact, the actual percentage of men in the network holding power (i.e. with $BC > 0$) slightly increased from 10.54% in 2015 to 11.26% in 2018. In this instance, network analysis demonstrates that although the aggregate statistics show a significant increase in number of women in the network and a drop in the number of men, the gendered distribution of systemic power in the network (measured by betweenness centrality) does not change.

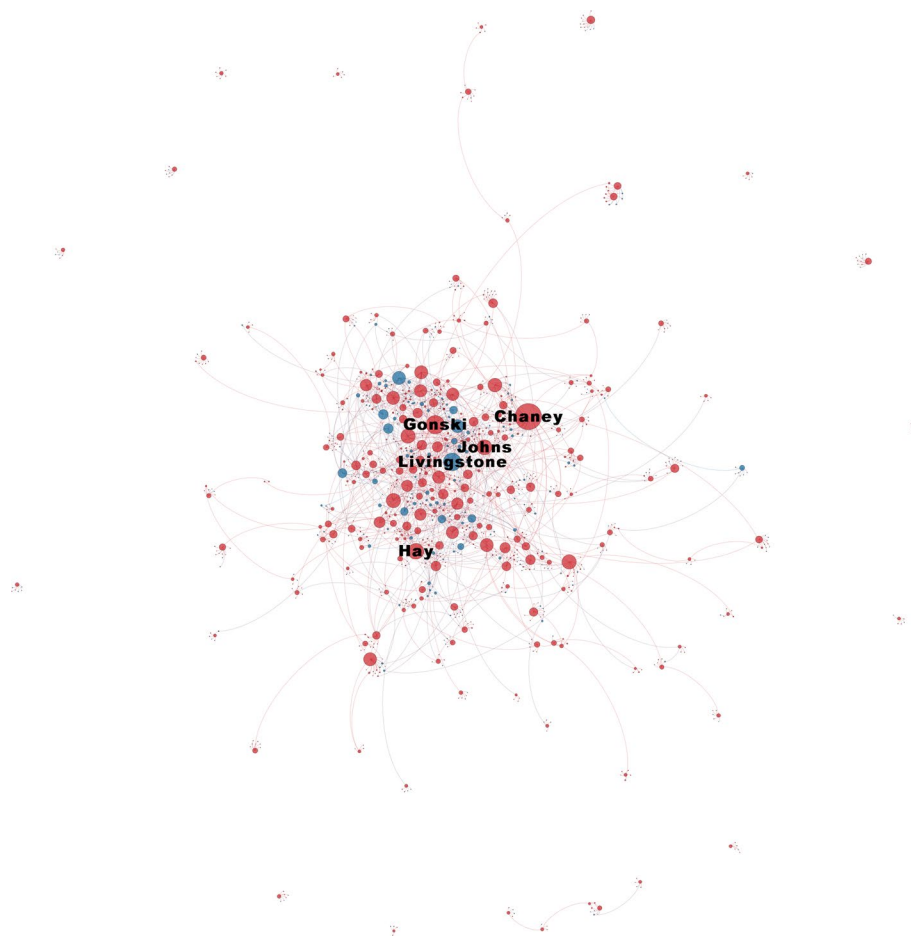


Fig. 4 Network Graph: Node Degree Centrality (2018)

As with BC, there is also a noteworthy effect that can be observed when comparing the full networks from both 2015 and 2018 in relation to k-core centrality (Table 4). Despite the increase of women in the 2018 network, the percentage of women with a maximum k-core equal to 4 decreases by 1.77% (from 8.82% in 2015 to 7.05% in 2018) indicating that these women directors are not necessarily in the network core. This finding is reiterated by the percentage of women with $KC = 1$ which remains stable between 2015 (57.84%) and 2018 (57.72%) even though the number of women in this category increases by 94 (up from 118 in 2015 to 172 in 2018). As for men, in 2018 there were 126 fewer men in the network than in 2015 and the number of men with $KC = 4$ decreased by 1.7% from 73 to 49 (from 7.33% in 2015 to 5.63% in 2018). At the same time, the percentage of men with $KC = 1$ decreased from 64.76% (2015) to 62.76% (2018) but their number also decreased by 126.

These results are consistent with the findings for betweenness centrality and show that although the aggregate statistics demonstrate a significant increase in number of women in the network and a drop in the number of men, the gendered distribution of systemic influence and coreness in the network (measured by k-core centrality) does not change. So perhaps the impact of additional women joining the network has resulted in changes where influence is the greatest, i.e. among directors who are already well-connected?

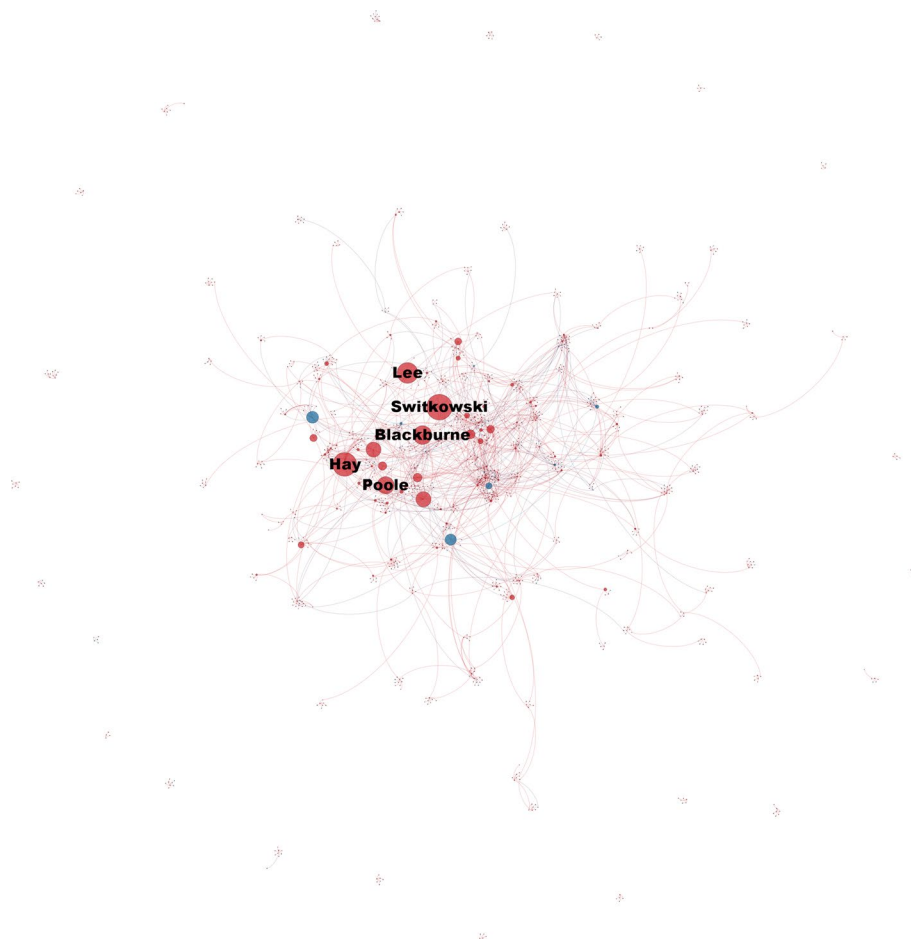


Fig. 5 Network Graph: Betweenness Centrality (2015)

To ascertain this, we look deeper into the position and characteristics of both men and women with $BC > 0$.

Betweenness centrality and node degree centrality for directors with $BC > 0$

As the number of all nodes in the network with $BC = 0$ is at the level of 90% and as we are principally interested in who holds power in the network, the next stage of the analysis excludes directors whose BC is 0. However, before removing these directors with $BC = 0$, we examine the distribution of their ND (Fig. 7).

The vast majority of directors (over 90%) with $BC = 0$ also have a very low node degree. These would be board members who are poorly connected and consequently have little to no influence. No women who have $BC = 0$ have a node degree above 10 but there are three men in 2015 and two in 2018 whose node degrees are higher than 20 and at the same time they have $BC = 0$. These are board Chairs who do not hold any non-Chair positions and in a directed network such as the one we prepared for analysis, their in-degrees are 0 despite impressive out-degrees. In 2015 these were: Graham Kraehe with degree 35, Sir Frank Lowy with degree 24 and Kerry Stokes with degree 23. In 2018 these were: Dr. Michael Chaney with degree 40 and Kerry Stokes with degree 22.

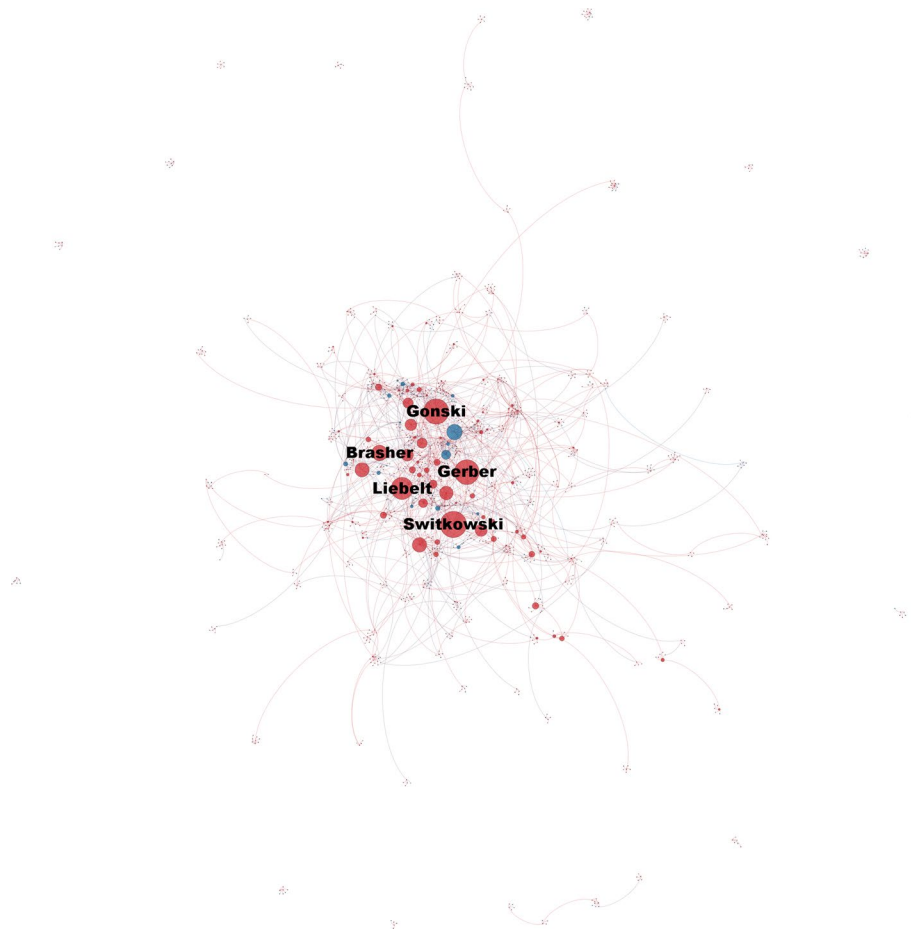


Fig. 6 Network Graph: Betweenness Centrality (2018)

Table 2 Node degree centrality ranges by gender (2015 and 2018)

Node degree centrality (ND) range	2015				2018			
	Women		Men		Women		Men	
	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)
(0;5]	187	91.67	842	84.54	281	94.30	718	82.53
(5;10]	11	5.39	93	9.34	7	2.35	88	10.11
(10;20]	5	2.45	48	4.82	9	3.02	56	6.44
(20;40]	1	0.49	13	1.31	1	0.34	8	0.92
Total	204	100	996	100	298	100	870	100

Figure 8 shows the distribution of Betweenness Centrality for Directors after removing directors with $BC=0$. At the top end of the scale, the number of women directors with BC lower or equal to 1000 increased over the period we studied, from 11 in 2015 to 12 in 2018 (Fig. 8). We can also observe that these women increased their influence as we have more women with $100 < BC \leq 1000$ (on a power law distribution the definition of people with some influence) in 2018 than in 2015 (twelve and four women respectively). Men

Table 3 Betweenness centrality ranges by gender (2015 and 2018)

Betweenness centrality (BC) Range	2015				2018			
	Women		Men		Women		Men	
	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)
0	190	93.14	891	89.46	284	95.30	772	88.74
(0;10]	1	0.49	10	1.00	0	0.00	11	1.26
(10;100]	6	2.94	21	2.11	0	0.00	18	2.07
(100;1,000]	4	1.96	56	5.62	12	4.03	49	5.63
(1,000;10,000]	3	1.47	18	1.81	2	0.67	20	2.30
>0	14	6.86	105	10.54	14	4.70	98	11.26
Total	204	100	996	100	298	100	870	100

Table 4 K-core centrality values by gender (2015 and 2018)

K-core centrality (KC) values	2015				2018			
	Women		Men		Women		Men	
	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)
1	118	57.84	645	64.76	172	57.72	546	62.76
2	41	20.10	183	18.37	63	21.14	180	20.69
3	27	13.24	95	9.54	42	14.09	95	10.92
4	18	8.82	73	7.33	21	7.05	49	5.63
Total	204	100	996	100	298	100	870	100

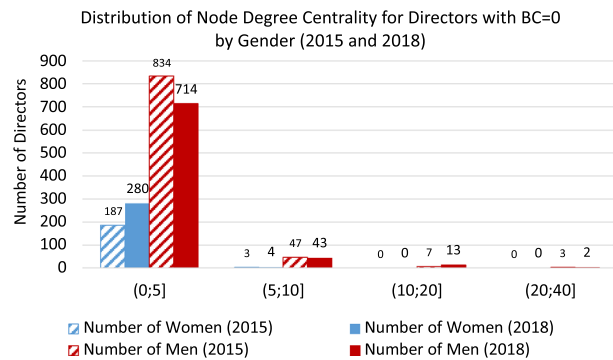


Fig. 7 Distribution of Node Degree Centrality for Directors with BC = 0 by Gender (2015 and 2018)

with a BC lower or equal to 1000 seem to lose some power (their number dropped from 87 in 2015 to 78 in 2018) but at the same time they gain in the range above 1000 (18 men in 2015 as opposed to 20 in 2018). Whereas in this very top range (above 1000), women lost some power as their numbers dropped from three in 2015 to two in 2018.

Interesting observations can be made when we look at the values and ranges of node degrees for directors with BC > 0 (Fig. 9). There is a decline in the number of men with node degrees below or equal to 10 from 54 in 2015 to 49 in 2018 (decreased by 9%). In addition, there is a small 4% decrease in the number of men with a node degree larger than 10 (from 51 in 2015 to 49 in 2018). When we look at women and

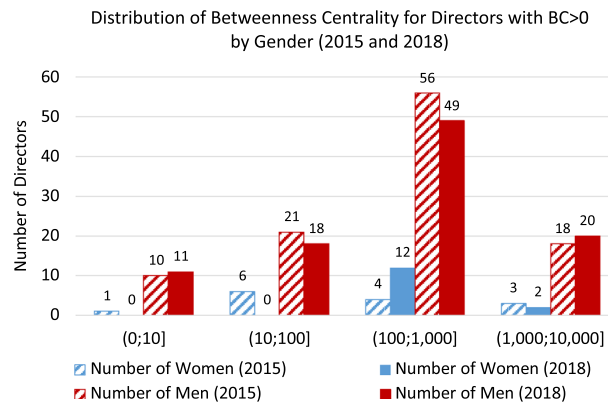


Fig. 8 Distribution of Betweenness Centrality for Directors with BC > 0 by Gender (2015 and 2018)

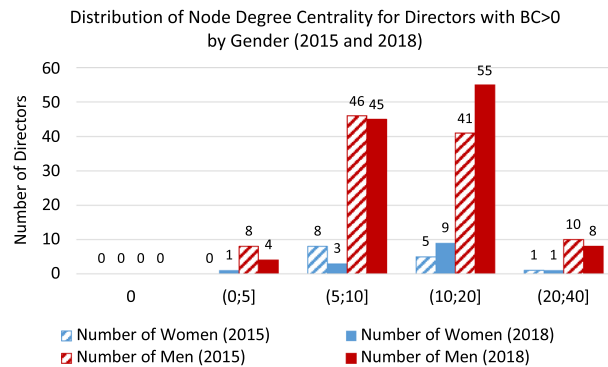


Fig. 9 Distribution of Node Degree Centrality for Directors with BC > 0 by Gender (2015 and 2018)

their degree, the trend is different to the one displayed by men. On the one hand, the number of women (BC > 0) with a node degree smaller or equal to 10 dropped more significantly, from eight in 2015 to four in 2018 (a decrease of 50%). On the other hand, the number of women with a degree measurement higher than 10 increased from six in 2015 to ten in 2018 (a large increase of 66%).

This analysis of the gendered distribution of agency in Australian corporate boards between 2015 and 2018 gives a nuanced picture of trending change. What it clearly reveals is that there is no proportional change in men losing power (or women gaining power) commensurate with the significant increase in the number of women in the network (from 204 in 2015 to 298 in 2018, an increase of 46%) and decreasing number of men (from 996 in 2015 to 870 in 2018, decrease of 13%). One might expect that women would occupy a more influential position in the network as their numbers increased but instead, women are still at the periphery of the network (with low k-core centrality), limited control over the information flow in the network (with low betweenness centrality) and are not well-connected (with low node degree). Is there another way to identify which directors benefited from the increasing number of women in the ASX200 board network?

To better understand who gained power in the network fastest and who was better at growing their circle of connections we analyze the relations between node degree

and betweenness centrality (for directors with $BC > 0$) for 2015 (Fig. 10) and 2018 (Fig. 11) for each gender.

There are only 14 women (in both 2015 and 2018) and 105 and 98 men in 2015 and 2018, respectively, with a $BC > 0$. The lines of fit in Figs. 10 and 11 represent the relative power (on average) of men and women in the network at two points in time. These lines of fit show that, relatively speaking, men in ASX board networks acquire power faster than women despite a decrease in the overall numbers of men in the network and a larger increase in the number of women. We can conclude from the lines of fit that from 2015 to 2018 not only do the lines become steeper, but also the difference between them increased. This observation supports our previous conclusion

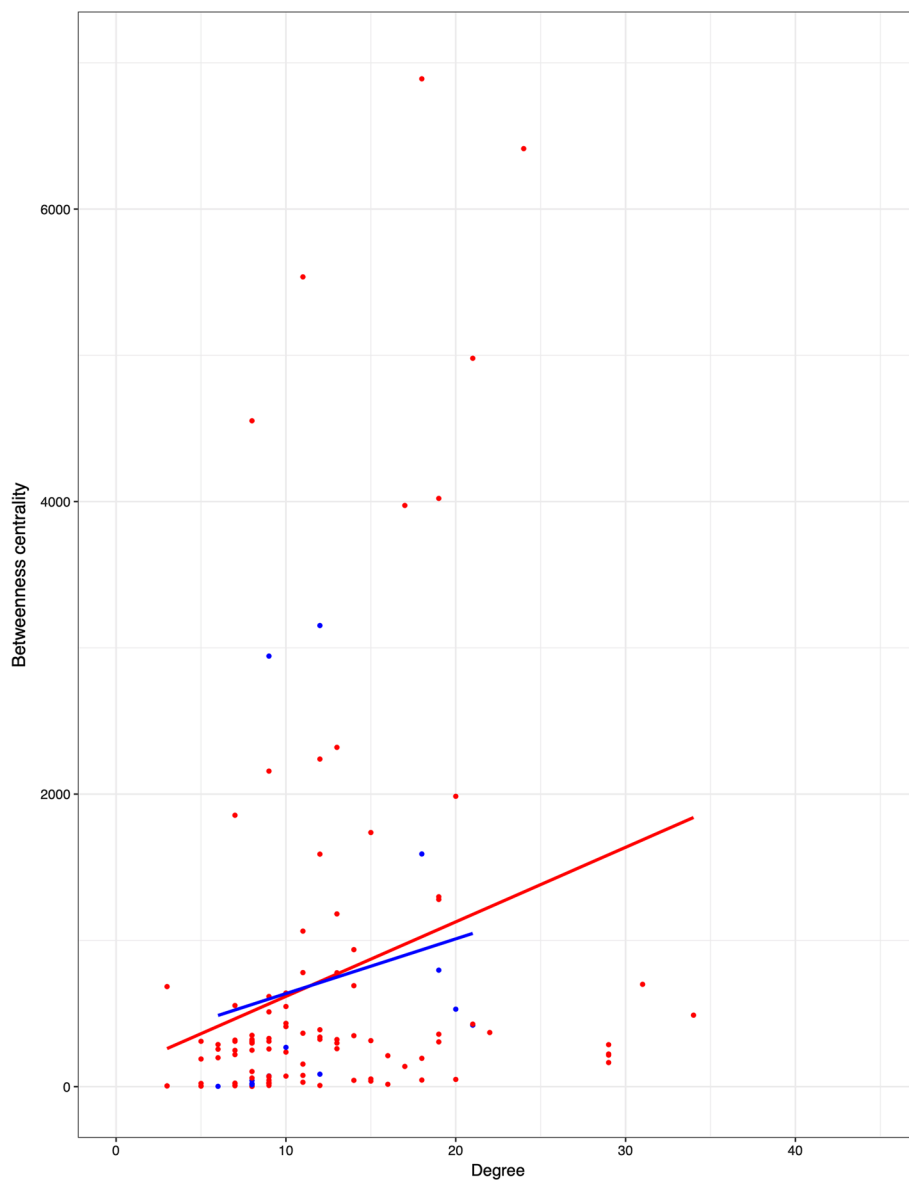


Fig. 10 Relations between Node Degree and Betweenness Centralities for Directors with $BC > 0$ (by Gender in 2015)

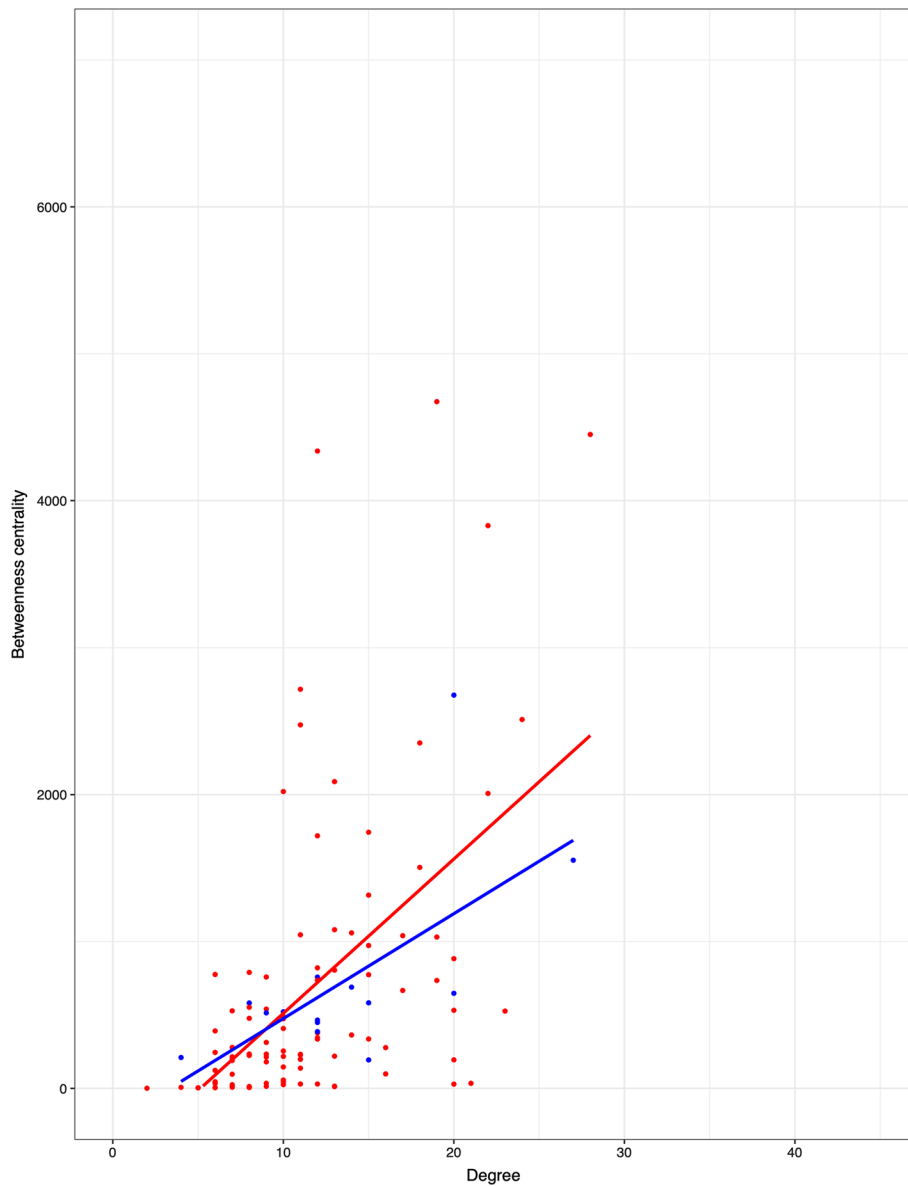


Fig. 11 Trend between Node Degree and Betweenness Centralities (for Directors with $BC > 0$ (by Gender in 2018)

that adding women to the network does not necessarily increase their power or decrease the power of men. More critically, our results suggest that the divergence between men and women increases with time. This exploratory analysis shows that understanding the position of women in board networks requires looking beyond aggregated “headcount” statistics.

Table 5 shows that statistically, on average the small number of 14 women with a $BC > 0$ in 2015 and 2018 respectively have gained power relative to the averages before and after from the larger group of men (105 and 98). For women the means and medians for both BC and ND increased over time while for men those statistics decreased. This is mainly the effect of a difference between the sample size of each gender. When

Table 5 Basic statistics for BC and ND by gender (2015 and 2018)

Full network								
Statistics	2015				2018			
	Women		Men		Women		Men	
	BC	ND	BC	ND	BC	ND	BC	ND
Mean	711.14	12.00	728.09	12.18	730.68	13.57	674.17	11.55
Median	176.83	9.50	298.67	10.00	551.60	12.00	265.88	10.50
Std. Deviation	1082.43	5.20	1330.87	6.38	646.83	5.77	990.29	5.05
Variance	1 171 650	27.08	1 771 211	40.73	418 383	33.34	980 668	25.51
N	14.00	14.00	105.00	105.00	14.00	14.00	98.00	98.00

Table 6 Category 1—The Delisted: directors in the 2015 network who left or BC became 0

Category 1—The delisted								
Statistics	2015				2018			
	Women		Men		Women		Men	
	BC	ND	BC	ND	BC	ND	BC	ND
Mean	611.06	10.33	369.78	11.15	7.09	1.92	35.26	2.63
Median	143.75	8.50	200.27	9.00	0.00	1.00	0.00	1.00
Std. Deviation	1155.26	5.39	667.62	6.21	53.40	2.80	242.91	3.92
Variance	1 334 633	29.07	445 711	38.52	2 851	7.81	59 003	15.35
N	6		52		62		483	

we focus on the top directors only (see Figs. 10 and 11), we see a different picture: women are absent from the most powerful group of directors. Since women are not present in the top end of the cloud in the graph, the line of fit for men is much steeper than a simple comparative table of means would suggest. This strongly underscores the importance of examining network measures in relation to specific cohorts or categories of board director membership.

To better understand the dynamics of the changes in the network between 2015 and 2018, we look at different subsets of the data. In our investigation of board composition and networks we found three distinct director categories that serve to differentiate entries into, dynamics within, and exits from the network over time: *The Delisted* (directors who left between 2015 and 2018 or whose BC was reduced to 0), *The Draft Picks* (newly appointed directors or directors whose BC rose above 0 between 2015 and 2018), and *The Veterans* (directors present in both 2015 and 2018).

Impact of board members leaving or losing influence: category 1 (The Delisted)

First, we consider *The Delisted*. These are directors who were present in the network in 2015 but who left and are therefore no longer present in 2018 or lost power (who stayed but their BC became zero). Table 6 provides a summary on *The Delisted* for both networks in 2015 and 2018.

In total 62 women and 483 men left the network, or their BC became 0 and out of these 6 women and 52 men had betweenness centrality greater than 0 (Table 6). It can be observed that the 6 women with $BC > 0$ who left the network or lost power because their BC became 0 were more powerful on average (in terms of BC) than men in this category. However, this is a result of the different number of women and men in this category and of a power law distribution of the BC which results in averages being very skewed. This is also reflected by the fact that the median for women is smaller, and their standard deviation is much higher than that for men.

When we look at the whole network, the mean values of both BC and ND for men who left the network or their BC became 0 are higher than those for women in the same category and this suggests that in the context of measuring relative power, all men who left or lost their power held more power in 2015 than all women who left or lost their power. When we compare the 6 top women and 6 top men who left the network with respect to degree, min and max degrees are 35 and 20 for men and 21 and 4 for women, respectively. This shows that the best-connected men who left the network had stronger networks than the top 6 women combined.

There are two possible explanations for people who have left the network, when comparing 2015 and 2018 (Table 7). First, it can be because the company itself left the ASX200 before 2018 and so all the board directors of that company (if they do not sit on other boards) that were not in the ASX200 for our last data snapshot in 2018 will be absent. Second, the board director could have left the network because they left all the boards they sat on during this time. There is not much difference between genders when it comes to the percentage of directors who left the network for each of these reasons. This shows that the situation is similar for both women and men with respect to the dual reasons for leaving the network.

The impact of board members joining: category 2 (The Draft Picks)

Another category of board members to explore are *The Draft Picks*. These are directors who were not on any board in 2015 but are present in 2018 or whose BC was 0 in 2015 and is positive in 2018.

As shown in Table 8, out of 156 women who joined the network and are present in 2018 (but not in 2015) or their BC became positive, only six of them have $BC > 0$ (3.8%) and all six were present in the network in 2015. Out of 357 new men or those for whom

Table 7 Category 1—The Delisted: reasons for leaving the network (by gender)

Reason for leaving network	Number of directors			Percentage of directors		
	Men	Women	Total	Men (%)	Women (%)	Total (%)
	Reason 1: Company Left Index in 2018	202	27	229	41.82	43.55
Reason 2: Director Left Board	263	33	296	54.45	53.23	54.31
Reason 1 and Reason 2	18	2	20	3.73	3.23	3.67
Total	483	62	545	100	100	100

“Reason 1 and Reason 2” means that a director had multiple positions and she/he left the network because the company left the ASX200 index in 2018 and she/he also left the board of a company that was still in the 2018 ASX200 index

Table 8 Category 2—The Draft Picks: new directors who entered the network between 2015 and 2018

Statistics	Category 2—The Draft Picks							
	2015				2018			
	Women		Men		Women		Men	
	BC	ND	BC	ND	BC	ND	BC	ND
Mean	554.77	11.67	243.90	9.29	0.00	1.33	7.59	1.88
Median	523.27	12.00	122.50	9.00	0.00	1.00	0.00	1.00
SD	146.74	1.97	371.75	3.83	0.00	0.73	108.69	2.19
Variance	21 532	3.87	138 199	14.66	0.00	0.53	11 813	4.82
N	6		45		156		357	

Table 9 Category 2—The Draft Picks: reasons for joining the network (by gender)

Reason for joining network	Category 2—The Draft Picks					
	Number of directors			Percentage of directors		
	Men	Women	Total	Men (%)	Women (%)	Total (%)
Reason 1: Company Joined Index in 2018	183	56	239	51.26	35.90	46.59
Reason 2: Director Joined Board	166	90	256	46.50	57.69	49.90
Reason 1 and Reason 2 combined	8	10	18	2.24	6.41	3.51
Total	357	156	513	100	100	100

“Reason 1 and Reason 2 combined” indicate that a director had multiple positions and she/he joined the network because the company entered the ASX200 index in 2018 and she/he also joined the board of the company that was already in ASX200 index

BC became positive from 2015 to 2018, 45 of them have $BC > 0$ (12.6%). So, there are more men in this category holding some power in the network in comparison to the number of women. But when we look at the average power of people with $BC > 0$ in this category, women are more powerful than men with respect to both BC and ND (although we note that the number of women and men who are new to the network or their BC became positive is significantly different and therefore the comparative sample sizes vary). However, on average women in this category with $BC > 0$ have more influence than men (with $BC > 0$) as both their mean and median for both BC and ND are higher than those for men.

However, when we analyze the members of this category and their standing in the context of the whole network, on average men are more powerful both in respect to BC and ND. When we compare the 6 top women and 6 top men in this category with respect to degree, the min and max degrees are 14 and 11 for men and 5 and 3 for women, respectively. This shows that the six best-connected men in this category have stronger networks than top 6 women.

Looking at directors who joined the network between the 2015 and 2018 “snapshots”, there are two possible reasons that account for their appearance (Table 9). Firstly, they might appear because the company they represented joined the ASX200 after 2015 and so all the board directors, if they did not sit on other boards in 2015, would be added. Secondly, the board director could newly appear in the 2018 network by being appointed

after 2015 to the boards of one (or more) companies that were present in both 2015 and 2018. Almost 15% fewer women (56 out of 156) than men (183 out of 357) joined the network because the company on which they held a board position joined the network. Over 11% more women (90 out of 156) than men (166 out of 357) joined the network through joining the board of directors of a company that was part of ASX200 in both 2015 and 2018 (Table 8). This shows that the campaign of bringing more women to the board of directors was indeed successful. The question is however did this improvement occur at the cost of women already in the network (The Veterans) (Table 6)?

The changing fortunes of board members that persist: category 3 (The Veterans)

The final subset of directors that we analyze are *The Veterans*. These are directors who are present in both the 2015 and 2018 networks.

Table 10 shows that from 2015 to 2018 the power of men in this category decreased a little and the power of women increased. The results for the subset of directors with BC > 0 also show that men in both networks are doing better in the context of the BC (median). When looking at ND women have slightly improved, however, this change is not statistically significant.

Overall, there are no substantive changes in *The Veterans*' core network with the exception that the mean BC for women who have BC > 0 increased from 786.21 in 2015 to 862.62 in 2018 and the mean BC for men with BC > 0 marginally decreased (from 1079 in 2015 to 1039 in 2018) and that the median for BC (on a sample where directors have BC > 0) increased for both men and women. Both women and men became more powerful when considering the median. This suggests that although the situation is improving in terms of the number of women in the network, the power balance between men and women has not significantly changed. Despite apparent numerical gains in the appointment of women to board directorships, there is still a lot of work ahead to achieve a truly equitable environment between men and women in terms of board directorships.

Table 10 Category 3 – The Veterans: directors present in both the 2015 and 2018 Networks

Category 3—The Veterans								
Statistics	2015				2018			
	Women		Men		Women		Men	
	BC	ND	BC	ND	BC	ND	BC	ND
Panel A: BC > 0								
Mean	786.21	13.25	1079.63	13.19	862.62	15.00	1039.49	13.47
Median	307.38	12.00	339.00	12.00	552.15	15.00	734.86	12.00
SD	1098.90	5.04	1688.47	6.45	845.70	7.33	1190.02	5.19
Variance	1 207 586	25.36	2 850 937	41.58	715 200	53.71	1 416 155	26.98
N	8		53		8		53	
Panel B: Full Network								
Mean	67.02	2.73	115.83	3.46	72.04	3.58	123.51	4.08
Median	0.00	1.00	0.00	1.00	0.00	2.00	0.00	2.00
SD	390.46	3.27	631.13	4.82	293.87	4.03	499.25	5.09
Variance	152 459.20	10.70	398 329.90	23.21	86 358.96	16.22	249 247.60	25.92
N	142		513		142		513	

Limitations and explanation

There are several limitations to the analysis presented in this paper. One of these is endemic to participation studies of this kind: it is difficult to analyze the specific role of women in networks when there are so few women in them. The limited number of women appointed to ASX200 boards means the surety of our conclusions is sometimes hampered by small sample sizes. Extending our sample to ASX300 companies would have resulted in more data. We chose ASX200 companies for two reasons. First, the ASX200 index is Australia's leading share market index which is globally recognized. Second, using ASX200 companies matches the standard analysis produced by industry organizations such as the Australian Institute of Company Directors (AICD). For the same reasons, our data sample is limited to publicly listed companies and not private companies. We do not measure differences between industry sectors (financial services versus mining for example), in part due to the small sample sizes noted above. Additionally, our analysis is limited to an Australian jurisdiction and may not be generalizable in a global context. Future research expanding this analysis for international comparisons would be fascinating.

Our comparative time-period covers only three years (the same three years examined by key Australian organisations such as the AICD). However, networks take time to develop. Although a longer timeframe would be useful for demonstrating more significant shifts in the networks it would also include more "noise" such as a higher number of entrances and exits which would serve to obscure any results. Finally, our analysis draws on a very limited binary gender model and does not encompass an intersectional lens on board member identity. Consequently, our analysis is not sensitive to a broader range of factors (non-binary gender, race, class, ethnicity, educational level, sexuality, citizenship and migration status, disability, health conditions and so on.), which mediate social inequalities and may contribute to the network barriers that many women experience.

Conclusion

In this research we use node degree centrality to measure the extent to which a director exerts influence over their immediate connections and betweenness centrality to understand the extent to which a director is influential at the level of the whole network. We also look into k-core centrality to understand who is in the center and who is at the periphery of a network. Between 2015 and 2018 we did not find improvements for women with this combination of network characteristics. By exploring these measures in terms of the distribution of gender in the director networks of Australia's largest 200 companies we can ascertain that despite statistical gains in participation rates, women directors have not significantly improved their agency.

Where women have made some network-level gains is in terms of node degree centrality. There is some evidence that directors with multiple directorships hold higher status, and hence, have higher influence on board decisions (Badolato et al. 2014). However, people with high node degree but low betweenness centrality have a limited impact, primarily exerting influence on their local environment while having little effect on the broader network.

Finally, network analysis reveals there is a small number of directors with high betweenness centrality and modest node degree centrality. Importantly, these directors are exclusively men. These characteristics perhaps point to an *éminence grise* role fulfilled by these men in the corporate board network. Identifying these board members is especially interesting since, at first sight, they might not be associated with a high level of power in the network due to their lower node centrality. But it is possible to use *licentia poetica* to suggest that they hold both tacit, formal power (expressed by a modicum of node degree centrality) and a high degree of covert power (significant betweenness centrality).

The findings of this paper make an important contribution to the arguments and efforts intended to improve the number of women appointed to corporate boards in Australia and perhaps beyond. Whilst we find that overall numbers of women are slowly increasing in line with the expectations of industry bodies and regulators, we also find that the agency of women in company board networks has not improved significantly at all. We note that our analysis should not be taken as an argument against quotas or more generally against increasing the number of women appointed to company boards. Rather, it should be seen as a call for a revised understanding of success that uses additional forms of measurement beyond aggregate statistics. We believe accountability needs to extend from summative statistics to also measuring relative status and influence. We are mindful that when “the numbers” become an end in themselves, the more nuanced ambition of social justice is often lost. Reaching a numerical target is only one of many steps towards meaningful and substantive equity, diversity and inclusion for all women.

Abbreviations

ASX	Australian Stock Exchange
BC	Betweenness Centrality
CEO	Chief Executive Officer
DAX	Deutscher Aktien Index
KC	K-core centrality
ND	Node Degree
S&P	Standard and Poor's

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Author contributions

DV developed research questions and guided research design and wrote the initial version of this manuscript. KM guided methodology, data processing, and result analysis and write-up. GH and SG provided manuscript development, result interpretation and write-up, and valuable comments. MS collected and processed data and wrote the code that produced results. All authors have read and approved the manuscript.

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Availability of data and materials

The data obtained from the *BoardEx* database that support the findings of this study are available from Management Diagnostic Limited but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and subject to permission of Management Diagnostic Limited. Network data is available via DOI from Figshare: 10.6084/m9.figshare.14910015.

Declarations

Competing interests

The authors declare that they have no competing interests.

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