

LEADERSHIP DIVERSITY AND FIRM PERFORMANCE

A Study of Singapore-
Listed Companies

February 2022



Centre for Governance and Sustainability
NUS Business School



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LEADERSHIP DIVERSITY AND FIRM PERFORMANCE

TECHNICAL REPORT

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DBS, EDGE Strategy, Securities Investors Association (Singapore)

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About Centre for Governance and Sustainability

The Centre for Governance and Sustainability (CGS), formerly known as Centre for Governance, Institutions and Organisations (CGIO), was established by the National University of Singapore (NUS) Business School in 2010. It aims to spearhead relevant and high-impact research on corporate governance (CG) and corporate sustainability (CS) issues that are pertinent to institutions, government bodies and businesses both in Singapore and Asia. This includes corporate governance and corporate sustainability, governance of family firms, government-linked companies, business groups, and institutions. CGS also organises events such as public lectures, industry roundtables, and academic conferences on topics related to governance and sustainability.

CGS is the national assessor for the CS and CG performance of listed companies in Singapore.

More information about CGS can be accessed at <https://bschool.nus.edu.sg/cgs/>

For more than 50 years, NUS Business School has offered a rigorous, relevant and rewarding business education to outstanding students from across the world.

Founded in the same year that Singapore gained independence, NUS Business School stands today among the world's leading business schools. It is distinctive for offering the best of global business knowledge with deep Asian insights, preparing students to lead Asian businesses to international success and to help global businesses succeed in Asia.

The School attracts a diversity of smart and talented students to our broad portfolio of academic programs, including BBA, MBA, Executive MBA, MSc and PhD programs in addition to our customised and open enrolment Executive Education courses. Admission to NUS Business School is highly competitive, and we are proud of the exceptional quality of our students.

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About EDGE Strategy

EDGE Strategy is a Swiss-based tech company that offers an integrated SaaS-based DE&I solution allowing organizations to measure, accelerate and get certified for where they stand in terms of gender and intersectional equity.

EDGE's customer base consists of 200 large organizations in 44 countries across five continents, representing 29 different industries. Organizations that are certified include IKEA, L'Oréal, Philips, UNICEF, Dow, the World Bank, the European Central Bank, IFF, Firmenich, Zurich Financial Services and Pictet, among many others.

Headquartered in Zug, Switzerland, EDGE Strategy is a high-growth, global and mission-driven organization.

As the most rigorous and recognized assessment and certification of gender equity in the workplace, EDGE helps clients transform their workforce and positively impacts the lives of millions of people.

The growing interest and pressure to a more diverse and inclusive workplace requires both measurement and actions to transform. EDGE can provide both. Times are ready for organizations to transform their workplace, contributing to a more inclusive, equitable and prosperous society, powered by gender and intersectional equity. EDGE can support with a holistic, methodologically sound, and actionable approach.

About Connecting the Dots

Connecting the Dots is a Singapore-based boutique consultancy. Since its launch in 2014, the company has focused on projects that enable companies and organisations to better align their objectives to the UN SDGs and their own ESG goals through new business models, strategies, and technology. Connecting the Dots works with global tech companies, multi-lateral development agencies and banks, universities, SMEs, and FinTech companies with an aim to scale and grow activities in the Asia region with a “profit with purpose” mindset.

Ms Juanita Woodward is the Principal of Connecting the Dots. Ms Woodward was awarded the – HERo Award, Trailblazer of the Year, SME - by the American Chamber of Commerce of Singapore in November 2021. In presenting her with this award, the Chamber acknowledged Ms Woodward for her many accomplishments over the years, and her contributions towards promoting diversity, equity and inclusion and advancing women leaders:

Juanita Woodward, Principal at Connecting the Dots, has been a trailblazer in Singapore since the early '90s. She is the Founding President of the PrimeTime Business and Professional Women's Association, which will celebrate its 25th anniversary in 2022, and Co-Founder of BoardAgender, which celebrated its 10th anniversary in 2021.

In her professional career, Ms. Woodward has held Asia Pacific and global roles at Citi, ABN AMRO and Standard Chartered Bank. At Connecting the Dots, she now works with FinTech startups, global tech companies and multilateral development agencies focused on developing innovative, digital financial services for the Asia region. With UNCDF and others, her work has enabled financial access for women and women-led businesses in Asia's emerging markets.

Ms. Woodward is an Advisor to the newly launched National University of Singapore (NUS) Women In Business Club, empowering the next gen female leaders in Singapore. Since 2013, she has been an Advisory Board Member of the NUS Business School NUS Centre for Governance and Sustainability (CGS).

About DBS

DBS is a leading financial services group in Asia with a presence in 18 markets. Headquartered and listed in Singapore, DBS is in the three key Asian axes of growth: Greater China, Southeast Asia and South Asia. The bank's "AA-" and "Aa1" credit ratings are among the highest in the world.

Recognised for its global leadership, DBS has been named "World's Best Bank" by Euromoney, "Global Bank of the Year" by The Banker and "Best Bank in the World" by Global Finance. The bank is at the forefront of leveraging digital technology to shape the future of banking, having been named "World's Best Digital Bank" by Euromoney and the world's "Most Innovative in Digital Banking" by The Banker. In addition, DBS has been accorded the "Safest Bank in Asia" award by Global Finance for 13 consecutive years from 2009 to 2021.

DBS provides a full range of services in consumer, SME and corporate banking. As a bank born and bred in Asia, DBS understands the intricacies of doing business in the region's most dynamic markets. DBS is committed to building lasting relationships with customers, and positively impacting communities through supporting social enterprises, as it banks the Asian way. It has also established a SGD 50 million foundation to strengthen its corporate social responsibility efforts in Singapore and across Asia.

With its extensive network of operations in Asia and emphasis on engaging and empowering its staff, DBS presents exciting career opportunities.

For more information, please visit www.dbs.com

About Securities Investors Association (Singapore) or SIAS

SIAS actively promotes good corporate governance and transparency practices, investor rights, investor education and is the watchdog for investors in Singapore. SIAS rates companies on their governance practices together with industry partners and rewards companies excelling in good corporate governance practices.

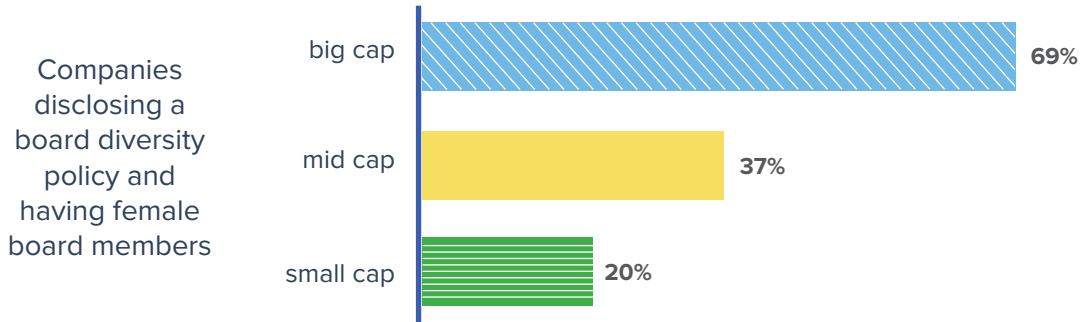
SIAS, the largest organised investor group in Asia, is run by an elected Management Committee comprising professionals who are volunteers. It is now a registered Charity and an Institution of Public Character.

Besides its focus on corporate governance, SIAS also extensively provides a variety of investor education programmes to its members and the investing community at large through collaborative arrangements with financial institutions and listed companies interested in investor education as part of its corporate social responsibility agenda.

For more information about SIAS, please visit www.sias.org.sg

Executive Summary

Board diversity policy disclosure



Companies disclosing a board diversity policy and having female board members: 69% of big cap companies; 37% of mid cap companies; 20% of small cap companies.

Gender diversity



ROA growth peaks when the number of female leaders equals the number of male leaders

Age diversity



Age diversity index has a positive impact on ROA; proportion of leaders aged over 60 years has a negative impact on ROA

Education diversity



Education diversity index has a positive impact on ROA

Diversity in industry experience



Proportion of leaders with more than 10 years of industry experience has a positive impact on ROA

Executive Summary

Leadership diversity is an increasingly major issue for companies across the world. There has been much discussion on the benefits of diversity, such as challenging groupthink and being a medium for initiating positive change in organisations. Among the various aspects of diversity, gender diversity has attracted particular attention. Board gender diversity has been associated with characteristics such as better quality decision-making, greater corporate innovation, and improved resource usage.

Nevertheless, global research consensus on the effect of leadership diversity on firm performance has not yet been reached. Responsible public discourse regarding leadership and gender diversity must be undergirded by sound empirical research. As such, this study aims to examine the influence of leadership diversity and remuneration by gender on firm performance. In doing so, we seek alignment with a national movement aiming to lay a robust foundation for promoting gender diversity. We further aim to contribute to developing diversity policies and practices in companies and other organisations.

The study covers all 577 SGX-Listed companies as of June 2021, and examines diversity among the board of directors and senior management (collectively referred to as 'leadership'). A comprehensive approach is adopted, incorporating four dimensions of diversity: gender; age; education; and industry experience. Two indicators of diversity are employed: Blau's Index; and the proportion of leadership falling into the relevant categories for each diversity dimension.

Our results confirmed the need for nuance in discussions on diversity. Diversity indices for gender, age and education are shown to have a positive impact on firm performance as measured by ROA. However, the positive impact of age diversity is moderated somewhat by the fact that the proportion of leaders aged 60 years and older, has a negative impact on ROA. Similarly, while the diversity index for industry experience has no significant effect on ROA, the proportion of leaders with more than ten years of relevant industry experience has a positive influence on firm performance.

Further, while gender diversity has a positive impact on ROA as seen in both the gender diversity index and the proportion of female leaders, our results show there is a limit to the positive effect of increasing female leadership. We found the inflexion point to be the gender parity point (i.e. the point at which there is an equal number of males and females in leadership). The growth in ROA from additional female leadership peaks when the number of female leaders equals that of males, and declines when the proportion of female leaders exceeds the 50% threshold. Our findings thus highlight the important role of gender parity in leadership, and suggest that this should be the company's focus with regards to gender diversity.

Finally, analysis of the effect of gender-based differences in remuneration was not possible due to scarcity of remuneration disclosure. This underscores the need for greater disclosure in this aspect of leadership governance.

1. Introduction

Leadership diversity is an increasingly major issue for companies across the world. There has been much discussion – both in the popular and academic literature - on the benefits of diversity, such as challenging groupthink by bringing multiple perspectives to the board and senior management for consideration (Loh and Nguyen 2018, Ciavarella 2017, Ararat et al. 2015). It is also maintained that a top-level culture of diversity can influence and initiate positive change for growth in human resource talent, and hence, throughout the organisation.

Among the various aspects of diversity, gender diversity has attracted particular attention of late. Board gender diversity has been associated with characteristics such as better quality decision-making, greater corporate innovation, and improved resource usage (Conyon and He 2017).

Singapore's progress in board gender diversity among listed companies can be seen in **Figures 1 and 2**, which show a general trend of increased participation of women in board leadership, and a decreased trend of all-male boards since 2013. This trend is even more pronounced in the top 100 companies by market capitalisation.

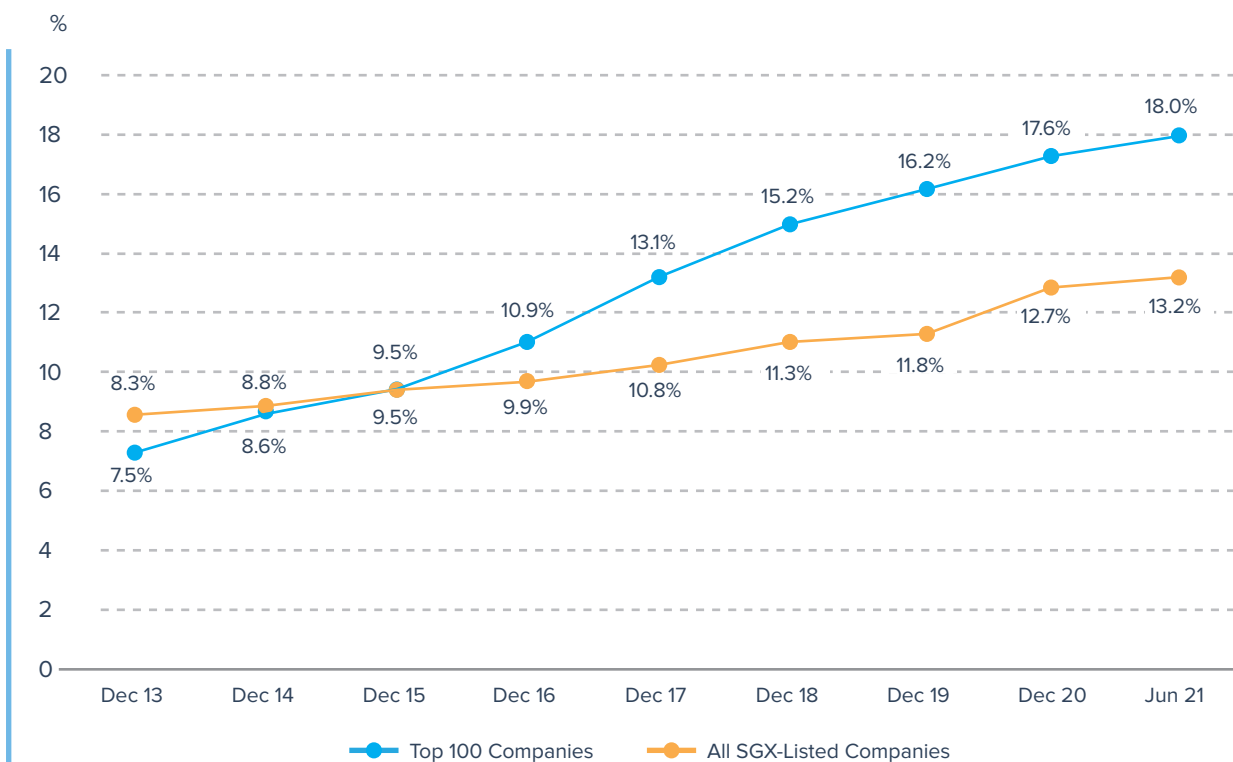


Figure 1: Board Gender Representation among Singapore-Listed Companies: Participation of Women on Boards

Source: Council for Board Diversity (2021)

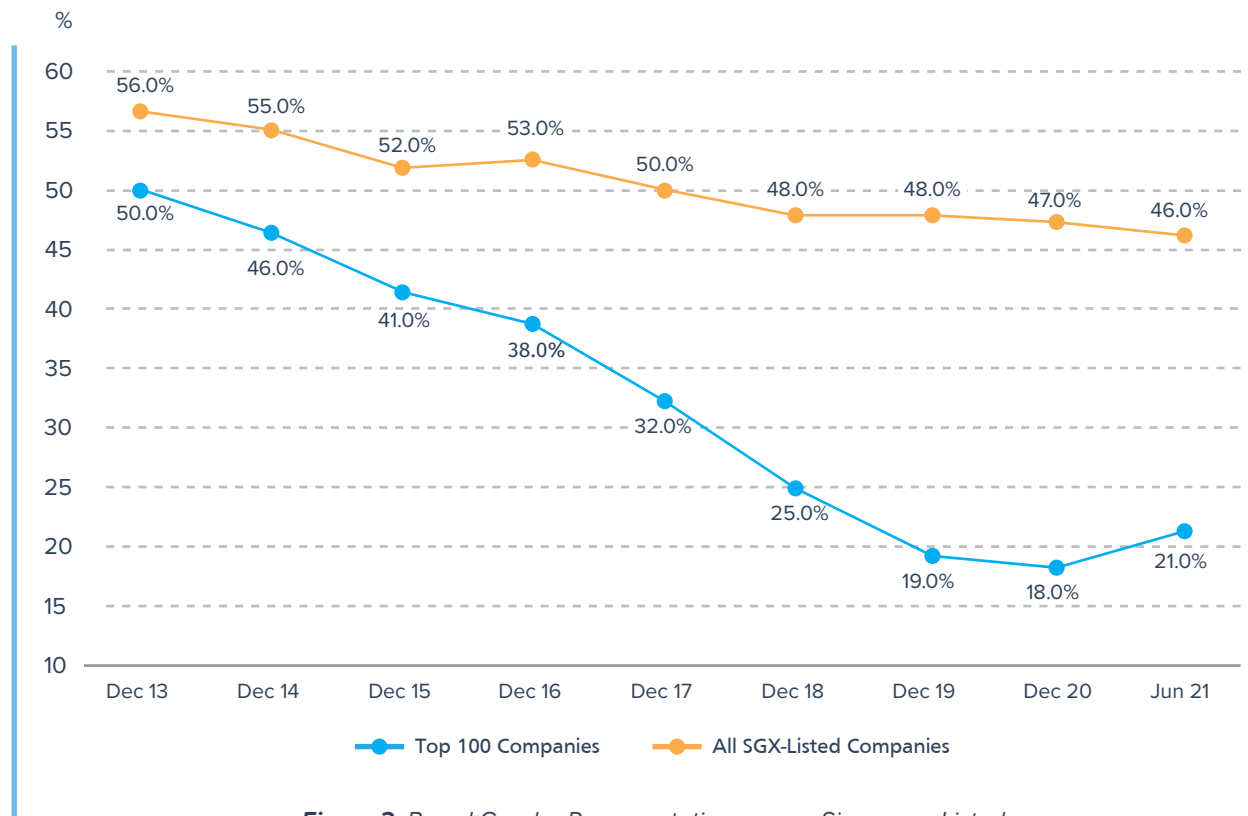


Figure 2: Board Gender Representation among Singapore-Listed Companies: All-Male Boards

Source: Council for Board Diversity (2021)

Singapore's global standing with regards to gender equality can be obtained from the World Economic Forum's Global Gender Gap Index, which tracks gender progress in economic participation and opportunity, educational attainment, health and survival, and political empowerment. In the 2021 Index, Singapore maintained its rank of 54th out of 156 countries, as well as its 5th-place regional ranking¹ (World Economic Forum 2021). Nevertheless, closer examination reveals room for improvement, showing below-average scores in terms of leadership representation in the corporate and political spheres.

The Singapore government is taking active steps to address and recognise the important societal and economic contributions of women (Begum 2021). As part of a review of women's issues, the government initiated a series of discussions, *Conversations on Singapore Women's Development*, beginning in late 2020 and continuing through 2021. The insights from these dialogues will form the basis of a White Paper containing recommendations for the continued progress of women in Singapore, which will be presented to Parliament in early 2022 (Ministry of Social and Family Development 2021). 2021 was also designated a year to celebrate the progress and potential of Singapore women.

¹ This refers to economies of East Asia and the Pacific.

1.1 Leadership Diversity: The Need for Empirical Evidence

Responsible public discourse regarding leadership and gender diversity must be undergirded by sound empirical research. In this, it is also important to identify, and take into account, nuances in the relevant issues. This is especially because global research consensus on the effect of leadership diversity on firm performance has not yet been reached (Aggarwal et al. 2019). There is evidence of a positive effect, in studies spanning developed economies (Canyon & He 2017, Ali et al 2014) to emerging markets (Ararat et al. 2015), and covering a range of aspects of diversity, including gender, age, education and nationality. However, the relationship is not always straightforward. It has also been found to vary according to factors such as the level of diversity and firm performance (Ali et al. 2014, Canyon and He 2017). It has also been found to depend on the type of directorship (Ciavarella 2017, Loh and Nguyen 2018) or to have an indirect effect through intermediary variables such as corporate governance performance (Loh and Nguyen 2018).

Given this background, this study aims to examine the influence of leadership diversity and remuneration by gender on firm performance. In doing so, we seek alignment with a national movement aiming to lay a robust foundation for promoting gender diversity. We further aim to contribute to developing diversity policies and practices in companies and other organisations, educating and informing the motivation of leadership and stakeholders involved in talent-search.

2. Research Methodology

2.1 Dimensions of Diversity Included in Study

This study adopts a comprehensive approach to leadership diversity, incorporating four aspects of diversity (**Figure 3**):

1. Gender
2. Age
3. Education (degree holders vs. non-degree holders)
4. Industry experience (years of experience in the company's main industry)

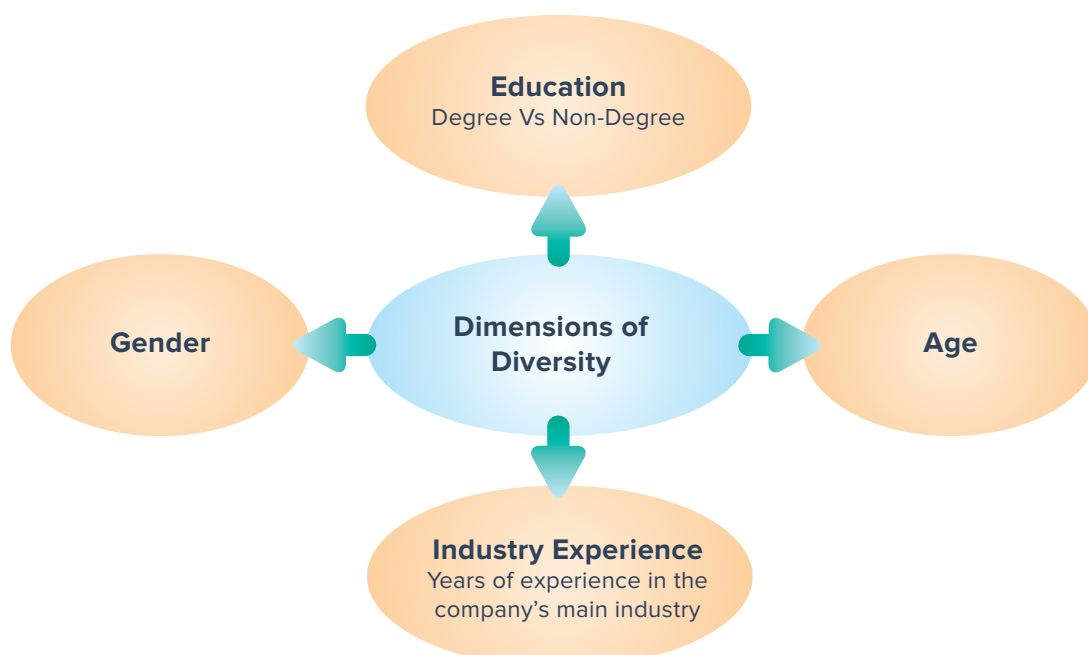


Figure 3: Dimensions of Diversity Included in Study

2.2 Research Scope and Data Sources

The study covers all SGX-Listed companies as of June 2021, excluding those newly listed, suspended from trading, secondary listings, cash companies, or companies under judicial management. This resulted in a total of 577 companies for assessment.

Data sources for this project comprised publicly-available sources such as annual reports and company websites. The Orbis database² was used for collating financial performance data for each company.

Data was collected at both the individual and company levels:

- Individual-level data on directors and senior management: Gender, age, education, industry experience, remuneration.
- Company-level data: Financial performance, diversity policy disclosure and gender representation.

2.3 Measures of Leadership Diversity

Two measures of diversity are employed:

1. Proportion of board of directors (BOD) and senior management (SM) (collectively referred to as 'leadership') falling into the relevant categories for each diversity dimension.

2. Blau's Index, a commonly used measure of diversity (Solanas et al. 2012). Based on Blau (1977), the Index is calculated as:

$1 - \sum p_i^2$, where p_i is the proportion of leadership in each category

For example, a board comprising 40% females and 60% males has a Blau's Index of $1 - (0.4^2 + 0.6^2) = 0.48$. The range of the index is from 0 to 1, with a higher value indicating greater diversity.

Blau's Index is calculated for each dimension being studied, yielding four diversity indices; i.e. diversity indices for gender, age, education and industry experience.

2.4 Measures of Firm Performance

Firm performance is measured by the return on assets (ROA) ratio. ROA is a short-term performance indicator measuring the efficiency by which a firm utilises its assets to generate earnings. Defined as the ratio of net profits to total income, a higher ROA indicates greater firm profitability and efficiency.

For this study, ROA data from 2016 to 2020 was collated.

² Orbis is a database comprising financial and business information about companies worldwide, based on annual reports.

2.5 Control Variables

Previous studies have shown that factors derived from financial statements and market transactions of listed companies are likely to affect their performance. These include: firm size; leverage; and earnings per share (see e.g. Ararat et. al. 2015, Conyon and He 2017).

We included these factors as control variables in our regression analysis, in order to isolate the effect of diversity on firm performance and avoid a confounding effect from these variables.

The control variables are defined as follows:

- Firm size: The natural logarithm of the market capitalisation of the firm.
- Leverage: The ratio of total liabilities and debt to total assets.
- Earnings per share: The net income (loss) divided by the number of outstanding shares.

All control variables are computed as at the end of the relevant fiscal years.

3. Results

3.1 Diversity and Gender Representation in Singapore-Listed Companies

3.1.1 Age Diversity

Figure 4 shows the distribution of leadership in Singapore-Listed companies by age. The largest representation is found in the 51-60 years and 61-70 years age groups (around 30% for each age group), followed by the 41-50 years age group (22%).

However, a somewhat different picture emerges if the companies are categorised according to market value³. As can be seen in Figure 5, mid cap companies have a comparable share of leadership in the three age groups of 50 years or younger, 51-60 years and 61-70 years (around 23%). Small cap companies also diverge from the overall pattern in having the highest share of younger leadership (26% of leadership aged 50 years or younger), exceeding the share of those in the 51-60 years age group (24%) and the 61-70 age group (21%).

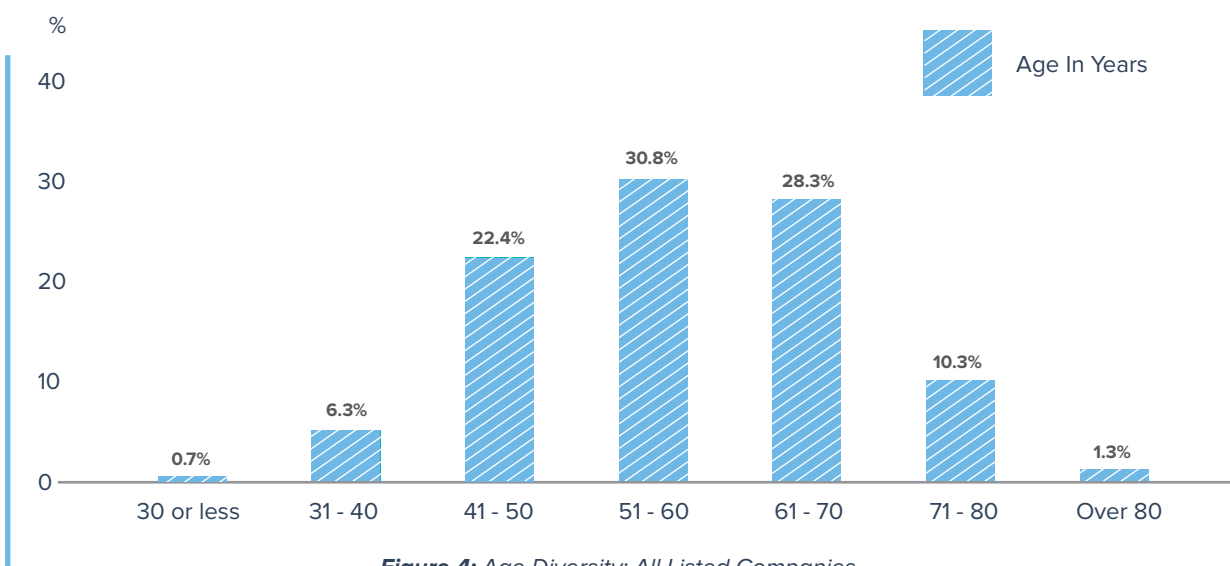
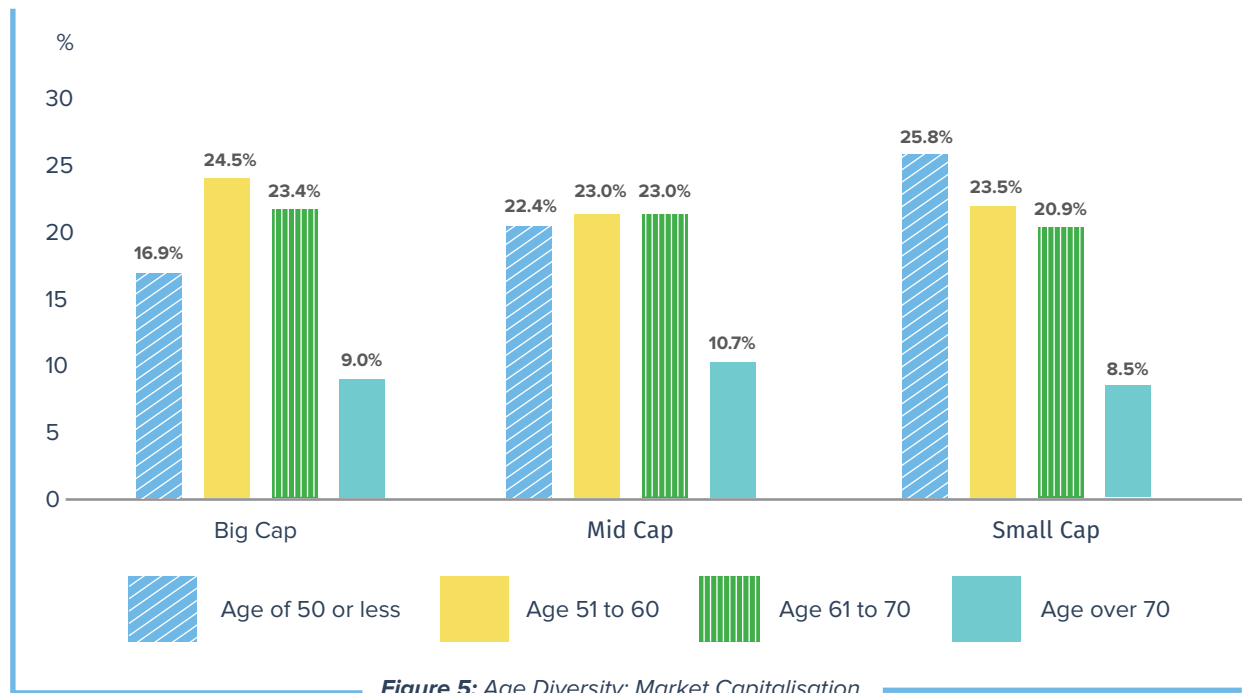


Figure 4: Age Diversity: All Listed Companies

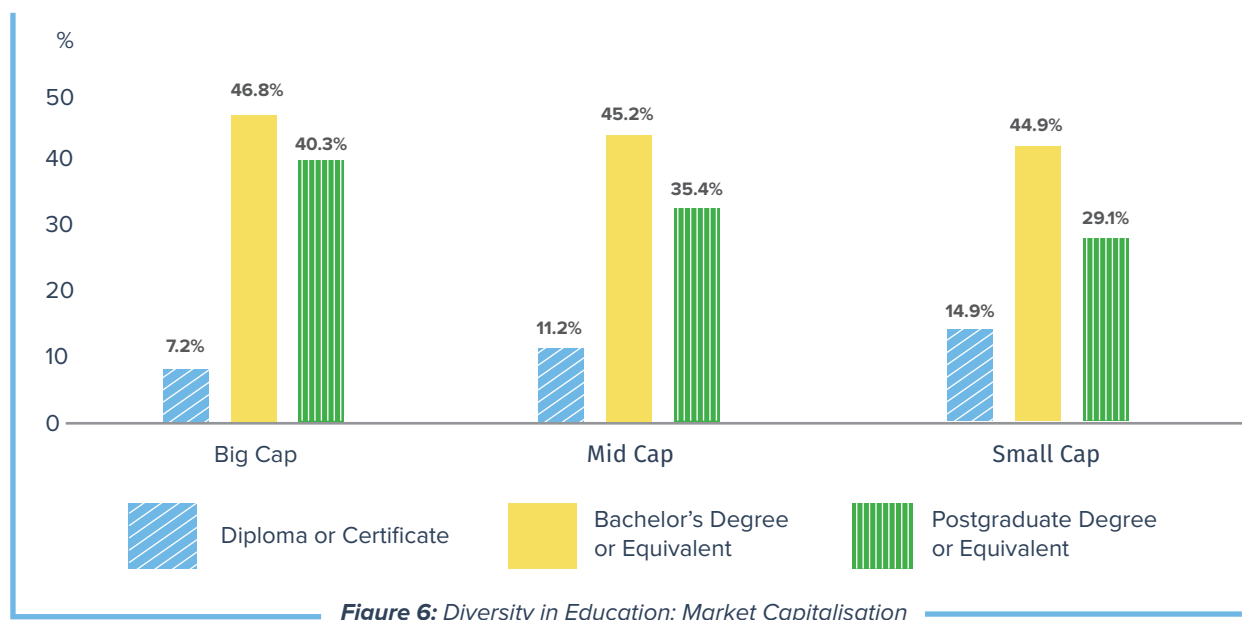
³ Companies are categorised into three groups based on market capitalisation as at 31 December 2020: big cap (>S\$1 billion, n=87); mid cap (S\$300 million-S\$1 billion, n=75); small cap (< S\$300 million, n=415).



3.1.2 Diversity in Education and Industry Experience

All three categories of companies have similar shares of basic-degree holders in leadership (around 45%) (**Figure 6**). However, they diverge with regards to non-degree holders, with small cap companies having twice the share of non-degree holders in leadership as compared to large cap companies (15% vs. 7% respectively). The reverse trend is seen with regards to leadership with higher degrees; 40% of big cap leadership have such degrees, notably higher than the 29% in small cap companies.

By contrast, the three categories of companies have relatively homogenous profiles in terms of the industry experience of their leadership. Very little difference can be seen, with small, mid and big cap companies all having around one-quarter of their leadership having up to 5 years' experience, more than 10 to 20 years, and over 20 years respectively (**Figure 7**).



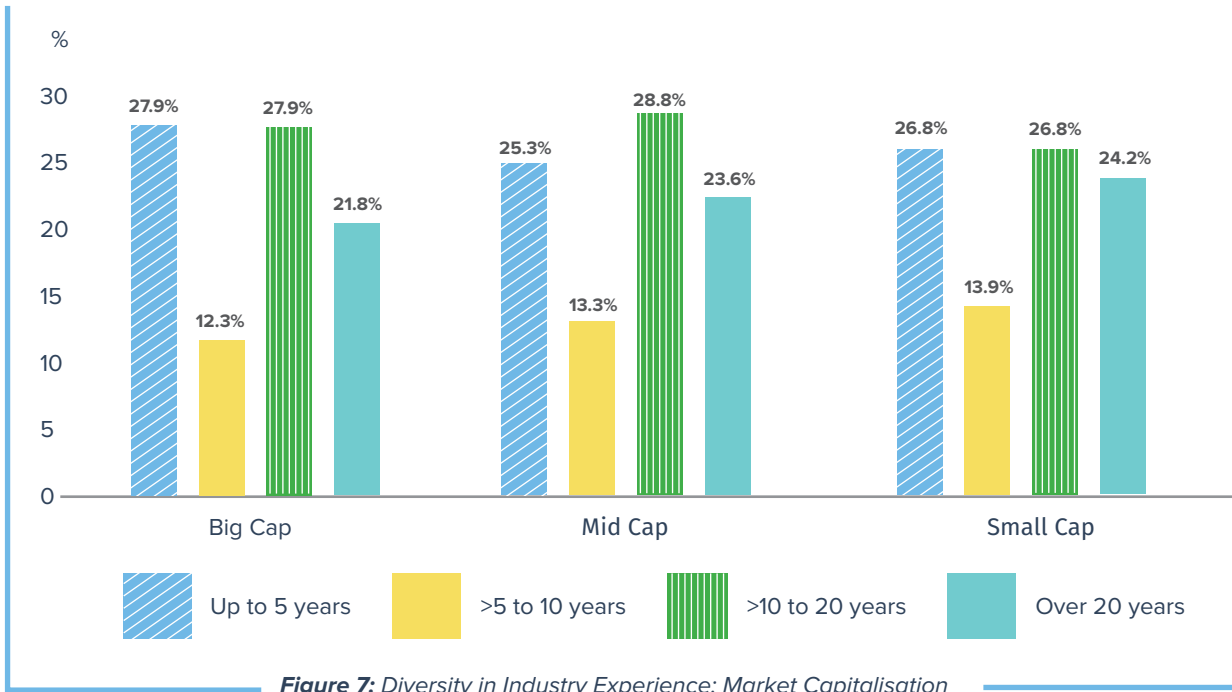


Figure 7: Diversity in Industry Experience: Market Capitalisation

3.1.3 Gender Diversity

A distinct size effect can be seen with respect to board gender representation; 83% of big cap companies have at least one female board member, as compared to around 50% for small and mid cap companies (Figure 8).

Within the sub-sample of companies which have at least one female board member, a further size effect can be seen in disclosure of diversity policies. 69% of big cap companies have a diversity policy; almost twice the share of mid cap companies with such policies (37%), and more than three times the share of small cap companies (20%). Conversely, almost one-third of small cap companies have no diversity policy; this is double the share of other companies (around 15% for mid cap and big cap companies).

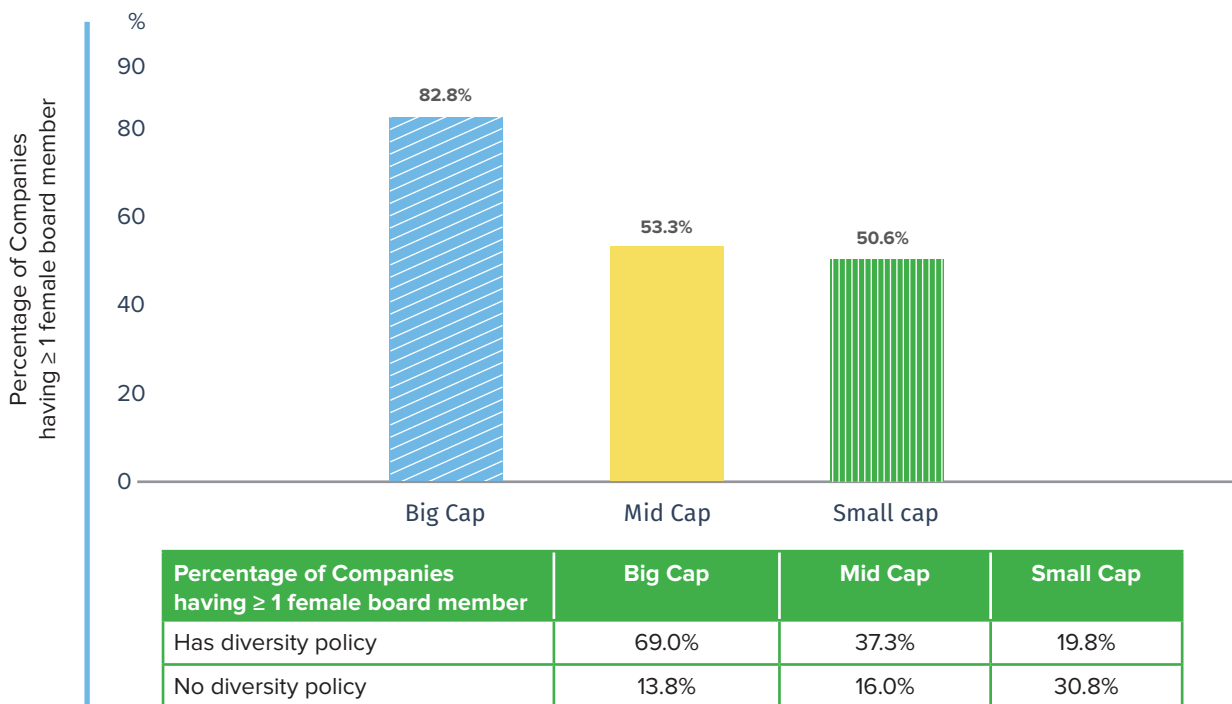


Figure 8: Board Gender Representation and Diversity Policies

Widening the perspective to consider female representation in leadership generally shows that the size effect is not unique to boards. **Figure 9** shows the share of females in boards and in senior management to be notably higher in big cap companies (17% for boards and 28% for senior management) as compared to mid cap and small cap companies (both 11% and 20% respectively).

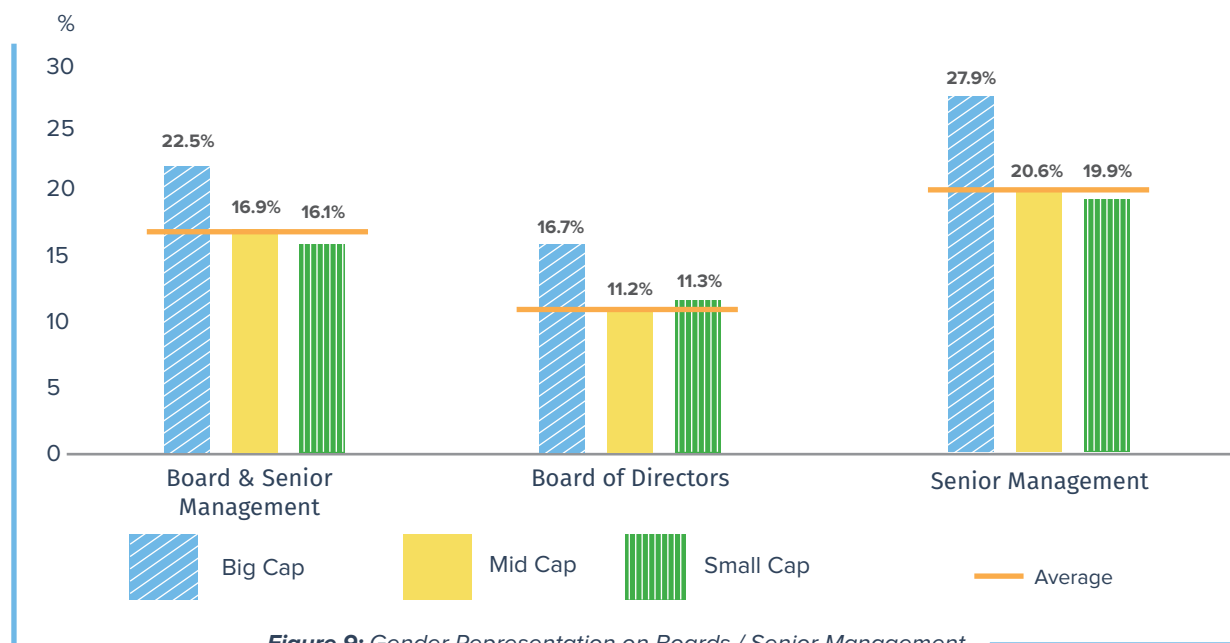


Figure 9: Gender Representation on Boards / Senior Management (Percentage of Females)

3.2 Influence of Leadership Diversity on Firm Performance

Regression analysis was used to examine the impact of leadership diversity on financial performance. Details on the model, variables and data are available in **Appendix A**, while descriptive statistics can be found in **Appendix B**.

Table 1 presents the results for the impact of diversity, as measured by Blau's index, on ROA. Model 1 is the basic model, while Model 2 provides a robustness test by using an alternative indicator for gender diversity (i.e. the proportion of female leaders)⁴.

For Model 1, the coefficients for Blau's indices for three of the diversity dimensions (gender, age, and education) are positive and significant ($\beta = 3.01$, $p < 0.05$; $\beta = 4.29$, $p < 0.01$; $\beta = 3.40$, $p < 0.05$ respectively). This suggests that, everything else being equal, firms with a leadership that is more diverse in terms of gender, age, and education will have higher ROA. The coefficient for Blau's index of industry experience however, is statistically insignificant. Thus, it cannot be concluded that diversity in industry experience affects firm performance as measured by ROA.

The results for the diversity indices in Model 2 are similar to Model 1. In addition, the coefficient for the proportion of female leaders is also significantly positive ($\beta = 3.66$, $p < 0.05$). Thus, both measures of gender diversity positively influence ROA. Specifically for Model 2, an increase in the proportion of female leaders by 10 percentage points will lead to a 0.37 percentage point increase in ROA, everything else being equal.

⁴ Both models have a R^2 value of 37.6%, indicating that the independent variables in the models explain 37.6% of the change in ROA (Brooks 2014).

Table 1: Influence of Diversity Index on ROA

Model no.	1		2	
Independent variables	Coefficient (β)	p-value	Coefficient (β)	p-value
ROA of the previous year	0.31	0.000 ***	0.31	0.000 ***
Blau's index of gender	3.01	0.035 *	-	-
Proportion of female leaders	-	-	3.66	0.035 *
Blau's index of age	4.29	0.004 **	4.88	0.004 **
Blau's index of education	3.40	0.029 *	3.38	0.030 *
Blau's index of industry experience	-0.44	0.776	-0.35	0.820
Firm size	2.35	0.000 ***	2.36	0.000 ***
Leverage	-4.99	0.000 ***	-5.00	0.000 ***
Earnings per share	16.84	0.000 ***	16.88	0.000 ***
Constant	-23.48	0.000	-23.45	0.000
Coefficient of determination (R^2)	37.62%		37.61%	

Note: ***, ** and * indicate 0.1%, 1% and 5% levels of significance respectively.

Table 2 presents the results of an alternative model, in which the proportion of each diversity attribute, rather than diversity indices, is used as an indicator for diversity. The results show that all dimensions of diversity except for education have a significant impact on ROA.

For gender, the proportion of female leaders has a significantly positive effect on ROA ($\beta = 4.40$, $p < 0.05$). This implies that, everything else being equal, an increase in the proportion of female leaders by 10 percentage points will result in an increase in ROA by 0.44 percentage points.

Table 2: Influence of Proportion of Diversity Attributes on ROA

Independent variables	Coefficient (β)	p-value
ROA of the previous year	0.30	0.000 ***
Proportion of female leaders	4.40	0.010 *
Proportion of age 51 to 60	-2.51	0.088
Proportion of age 61 to 70	-4.07	0.012 *
Proportion of age over 70	-6.34	0.003 **
Proportion of bachelor's degree and above	-1.72	0.172
Proportion of industry experience >5 to 10 years	-0.58	0.703
Proportion of industry experience >10 to 20 years	5.93	0.000 ***
Proportion of industry experience >20 years	6.80	0.000 ***
Firm size	2.65	0.000 ***
Leverage	-4.77	0.000 ***
Earnings per share	16.82	0.000 ***
Constant	-20.06	0.000
Coefficient of determination (R^2)	38.91%	

Note: ***, ** and * indicate 0.1%, 1% and 5% levels of significance respectively.

Leadership with greater industry experience also have a positive effect on firm performance, with the coefficients for the share of leaders with >10 to 20 years of experience and >20 years of experience being positive and statistically significant ($\beta = 5.93$, $p < 0.001$; $\beta = 6.80$, $p < 0.001$ respectively). Thus, all else being equal, a 10 percentage point increase in the proportion of leaders with >10 to 20 years of industry experience would lead to an increase in ROA of 0.59 percentage points; similarly a 10 percentage point increase in the proportion of leaders with more than 20 years of experience would result in a corresponding increase in ROA of 0.68 percentage points.

The results for age show a reverse effect for more senior leaders. Leaders that are over 60 years old have a significantly negative effect on ROA ($\beta = -4.07$, $p < 0.05$ and $\beta = -6.34$, $p < 0.01$ for those aged 61-70 and over 70 years respectively). Thus if the proportion of leaders aged 61-70 years increases by 10 percentage points, ROA will fall by 0.41 percentage points, everything else being equal. Similarly, an increase in the proportion of leaders who are older than 70 years would lead to a decrease in ROA by 0.63 percentage points.

3.3 Influence of Gender on Firm Performance

The results in **Section 3.2** show that increasing the share of female leadership has a positive effect on ROA. In this section, we investigate whether there is a point at which increasing the share of female leadership is no longer beneficial to firm performance.

This question is examined using the concept of the *gender parity point*. At the gender parity point, there is an equal number of males and females in leadership; i.e. the ratio of males to females is 1. Specifically, the variable of interest in our analysis is the distance between the proportion of female leadership (PFL) and the gender parity point⁵. Again, regression analysis was used. Details on the regression model can be found in **Appendix C**.

The regression results show that the distance variable has a significantly negative impact on ROA ($\beta = -3.92$, $p < 0.05$) (**Table 3**). That is, the further PFL is from the gender parity point, the worse the company's financial performance:

- If the PFL is less than 50%, a 10 percentage point increase in the PFL results in a higher ROA (specifically, an increase of 0.39 percentage points).
- If the PFL is higher than 50%, a 10 percentage point increase in the PFL results in a lower ROA (specifically, a fall of 0.39 percentage points).

Table 3: Proportion of Female Leadership, Gender Parity and ROA

Independent variables	Coefficient (β)	p-value
ROA of the previous year	0.32	0.000 ***
Distance between proportion of female leaders to the gender parity point (at 50%)	-3.92	0.027 *
Firm size	2.43	0.000 ***
Leverage	-4.93	0.000 ***
Earnings per share	16.79	0.000 ***
Constant	-16.78	0.000
Coefficient of determination (R^2)	37.04%	

Note: ***, ** and * indicate 0.1%, 1% and 5% levels of significance respectively.

⁵ Note that at the gender parity point, the proportion of female leadership would be 50%.

3.4 Influence of Gender Pay Gap on Firm Performance

We sought to examine the effect of gender-based differences in remuneration on firm performance using the *gender pay gap*, an indicator used to measure the difference between the average earnings of women and men.

However we were unable to do this due to scarcity of remuneration disclosure. Out of the 577 companies in this study, only 141 (24%) disclosed the exact remuneration of their leadership. Further, among these companies, only 88 (15% of the listed companies) also had at least one female in leadership. This does not provide a sufficiently large sample for robust statistical analysis, and highlights the need for greater disclosure in this aspect of leadership governance.

4. Conclusion

This study found several significant relationships between leadership diversity and firm performance, as summarised in **Figure 10**.

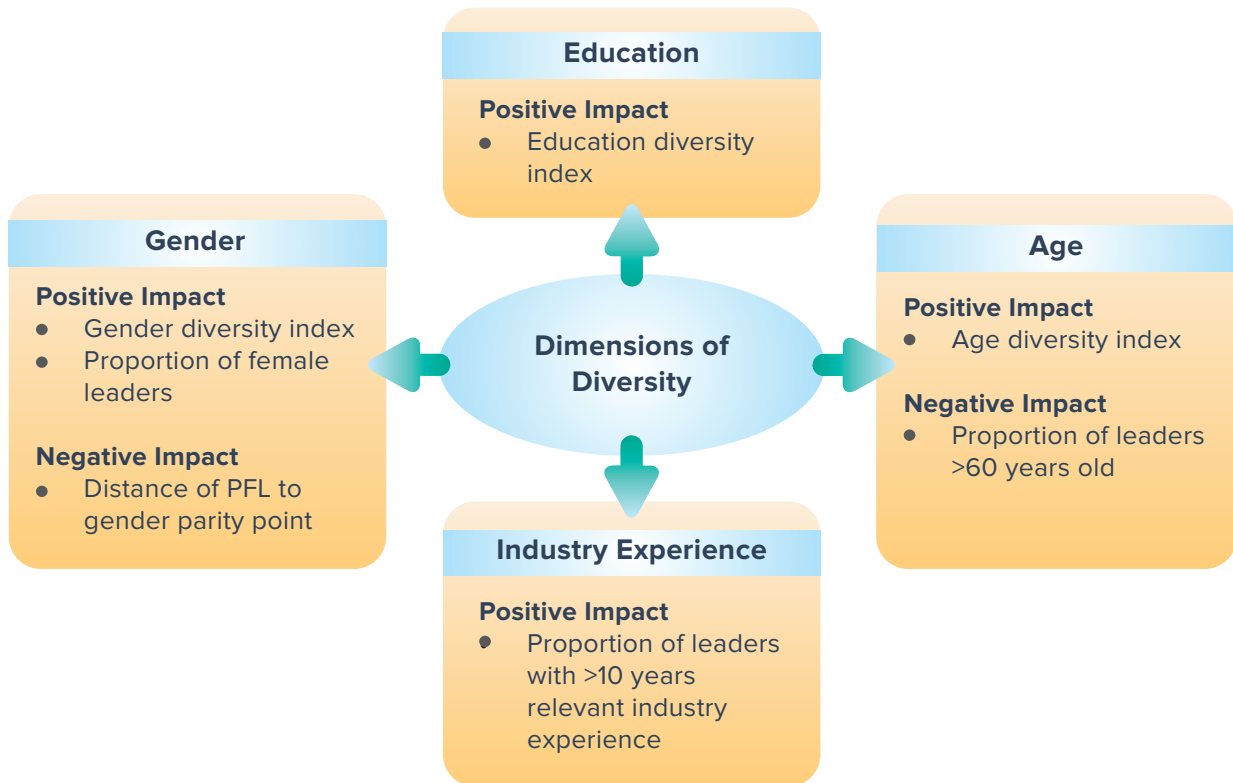


Figure 10: Impact of Leadership Diversity on Firm Performance: Summary

The effects of the four dimensions of leadership diversity are as follows:

1. Gender diversity:

- Positive and significant impact on ROA. This is seen in both indicators, i.e. the gender diversity index and the proportion of female leaders.
- However, the finding with regards to the proportion of female leadership is moderated by the existing share of female leadership in the company. Specifically, whether the company has reached the gender parity point:
 - If the share of females in leadership is less than 50%, an increase in the proportion of female leaders will contribute to an increase in ROA.
 - However, this ROA growth peaks when the number of female leaders equals that of males, and declines when the proportion of female leaders exceeds the 50% threshold.

The findings of our study thus highlight the important role of gender parity in leadership, and suggest that this should be the company's focus with regards to gender diversity.

2. Age diversity:

- Age diversity index has a positive impact on ROA.
- The proportion of leaders aged over 60 years has a negative impact on ROA.

3. Education diversity:

- Education diversity index has a positive impact on ROA.

4. Diversity in industry experience:

- Industry experience diversity index has no significant impact on ROA.
- The proportion of leaders with more than 10 years of industry experience has a positive impact on ROA.

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Appendix A

Influence of Leadership Diversity on Firm Performance: Regression Model, Variables and Data

A random effects model is used as follows:

$$Y = \sum_i a_i \times X_i + \sum_i b_i \times Ctrl_i + DM + c$$

where i denotes the variable categories, Y denotes the dependent variable and X the independent variables. $Ctrl$ refers to the control variables, and DM to the dummy variables.

The dependent variable captures firm performance as reflected by ROA over 2016-2020.

The independent variables (IVs) comprise the diversity variables for the four dimensions (gender, age, education and industry experience) among the companies' leadership. In Model 1, the IVs take the form of diversity indices based on Blau's Index; in Model 2, they take the form of the proportion of leadership in each category for each dimension. It is assumed that the composition of company leadership has remained relatively unchanged over the period 2016 to 2020.

In order to avoid confounding issues from endogeneity and reverse causality:

- An autoregressive distributed lag model is employed. Thus, lagged dependent variables are used.
- To control for firm-specific financial characteristics, firm size, leverage and earnings per share are included as control variables.
- Dummy variables for industry are used to control for baseline differences between industries.
- Dummy variables for years are used to control for temporal effects.

Appendix B

Descriptive Statistics of Variables Included in Analysis

Table B1: Descriptive Statistics of Variables Included in Analysis

Variables	N	mean	sd	min	max
ROA	2773	0.0012	13.59	-93.64	93.07
SGTI	2666	64.08	19.17	-5	131
Proportion of female leaders	2885	0.17	0.13	0	0.6
Proportion of age 51 to 60	2885	0.24	0.16	0	0.8
Proportion of age 61 to 70	2885	0.22	0.14	0	0.8
Proportion of age over 70	2885	0.09	0.11	0	0.6
Proportion of bachelor's degree and above	2885	0.77	0.19	0.2	1
Proportion of industry experience >5 to 10 years	2885	0.14	0.15	0	0.8
Proportion of industry experience >10 to 20 years	2885	0.27	0.19	0	1
Proportion of industry experience >20 years	2885	0.24	0.20	0	1
Blau's index of gender	2885	0.25	0.16	0	0.5
Blau's index of age	2885	0.74	0.14	0.18	1
Blau's index of educational qualification	2885	0.59	0.15	0	0.97
Blau's index of industry experience	2885	0.63	0.15	0	1
Firm size	2629	7.90	0.85	6.07	10.69
Leverage	2749	0.57	3.21	0.00	146.88
Earnings per share	2630	0.03	0.18	-1.60	2.38

Appendix C

Influence of Gender Diversity on Firm Performance: Regression Model, Variables and Data

The impact of gender diversity on ROA is examined using the proportion of female leaders (PFL) as a proxy in a modulus function. A random effects regression model is used:

$$ROA_{i,t} = \alpha + \beta_1 \times ROA_{i,t-1} + \beta_2 \times \text{abs}(\text{female_prop}_{i,t} - 0.5) + \sum_k \beta_k \times \text{Control}_{i,t}^k + \text{IndustryDummies} + \text{YearDummies} + \varepsilon_{i,t}$$

- where i and t denote the firm and the year respectively, and k refers to control variables.
- The term $\text{abs}(\text{female_prop}_{i,t} - 0.5)$ represents the distance between PFT and the gender parity point. Since the gender parity point is at 50%, this term is measured as the absolute value of PFL minus 0.5.

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