



# Do females on boards enhance firm performance? evidence from Indonesia manufacturing firm

*¿Las mujeres en los directorios mejoran el desempeño  
de la empresa? evidencia de una empresa  
manufacturera de Indonesia*

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## Abstract

The impact of female directors on firm performance needs to be more consistent in the previously conducted empirical studies, which may be due to the endogeneity problem or specific characteristics (i.e., governance, industry, competition). Financial performance is the primary concern of investors. Supervising various types of ownership and boards is a concern in good corporate governance. This study examines the relationship between board sex diversity (in commissioner and director) on financial performance. Data were collected from manufacturing companies listed on the Indonesia Stock Exchange. We analyzed the collected data using ordinary least squares with heteroskedasticity-robust standard errors to obtain unbiased standard errors of OLS coefficients under heteroscedasticity and quantile regression. This study found that only female director has a significant relationship with financial performance. These results have been tested for robustness before and during the COVID-19 pandemic. As there has been limited specific research using quantile regression about the female Board of the manufacturing industry during the COVID pandemic in Asia and may be helpful after this period (endemic and routine period), the study is considered to contribute to academic research and practice in Asian business.

*JEL Code:* G30, G34, J16

*Keywords:* management ownership; female directors; board of commissioners; firm performance; corporate governance

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## **Resumen**

El impacto de las directoras en el desempeño de la empresa debe ser más consistente en los estudios empíricos realizados anteriormente, lo que puede deberse al problema de endogeneidad o características específicas (es decir, gobernanza, industria, competencia). El rendimiento financiero es la principal preocupación de los inversores. La supervisión de varios tipos de propietarios y directorios es una preocupación en el buen gobierno corporativo. Este estudio examina la relación entre la diversidad de sexos en los directorios (en comisario y director) en el desempeño financiero. Los datos se recopilaron de empresas manufactureras que cotizan en la Bolsa de Valores de Indonesia. Analizamos los datos recopilados utilizando mínimos cuadrados ordinarios con errores estándar robustos a la heterocedasticidad para obtener errores estándar no sesgados de los coeficientes OLS en heterocedasticidad y regresión por cuantiles. Este estudio encontró que solo la directora tiene una relación significativa con el desempeño financiero. Se ha probado la solidez de estos resultados en el período anterior y durante la pandemia de COVID-19. Dado que ha habido una investigación específica limitada que utiliza la regresión por cuantiles sobre la junta directiva femenina de la industria manufacturera durante la pandemia de COVID en Asia y puede ser útil después de este período (período endémico y de rutina), se considera que el estudio contribuye tanto a la investigación académica como a la práctica. en los negocios asiáticos.

*Código JEL:* G30, G34, J16

*Palabras clave:* propiedad de la gerencia, directoras, comisarios, desempeño de la empresa, gobierno corporativo

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## **Introduction**

Good financial performance is one of the main goals of investors because it is related to returns (capital gains and dividends) for investors. Financial performance can be linked to governance mechanisms. Various attempts have been made so that agents act in harmony with the interests of investors and give higher investor protection. Investors need governance mechanisms that can improve oversight of company performance.

Board diversity is increasingly considered a significant mechanism of good corporate governance (Eulerich et al., 2014). The corporate Board's composition has gained significant importance in corporate governance, and a large amount of interest focuses on the composition of corporate boards and their various attributes as board qualities of corporate governance (Amin et al., 2022). The global trend tried to achieve global gender parity at the board level, with actual parity, is likely to be concentrated in the few countries currently making concerted efforts to overcome this issue, such as some countries in Europe and Australia (Deloitte, 2019). Studies have repeatedly shown that increasing diversity suits an organization's culture and improves business outcomes. Increased diversity leads to more intelligent decision-making, contributes to an organization's bottom line, and powers innovation, among other benefits (Deloitte, 2019). The female workforce can contribute from operational work positions to the Board of directors (International Finance Corporation, 2019:13). The female workforce has an educational

background that is equal to that of the male, moreover actually outperformed male directors (International Finance Corporation, 2019:46). Board gender diversity is good for improving company performance in the ASEAN region. Still, it requires a fundamental shift in the paradigm of corporate and business culture (International Finance Corporation, 2019:40).

The analyses of board structures, specifically male and female diversity, have contributed to understanding board dynamics and informed corporate governance reforms (Ararat et al., 2021). The phenomenon of female on boards or corporate board sex diversity is regarded as a topical corporate governance issue that has attracted considerable research attention (Altaf, 2022; Bøhren & Staubo, 2016; Shahab et al., 2018, 2020). The embracement of board gender diversity as both a viable and a necessary strategy for success rather than simply a morally desirable objective (International Finance Corporation, 2019:12). In addition, the existence of governance reforms led to the need for ongoing research on this matter. Therefore, there is a need to determine what specific diversity composition can support company management to achieve good financial performance.

The literature promotes the female workforce on boards. Gender diversity has been the most researched aspect of board diversity (Sharda, 2019); thus, this shows the importance of this research topic. The impact of female directors on firm performance needs to be more consistent in previously conducted empirical studies (Pasaribu, 2017). Moreover, in progress, the relationship between board diversity and firm performance needs to be clarified (Baker et al., 2020) and equivocal (Altaf, 2022). Nevertheless, there needs to be more consensus globally on the relationship between board diversity and firm performance caused by international variations in ownership and institutional structures (Aggarwal et al., 2019). Board gender diversity and accounting performance differ among countries and sectors (Amore & Garofalo, 2016; Labelle et al., 2015). The existing literature reveals a lack of board sex diversity studies for emerging market firms (Ararat et al., 2021) and developing countries (Altaf, 2022).

Governance reforms in several emerging markets have specifically targeted the regulation of boards (Ararat et al., 2021). The investigation of how women and men leaders enact, and experience leadership continues to surface unanswered questions (Gipson et al., 2017). The possibility of women breaking the proverbial 'glass ceiling' to occupy senior leadership roles is still considered low in countries worldwide, the underlying reason being the more significant issue of gender inequality (Sharda, 2019). Much more must be done to reach a level of board sex diversity commensurate with women's role in society and the workplace in the ASEAN region (International Finance Corporation, 2019:10).

Information about the Board's composition is in the company's financial statements. It can easily indicate the company's financial performance and future financial performance by small and non-institutional investors. Thus, the composition of the Board becomes more varied for companies operating in countries that use a two-tier system (separation between the Board of Commissioners and the executive or Board of directors). Investors quickly gain the information and thus can take advantage of this

information and make judgments about the company. Based on the things described, it is necessary to research the influence of female boards on firm performance in a developing country.

There have been positive global trends in the diversity of female boards. Some countries implemented female quotas, instead addressing diversity efforts through self-regulation or corporate governance code recommendations. While sex diversity is improving across businesses in Asia, it trails behind the global trend (Deloitte, 2019). Women fill 4.2 percent of board chair positions in Asia, a 1.6 percent increase from 2016, but trails 5.3 percent of board chair positions held by women globally (Deloitte, 2019). International Finance Corporation (2019) found evidence at both the country and company levels that ASEAN countries have the potential to make meaningful strides towards achieving board gender diversity in the coming years by addressing both the universal barriers that affect women around the world and the unique cultural and structural barriers at play in the region (International Finance Corporation, 2019:11).

Indonesia's governance reforms began in early 2014 with the introduction of the Indonesian Corporate Governance Roadmap ("Roadmap"). The most recent Indonesian corporate governance recommendations are provided for corporations listed on the capital market and managing public funds without setting a minimum limit for board diversity. The National Committee on Governance Policy (KNKG) issued the General Guidelines for Corporate Governance (PUGKI) 2021 as a guideline for corporate governance practices with global standards (Utama et al., 2022:10). The Board of Directors as the Executive Board and the Board of commissioners as the supervisory Board carry out roles and responsibilities independently to create sustainable value for the best long-term interests of the corporation and shareholders (Utama et al., 2022:16). Members of the Board of commissioners and directors are appointed and dismissed by the shareholders at the GMS. However, there needs to be a determination of the number of members and composition of the Board. This diversity creates a need for research on the diversity of board composition. Although Indonesia has not yet determined the minimum quota or proportion for women's diversity in boards, Indonesia has the highest proportion of female board chairs (11.7 percent), followed by Vietnam (7.8 percent) and Thailand (7.6 percent) in ASEAN (International Finance Corporation, 2019:15). Based on the survey of International Finance Corporation (2019), Indonesia's two-tier system of corporate boards is unique than other big ASEAN countries, namely Malaysia, Philippines, Singapura, Thailand and Vietnam. This research only focuses on Indonesia.

Developing economies are classified based on United Nations' Country Classification (United Nations, 2022). Tracing the results of previous research with a single country research object in a region reflects more homogeneous conditions. The single-country research for Southeast developing economies shows female diversity increased firm performance for Malaysian firms in 2010-2014 (Rahman et al., 2022) and Indonesian firms in 2011–2016 (Pasaribu et al., 2019). Conversely, female diversity decreased firm performance for Sri Lanka firms in 2006–2010 (Wellalage & Locke, 2013), Indonesia firms in 2011–

2015 (Tarigan et al., 2018), and Indonesia firms in 2014-2020 (Septiana et al., 2022). Based on previous research, research with research objects in Indonesia which had previous studies, showed conflicting results.

Several studies outside ASEAN show that a link between sex diversity and firm performance is associated with a particular threshold value. In German firms (2000–2005 periods), Joecks et al. (2013) found that sex diversity at first negatively affected firm performance and—only after a "critical mass" of about 30% of women (translates into an absolute number of about three women on the Board) has been reached—to be associated with higher firm performance than entirely male boards.

This paper is contributed academically and practically. The first expectation adds to the body of knowledge on corporate governance, ties to the board diversity, and specifically public firms with females in the Board of Commissioners and Board of Directors in those companies with firm performance in a two-tier system recently. As in Law No. 40 of 2007, Indonesian company is regulated to a two-tier board system consisting of commissioners (monitoring role) and the Board of Directors (executive role). Specifically, the relationship between female boards and firm performance in Indonesia's manufacturing sector in 2016-2021. Research in one country will provide more in-depth results and specific suggestions for that country being researched (Harymawan & Rahayu, 2022).

Further, the determinants and accounting performance can differ among countries and sectors (Amore & Garofalo, 2016; Labelle et al., 2015). Manufacturing firms tend to have lower diversity levels than service industry firms. Still, Indonesia manufacturing firms have the highest sex diversity on boards than other sectors (based on a survey from Economist Intelligence Unit Analysis in International Finance Corporation, 2019:26). Moreover, this research only focuses on the manufacturing sector as the largest firm population of the non-financial sector in the Indonesian Stock Exchange.

The second expectation is that this study will be a source for evaluating Indonesian corporate solid governance in both regular and emergency (COVID-19 pandemic) situations. This little observation has been done to the best of the researcher's knowledge. Surprisingly, this study demonstrates how having boards with female commissioners does not improve company performance during regular and challenging economic times like the COVID pandemic for businesses in the manufacturing sector. Meanwhile, female directors show a relatively weak association with performance in average periods but no association in the crisis period when uncertainty is high. In some circumstances, the findings of this study may be used to help interested parties make decisions on the board members' appointments when the female diversity of the Board is minimal. In addition, the critical mass number still requires further research.

The third expectation, this study uses an integrated multi-theoretical approach (resource dependency theory, upper echelon theory, and critical mass theory) and a multi-analysis tool. No previous research examines the composition of female commissioners and female directors in propositions and

numbers in one study. Corporate governance functions can be better understood from multiple theoretical perspectives (Altaf, 2022; Heuvel et al., 2006; Zahra & Filatotchev, 2004). Three test tools are used to get more conclusions: ordinary least squares and quantile regression. Quantile testing will give a broader data description than ordinary least squares.

The ordinary least square test results show that female directors influence firm performance consistently during regular and crisis times. Next relates to quantile regression; the test results show that female directors are associated with company performance when the ratio and number of female directors are in the 30% quantile (before the median). Female commissioners are associated with company performance when the ratio and female numbers are in the 80% and 90% quantiles. These results provide a complete description compared to the OLS results. In addition, the critical mass test shows that female commissioners and directors with more than three people each strongly influence company performance. Meanwhile, the combination of female commissioners and female directors compared to the total number of members of the Board of Commissioners and directors shows an influence on company performance when there are 20% or more than three people. Our empirical results provide guidelines to the firm principal and regulators in Indonesia concerning the consideration of female representation on the Board.

There are five sections to this study. The background is presented in the first section, followed by the literature review and development of the hypothesis in the second section, the research methods in the third section, the results and discussion in the fourth section, and the conclusion in the fifth section.

## **Literature review and hypothesis development**

Corporate governance is "a set of relationships (systems) between various parties with interest in the company organization" (Utama et al., 2022:10). The goal is "to direct and control the company/organization to achieve the goals of the company/organization" (Utama et al., 2022:10). The main party involved in the system is the Board. Board diversity can be a tool in supervisory, advising, ethical, and compliance with regulations in governance mechanisms (Aggarwal et al., 2019). The structural board differences would most like to capture differences in the function and how they perform. The role of the Board is critical in the governance process.

The Board of Commissioners supervises no conflict of interest and gives suggestions to directors, recommendations, and supervision (Utama et al., 2022:285). The role of independent commissioners is significant in making objective decisions and acting independently in monitoring and evaluating the directors' performance (Utama et al., 2022:304). In addition to contributing to the implementation of sound corporate governance in publicly traded corporations, independent commissioners show a company's independence and openness. While the independent director is in charge of overseeing the executive Board's activities and reducing conflicts of interest between managers and

company owners, the independent commissioner is tasked with the audit committee's oversight of the director's performance and serving as a representative of the firm's minority shareholders (Tanjung, 2020).

The Board of Directors is the organ of the company for the benefit of the company, following the aims and objectives of the company, and represents the company, both inside and outside the court, following the introductory provisions (Law No. 40 of 2007 about Limited Liability Company). The Board of Directors, like the Board of Commissioners, is appointed and dismissed by the shareholders at the general meeting of shareholders (GMS) and is responsible to the GMS. The Board of Directors' position is the same as that of the commissioners'. The difference is that the Board of Directors is entrusted with managing the resources owned by the shareholders, while the shareholders entrust the Board of Commissioners to supervise the directors.

Board diversity poses with several advantages and disadvantages. The advantages of more diversity in the Board of directors can be fosters creativity and innovation by considering a great variety of perspectives (Carter et al., 2003; Robinson and Dechant, 1997), then the Board is likely to have better information processing capabilities and can potentially make better decisions (Adams et al., 2015; Tasheva and Hillman, 2019). Another advantage of diversity is fostering independence of thought processes in the boardroom, which can result in better monitoring by the Board (Adams and Ferreira, 2009; Adams et al., 2015). Moreover, the diversity advantage helps better understand a firm's marketplace consisting of its prospective customers and suppliers and can improve its market penetration ability (Carter et al., 2003; Robinson and Dechant, 1997). Additionally, the diversity advantage promotes a firm's sensitivity towards different cultures and can foster better employee and global relationships (Carter et al., 2003; Robinson and Dechant, 1997). The composition, including the diversity of a firm's Board, can influence its functioning and performance (Aggarwal and Dow, 2013; Carter et al., 2010; Isidro and Sobral, 2015; Kim et al., 2009). Board diversity possesses some disadvantages. During environmental turbulence, such as financial crises, more diverse boards could be less likely to initiate strategic changes because such changes may intensify differences among the board members (Goodstein et al., 1994). Additionally, demographic differences among the board members may sometimes create frictions which, if not mitigated, may affect a board's performance (Veltrop et al., 2015). The diversity may represent a disadvantage to the Board as it may facilitate the formation of subgroups, dysfunctional conflicts, and distrust (Wiley & Monllor-Tormos, 2018).

Three theories can explain board compositions, that is resource dependency theory (Pfeffer & Salancik, 2003), Upper Echelon Theory (Hambrick and Mason, 1984; Hambrick, 2007), and critical mass theory (Kanter, 1977). Related to resource dependency theory, there is a need for organizations to reduce environmental interdependence and uncertainty, so organizations can enact to minimize environmental dependences: (a) mergers/vertical integration, (b) joint ventures and other inter-organizational relationships, (c) boards of directors, (d) political action, and (e) executive succession (Hillman et al.,

2009). Firms should appoint more diversity on the Board, such as independent, female, and ex-military members in boards, because of their attributes of characteristics. Their appointment offers several benefits, including a greater connection with the external environment and improved firm decision-making capabilities.

Related to upper-echelon theory, decision-making is influenced by the characteristics of the top management or leader (Hambrick & Mason, 1984; Hambrick, 2007). Moreover, an executive's unique background, characteristics, and experiences will impact strategic choice and firm performance (White & Borgholthaus, 2022). Related to upper echelons theory, the composition of the Board plays an essential role in decision-making strategy (Graham et al., 2016; Perryman et al., 2016) and innovation (Galia & Zenou, 2012). The Board's decisions are a product of the knowledge and experience of the people who make up the Board (Farag & Mallin, 2017). The need for these connections is motivated by contrasting characteristics of female personnel that are supposed to lead to different mutual benefits. The upper echelon theory described the professionalism and adaption of the female Board. Female is associated with higher firm performance. The contribution of female workers can trigger positive developments for the company, such as increasing company performance, because the heterogeneity level will impact the strategic planning and decision-making process (International Finance Corporation, 2019:13).

The benefits of female personnel are (a) women directors bringing strategic input to the Board (Bilimoria, 2000), (b) influence on decision-making and leadership styles of the organization (Rosener, 1990), (c) improving company image with stakeholders groups (Burgess & Tharenou, 2002), (d) women's capabilities and availability for director positions (Mattis, 2000), and (e) insufficient competent male directors (Burke & Kurucz, 1998). Women, especially outsider directors, contribute an independent view to the Board (Fondas, 2000). Having women in key positions has also been argued that as women directors tend to be younger than their male colleagues on the Board, the boards may benefit from new ideas and strategies (Burke, 1994; Ibrahim & Angelidis, 1994).

Related to critical mass theory, the critical mass threshold that the proportion of female Board can facilitate an advantage to the firm. Kanter (1977) divided four group types based on various proportional representations of kinds of people, i.e., uniform (a ratio of perhaps 100:0), dominants (a ratio of perhaps 85:15), tokens (solitary individuals or solos), titled (a ratio of perhaps 65:35), and balanced (a ratio of perhaps 60:40 or 50:50). Referring to the critical mass theory of Kanter (1977), Joecks et al. (2013) argue that the skills that female directors (minority) may bring into the group are not the primary determinant of board composition unless a critical mass of female directors has been appointed. (Kogut et al., 2014) argue that female quotas might create a critical mass of female directors to tip the equilibrium to structural equality, defined as "the degree to which women directors are connected without relying upon male intermediaries". The positive effect of board sex diversity on financial performance increases when there is at least a critical mass of 30% of women on a corporate board, so the women present a favorable

environment to capitalize on innovative ideas arising from board sex diversity (Torchia et al., 2011; Wiley & Monllor-Tormos, 2018), cause a fundamental change in the boardroom and enhance corporate governance (Erkut et al., 2008; Konrad et al., 2008). (Joecks et al., 2013) translate the critical mass of 30 % of women into an absolute number of about three women on the Board, supporting recent studies on a corresponding "magic number" of women in the boardroom. Additionally, below the critical mass threshold, board sex diversity may represent a disadvantage to the Board as it may facilitate the formation of subgroups, dysfunctional conflicts, and distrust (Wiley & Monllor-Tormos, 2018). Companies with gender-diverse boards have better profitability when firms appoint several women directors, which appears more assertive in bad economic times (Garanina & Muravyev, 2021).

Depending on resource dependency theory, upper echelon theory, and critical mass theory, as a valuable resource, female onboard offers benefits for firms, such as a stronger connection with the external environment, improved decision-making capabilities, and an influence on company performance. Female boards can be a significant determinant of firm performance. Boards with a robust complement of gender diversity are expected to offer more effective monitoring of agents (Galbreath, 2011; Liu et al., 2014). A few previous related research supports the associations between board sex diversity (female commissioners and female directors) with firm performance for a single country in Southeast Asia.

Some previous research that supports positive associations between board sex diversity and firm performance for a single country in Southeast Asia is Rahman et al. (2022) and Pasaribu et al. (2019). Rahman et al. (2022) inquire about the impact of the third Malaysian Code on Corporate Governance (MCCG 2012) introduced in March 2012 on the level of female directors and its possible association with firm financial performance using the different periods. The periods are two years (2010–2011) pre- and three years (2012–2014) post-enactment period of the code. After the code's enactment, female directors have significantly impacted financial performance (ROA and decreasing stock volatility). Interestingly, it is also unveiled that neither 'tokenism' nor 'critical mass' hypotheses apply in Malaysia's context. Pasaribu et al. (2019) investigated gender diversity in the boardroom in Indonesia's listed firms and its effect on firm performance from 2011-2016. Pasaribu et al. (2019) find that the proportion of female directors in the boardroom marginally improves firm performance. Firms with two or more females in the boardroom have a more substantial impact on firm performance than firms with one female, consistent with the critical mass effect. Increasing sex diversity in the boardrooms can benefit firm performance, but the benefits may be subject to the critical mass and firm industry.

Conversely, female diversity decreased firm performance for Sri Lanka firms in 2006–2010 (Wellalage & Locke, 2013) and Indonesian firms in 2011-2015 (Tarigan et al., 2018). Wellalage & Locke (2013) This study investigates the link between female board directors and company financial performance and agency costs in Sri Lanka's publicly listed companies. A dynamic panel generalized method of moment estimation is applied. Three variables are used as proxies for gender diversity of the

Board of directors, namely the percentage of women on the Board, a dichotomous dummy, and the Blau index. A Tobit model with endogenous regressors is used to investigate the impact of female board members on agency cost, using growth opportunities as a measure of agency cost. After controlling for size, industry, and other corporate governance measures, this study finds a significant negative relationship between the proportion of women on boards and firm value, along with an increase in company agency cost. This evidence provides insights for governments and academic institutions in their efforts to provide resources that will help enhance women's leadership skills.

Tarigan et al. (2018) extend the empirical evidence on the diversity of Boards and its impact on the financial performance of Indonesian listed manufacturing firms from 2011–2015. Board diversity uses traditional proportion measurement for the three indicators of gender diversity, nationality diversity, and education diversity. Additionally, Tarigan et al. (2018) used proportion for the three indicators and Blau Index to measure the heterogeneity degree of each proxy of diversity in commissioners. The result of the study reveals that the heterogeneity in terms of gender (female commissioners) is unbeneficial for the company as it negatively impacts the financial performance measures.

The different direction between research results leads to the necessity to examine these aspects. When unmandated (unpressured) is applied, firms have voluntarily appointed female directors taking into account the advantages and disadvantages of the female boards. Considering the above, we suggest that the presence and the role played by females on boards of commissioners and boards of directors, thus we posit the following hypothesis:

H1. Board sex diversity on the Board of Commissioners is associated with firm performance.

H2. Board sex diversity on the Board of Directors is associated with firm performance.

## **Research method**

### *Empirical context*

Recall that our main research question is whether female commissioners and female directors associate with firm performance. We seek to understand the effect of female commissioners and female directors on firm performance. We make use of the Indonesian manufacturing firm setting to test our hypotheses. First, Indonesia is one of the developing economies in Southeast Asia (United Nations, 2022). Second, Indonesia is one of the world's largest developing countries (Pasaribu et al., 2019). Third, the manufacturing industry is the most significant contributor to the Indonesian GDP (Tarigan et al., 2018). Forth, Indonesia has a significant military presence (Azis et al., 2022). Since 1967 (the first military background president in Indonesia), military personnel has been eligible to run for and be elected to

legislative, judicial, and numerous critical posts in state-owned businesses (Habib et al., 2018). This background is undoubtedly a differentiator from other countries. Moreover, the manufacturing sector is the largest corporate sector on the Indonesia Stock Exchange. The selection of one country and one company sector is adjusted to the advice of previous research (Amore & Garofalo, 2016; Harymawan & Rahayu, 2022; Labelle et al., 2015).

Indonesia adheres to a two-tier system of corporate governance, where the two boards consist of the Board of Commissioners and the Board of Directors. In OJK regulation No. 33/POJK.04/2014, at least one member of the Board of Commissioners and the Board of Directors comes from an independent party. Independent, in this case, means this member comes from outside the company, has no affiliation with the major shareholders, has no relationship with the Board of Commissioners and directors, and does not have a relationship with the Board of Commissioners or directors of other companies. Additionally, the IDX eliminated the independent director position at businesses listed on the IDX in 2018 via the Indonesia Stock Exchange Directors' Decree Number: Kep-00183/BEI/12-2018, which causes the independent directors are not scrutinized.

The female members have various managerial positions (International Finance Corporation, 2019). Still, Indonesia has not set a minimum quota for the number of women on Board, both on the Board of Commissioners and the Board of Directors. A company is defined as having board sex diversity if one of the company's leaders (member of the Board of Commissioners or Board of Directors) is female. The company's female commissioners can come from outside or inside the company, and recently company's female directors only can come from inside the company. The mutually beneficial interaction between female boards (both on the Board of Commissioners and the Board of Directors) and commercial activity in Indonesia offers a unique institutional environment for evaluating that relationship. Moreover, the testing and discussion of the Board of Commissioners and the Board of Directors have yet to be in previous research, so our main research question is whether female commissioners and directors influence firm performance.

This study employs a quantitative approach with an archival method. Then, this study uses an ordinary least squares regression model (OLS) with heteroskedasticity-robust standard errors to obtain unbiased standard errors of OLS coefficients under heteroscedasticity, followed by a robustness test using different measurements for female boards. Thus, the primary test is complemented by three additional tests carried out, namely (1) to find out the association of variables before and during the Covid pandemic, (2) to find out the association of variables in the quantile regression from the 10th quantile until the 90<sup>th</sup> quantile, and (3) to find out the association of board sex diversity in many various numbers of the female member to performance related to critical mass theory. These tests will increase the robustness of the test. Regarding the first additional test, the ordinary least regression test was repeated by dividing the sample period into 2016-2019 (regular period) and 2020-2021 (pandemic period) to provide more detailed results

under different circumstances. The Covid pandemic has significantly impacted the world economy, and Indonesia is no exception (Harymawan & Rahayu, 2022).

### *Sample selection*

Our unit analysis is the firm. Our study is conducted on listed manufacturing firms on Indonesia Stock Exchange, with annual observations (2015–2021). Our sample includes only the firms listed for at least two years respectively. The data used to measure variables are obtained from Bureau van Dijk’s database (OSIRIS) and hand collected from the company’s annual reports. We build some variables with our calculation. We examine the board members' names to find the gender composition of the Board of directors and Board of commissioners. Our final sample consists of 1071 observations on 166 firms between 2015 and 2021 (see Table 1, which introduces the number of observations per sub-sector). After eliminating missing data on the variables used in this study, the number of samples is the final number. The table shows that basic industry and chemicals have the most significant number of firms in our sample, 71 firms (473 firm-year observations or 44.2% of total firm-year observations). The consumer goods industry represents an integral part of our sample, with 51 firms (323 firm-year observations or 30.2% of total firm-year observations). The miscellaneous industry is the smallest market of the sample, with 44 firms (275 firm-year observations or 25.7% of total firm-year observations).

Table 1  
Description of Manufacturing's Sub Sectors

Sub Sectors	Sub Sub Sectors	Total Firms	%	Total Observations	%
Basic Industry and Chemicals	Cement	6	42.8%	42	44.2%
	Ceramics, Glass, Porcelain	8		51	
	Metal and Allied Products	15		105	
	Chemicals	13		82	
	Plastics and Packaging	11		75	
	Animal Feed	5		35	
	Wood Industries	2		14	
	Pulp and Paper	9		57	
	Others	2		12	
	Miscellaneous Industry	Machinery and Heavy Equipment		3	
Automotive and Components		13	86		
Textile Garment		18	115		
Footwear		2	14		
Cable		6	38		
Electronics		2	11		
Consumer Goods Industry	Food and Beverages	26	30.7%	159	30.2%
	Tobacco Manufacturers	4		28	
	Pharmaceuticals	10		67	
	Cosmetics and Household	6		38	
	Houseware	4		26	
	Others	1		5	
Grand Total		166	100.0%	1071	100.0%

Source: own calculation.

### *Variables and measurement*

We take demographic and structural diversity attributes as our main explanatory variables. We measure the board-level demographic diversity of a firm using sex attributes. The description and calculation of control variables used in the estimation analysis are presented in Table 2.

A total of sixteen variables were used in this study, including ten variables control. Female commissioner (FCOM) and female director (FDIR) effect on firm performance (PERFORM). PERFORM is the ratio of net income to total assets (ROA). FCOM is proxied as the ratio of the number of female commissioners to the number of all commissioners. FDIR is proxied as the ratio of the number of female directors to the number of all directors. The FCOM and FDIR measurement development is the ratio and number of total female members in two boards, the number of females in the commissioner board, and the number of females in the commissioner board. The ratio of the total number of female members on the Board of commissioners and directors is also included to look at the overall influence of women on the Board. Another measure of the ratio for counting the female diversity on the Board, this study uses a measure of the number of board members (in units of people) in the Board of Commissioners (FCOMNUM), Board of Directors (FDIRNUM), and combination of both boards (FCOMFDIRNUM). All these measurement variations (ratio and number) will be broken down again based on percentage proportions (10%, 20%, 30%, and more than 30%) and specific numbers (1, 2, 3, and more than three persons).

Among gender diversity measurement (using proportion and index), the measurement shows the same results between (1) the proportion of women on the Board and the Blau Index (Tarigan et al., 2018), (2) the percentage of women on the Board, a dichotomous dummy and the Blau index (Wellalage & Locke, 2013), (3) the proportion, the Blau Index, and the Shanon index (Arvanitis & Varouchas, 2022). The same results from different measurements are the leading causes of this study to choose a measure that is easy to use by readers of financial statements.

Firm size (SIZE), firm age (AGE), financial leverage (LEV), independent commissioner (ICOM), independent director (IDIR), audit committee (ACOM), audit reputation from Big Four Public Accountant (BIG4), institutional ownership (INSOWN), management ownership (MANOWN), and dividend (DIV) were used as controls variables. The summary of the measurement of each variable is presented in Table 2. The literature identifies them as corporate governance mechanisms or significant predictors of firm performance (Detthamrong et al., 2017; García-Meca & Santana-Martín, 2022; Junus et al., 2022; Li & Rainville, 2021).

The following formula was tested:

$$\text{PERFORM}_{it} = \alpha_0 + \alpha_1 * \text{FCOM}_{it} + \alpha_2 * \text{FDIR}_{it} + \alpha_3 * \text{SIZE}_{it} + \alpha_4 * \text{AGE}_{it} + \alpha_5 * \text{LEV}_{it} + \alpha_6 * \text{ICOM}_{it} + \alpha_7 * \text{IDIR}_{it} + \alpha_8 * \text{BIG4}_{it} + \alpha_9 * \text{INSOWN}_{it} + \alpha_{10} * \text{MANOWN}_{it} + \alpha_{11} * \text{DIV}_{it} + \varepsilon_{it} \quad (1)$$

For robustness, the FCOM is measured by an alternative measure, the female commissioners in number (FCOMNUM). FCOMNUM is proxied by the number of female commissioners on the commissioner board. The alternative measure for FDIR is the female commissioners in number (FDIRNUM). FDIRNUM is proxied by the number of female directors on the director board.

Table 2  
 Description of Variables Used in the Analysis

Variables	Names of Variables	Description	Data Sources
<b>Dependent Variable</b>			
Firm performance	PERFORM	The ratio of net income to total assets (return to total assets).	OSIRIS
<b>Independent Variable</b>			
Female Commissioner	FCOM	The ratio of the number of female commissioners to the number of all commissioners.	Annual Report
Female Director	FDIR	The ratio of the number of female directors to the number of all directors.	Annual Report
<b>Control Variables</b>			
Firm size	SIZE	The logarithm natural of total asset.	OSIRIS
Firm age	AGE	The logarithm natural of years of listing since the first date on the stock exchange.	Firm Profile in Indonesian Stock Exchange Website ( <a href="https://www.idx.co.id/perusahaan-tercatat/profil-perusahaan-tercatat/">https://www.idx.co.id/perusahaan-tercatat/profil-perusahaan-tercatat/</a> )
Financial Leverage	LEV	The ratio of total long-term debt to total assets.	OSIRIS
Independent Commissioner	ICOM	The ratio of the number of independent commissioners to the number of all commissioners.	Annual Report
Independent Director	IDIR	The ratio of the number of independent directors to the number of all directors.	Annual Report
Audit Committee	ACOM	The number of committee members (persons) formed by the Board of Commissioners to exercise oversight of the company's performance.	Annual Report
Audit reputation from Big Four	BIG4	A binary variable takes a value of one where a firm's auditor is one of the big four auditing firms and is null for otherwise.	Annual Report

Public Accountants		The big four auditing firms include KPMG, Deloitte, PricewaterhouseCoopers, and Ernest & Young (EY).	
Institutional ownership	INSOWN	The ratio of the number of institutional ownership to the number of all common stock.	Annual Report
Management ownership	MANOWN	The ratio of the number of managerial ownership to the number of all common stock.	Annual Report
Dividend	DIV	The dummy number equals one if a company pays a dividend or more than once in a given year and null otherwise.	Annual Report

## Result and discussion

### *Descriptive statistics*

Table 3 shows the descriptive statistics of the firm performance (PERFORM), female commissioner (FCOM), female director (FDIR), firm age (AGE), financial leverage (LEV), independent commissioner (ICOM), independent director (IDIR), audit reputation from big four auditing firms (BIG4), institutional ownership (INSOWN), and management ownership (MANOWN). The data summary from 2015 to 2021 reveals that most companies show reasonably good financial performance. Several companies recorded a return on assets of more than 50% in one period, while only a few firms gained success during 2019 and 2020.

On average, woman's representation on boards could be better, with only 9.9% on the board of commissioners and 11.6% on the board of directors (see Table 3). Many firms do not have a female representative on the board. Additionally, Table 4 illustrates how female representation in top executive positions has evolved over the sample. There is a trend of slowly decreasing the average number of female commissioners and increasing the average number of female directors (Table 4). The companies that have female commissioners and female directors in the same period exist during the observation period (2015-2021) are presented only in 6% of observed firms (10 firms with 50 firm-year observations). The houseware and electronics industry has a proportion of 50% of companies with female members as commissioners and directors who continuously exist during the observation period are presented in 6% of observed firms.

Conversely, female commissioners and directors do not exist during the observation period (2015-2021) and are presented in 30% of observed firms (50 firms with 325 firm-year observations). The wood industry is fully controlled by men (100%), while the machinery, heavy equipment, and chemical

industries are controlled mainly by men (67% and 62%). The number of female commissioners ranges from 0 to 5, with a mean of 0.365. The number of female directors ranges from 0 to 6, with a mean of 0.536. Initially, the board sex diversity on the board of commissioners was higher than the board sex diversity on the board of directors, but the trend reversed at the end of the period. In addition, many companies have yet to include women, especially on the board of commissioners. Overall, the average representation of women on boards needs to be improved in Indonesia and reach a critical mass of 30%. It is somewhat different when comparing the data for the three periods; the maximum value of female commissioners for the 2015-2019 period is the same as for the 2015-2021 period (i.e., five persons equal to 83.3%), then this maximum value decreases in the 2020-2021 period (i.e., three persons are equal to 66.7%).

Table 3  
 Descriptive Statistics of Data

Variables	Obs	Mean	Min	Percentile 25	Median	Percentile 75	Max	S.D.
<b>2015-2021</b>								
PERFORM	1071	0.027	-2.640	-0.002	0.028	0.068	0.921	0.140
FCOM	1071	0.099	0	0	0	0.2	0.833	0.172
FCOMNUM	1071	0.365	0	0	0	1	5	0.643
FDIR	1071	0.116	0	0	0	0.25	1	0.176
FDIRNUM	1071	0.536	0	0	0	1	6	0.873
SIZE	1071	28.484	25.216	27.388	28.287	29.337	33.537	1.565
AGE	1071	2.611	-5.207	2.137	3.138	3.313	3.793	1.138
LEV	1071	0.116	-0.271	0	0.037	0.169	3.794	0.244
ICOM	1071	0.378	0	0.333	0.333	0.5	1	0.146
IDIR	1071	0.134	0	0	0.091	0.25	0.667	0.157
ACOM	1071	2.990	0	3	3	3	5	0.395
BIG4	1071	0.347	0	0	0	1	1	0.476
INSOWN	1071	0.711	0	0.521	0.678	0.846	81.508	2.489
MANOWN	1071	0.082	0	0	0	0.022	21.628	0.678
DIV	1071	0.468	0	0	0	1	1	0.499
<b>2015-2019</b>								
PERFORM	750	0.034	-2.640	0.001	0.031	0.072	0.921	0.141
FCOM	750	0.101	0	0	0	0.2	0.833	0.175
FCOMNUM	750	0.380	0	0	0	1	5	0.664
FDIR	750	0.110	0	0	0	0.2	1	0.174
FDIRNUM	750	0.520	0	0	0	1	6	0.872
SIZE	750	28.465	25.216	27.378	28.258	29.276	33.495	1.548
AGE	750	2.548	-5.207	2.097	3.106	3.277	3.747	1.227
LEV	750	0.108	-0.271	0	0.035	0.164	3.533	0.198
ICOM	750	0.373	0	0.333	0.333	0.5	1	0.146
IDIR	750	0.150	0	0	0.125	0.25	0.667	0.157
ACOM	750	2.990	0	3	3	3	5	0.410
BIG4	750	0.360	0	0	0	1	1	0.481
INSOWN	750	0.629	0	0.515	0.676	0.831	0.998	0.270
MANOWN	750	0.060	0	0	0	0.022	1.079	0.155
DIV	750	0.465	0	0	0	1	1	0.499
<b>2020-2021</b>								

PERFORM	321	0.013	-1.050	-0.010	0.021	0.064	0.599	0.136
FCOM	321	0.094	0	0	0	0.183	0.667	0.165
FCOMNUM	321	0.340	0	0	0	1	3	0.592
FDIR	321	0.128	0	0	0	0.25	1	0.181
FDIRNUM	321	0.570	0	0	0	1	6	0.878
SIZE	321	28.527	25.361	27.450	28.309	29.395	33.537	1.605
AGE	321	2.757	0.416	2.163	3.225	3.415	3.793	0.878
LEV	321	0.134	-0.165	0.003	0.046	0.183	3.794	0.327
ICOM	321	0.390	0	0.333	0.333	0.5	1	0.147
IDIR	321	0.003	0	0	0	0	0.333	0.031
ACOM	321	2.990	0	3	3	3	5	0.358
BIG4	321	0.310	0	0	0	1	1	0.463
INSOWN	321	0.903	0	0.526	0.713	0.858	81.508	4.526
MANOWN	321	0.133	0	0	0	0.026	21.628	1.215
DIV	321	0.474	0	0	0	1	1	0.500

Source: own calculation.

Table 4  
 Descriptive of Female Data

Year	Average Female Commissioners	Average Female Directors
2015	0.104	0.096
2016	0.104	0.102
2017	0.103	0.114
2018	0.099	0.121
2019	0.093	0.117
2020	0.096	0.126
2021	0.089	0.129

Note: Female members who did not exist during the observation period (2015-2021) are presented in 30% of observed firms. Female members only exist at the beginning of the observation period, are presented in 14%, at the end of the observation period are presented in 13%, and only exist at the beginning and end of the observation period are presented in 2% of observed firms. Female members as commissioners exist during the observation period and are presented in 13% of observed firms. Female members as directors exist during the observation period and are presented in 22% of observed firms. Female members as commissioners and directors exist during the observation period and are presented in 6% of observed firms.

Source: own calculation.

Table 5 reports the correlations among variables. Both measurements of female commissioners are negatively correlated with performance. Both measurements of female directors (ratio and number) positively correlate with performance. The rest of the control variables are correlated with performance. We observe high correlation coefficients (above 0.70) among institutional and managerial ownership. However, since these variables are not the main variables in the regression model, the high correlation among them is not an issue.

Table 5  
 Correlation Matrix  
 The Ratio of Females in Board

Variables	PERFORM	FCOM	FDIR	SIZE	AGE	LEV	ICOM	IDIR	ACOM	BIG4	INSOWN	MANOWN	DIV
PERFORM	1	-0.041	0.045	0.124	0.030	-0.107	0.064	-0.057	0.089	0.173	0.005	0.007	0.351
FCOM		1	0.110	-0.055	-0.024	-0.004	-0.052	-0.007	-0.138	-0.210	-0.018	-0.014	-0.079
FDIR			1	-0.152	-0.081	-0.087	0.104	0.108	-0.104	-0.096	-0.015	-0.015	-0.027
SIZE				1	0.203	0.106	0.061	-0.234	0.144	0.464	0.022	-0.021	0.366
AGE					1	0.059	-0.026	-0.184	0.055	0.297	-0.032	-0.077	-0.005
LEV						1	0.036	-0.061	-0.008	-0.041	0.029	0.012	-0.134
ICOM							1	0.090	0.044	0.092	0.010	0.017	0.043
IDIR								1	-0.018	-0.158	-0.040	0.003	-0.110
ACOM									1	0.188	-0.014	0.003	0.086
BIG4										1	0.057	0.007	0.228
INSOWN											1	0.952	0.040
MANOWN												1	0.010
DIV													1

Source: own calculation.

### *Inferential statistics*

The primary test, an ordinary least squares regression model (OLS) with heteroskedasticity-robust standard errors, was performed to examine the effect of board sex diversity (female commissioners and female directors) on firm performance across 166 firms within six years. The first part of the regression results in Table 6 shows that female commissioners have no association with firm performance.

Hypothesis 1 (board sex diversity on the board of commissioners has an association with firm performance in Indonesia) is not supported. This finding differs from previous research on the positive and negative association between female commissioners and firm performance. The same result is robust when using the member number for female commissioners (FCOMNUM) (see Table 6). Then, compared to the first additional test, the separation of

regular and COVID-10 pandemic crisis periods, the findings were consistent in all periods (2015-2021 and 2020-2021). This finding contradicts previous research on the negative association between the female commissioner and firm performance in Indonesia (Tarigan et al., 2018).

Hypothesis 2 (board sex diversity on the board of directors is associated with firm performance in Indonesia) is supported. This finding aligns with previous research on the positive association between female directors and firm performance in Malaysia (Rahman et al., 2022) and Indonesia (Pasaribu et al., 2019). The same result is robust when using the number of female directors (FDIRNUM) (see Table 6). Then, compared to the first additional test, the separation of regular and COVID-10 pandemic crisis periods, the findings were consistent in all periods (2015-2021 and 2020-2021). This finding of the association between female and firm performance is inconsistent with Wellalage & Locke (2013) in Sri Lanka.

Table 6  
 OLS Regression Results

Variables	Main Test 2015-2021		First Additional Test 2015-2019		2020-2021	
	Female Ratio	Female Number	Female Ratio	Female Number	Female Ratio	Female Number
Constanta	0.028 (0.087)	0.050 0.088	-0.038 (0.100)	-0.002 0.105	0.052 (0.160)	0.062 0.153
FCOM	0.006 (0.026)		0.021 (0.028)		-0.045 (0.064)	
FCOMNUM		-0.002 (0.006)		0.002 (0.006)		-0.015 (0.015)
FDIR	0.046** (0.020)		0.053** (0.024)		0.042** (0.036)	
FDIRNUM		0.014** 0.004		0.015*** 0.005		0.014* 0.007
SIZE	-0.004 (0.003)	-0.005* (0.003)	-0.003 (0.003)	-0.004 (0.003)	-0.005 (0.006)	-0.006 (0.006)
AGE	0.002 (0.003)	0.002 (0.003)	-0.031 (0.034)	-0.001 (0.003)	0.022** (0.011)	0.022** (0.011)
LEV	-0.028 0.019	-0.027 0.019	-0.031 0.034	-0.030 0.034	-0.021 0.017	-0.019 0.017
ICOM	0.037 (0.030)	0.027 (0.030)	0.032 (0.038)	0.025 (0.037)	0.053 (0.051)	0.042 (0.051)
IDIR	-0.026 (0.030)	-0.020 (0.030)	-0.026 (0.030)	-0.021 (0.029)	-0.058 (0.080)	-0.051 (0.079)
ACOM	0.017 (0.011)	0.017 (0.011)	0.026* (0.014)	0.025* (0.013)	-0.001 (0.010)	-0.001 (0.010)
BIG4	0.032*** (0.010)	0.031*** (0.010)	0.031** (0.013)	0.029** (0.013)	0.019 (0.018)	0.020 (0.018)
INSOWN	-0.009*** (0.003)	-0.010*** (0.003)	0.032*** (0.012)	0.028** (0.012)	-0.022*** (0.007)	-0.023*** (0.007)
MANOWN	0.032** (0.013)	0.035*** (0.013)	0.056** (0.023)	0.054** (0.023)	0.083*** (0.023)	0.085*** (0.026)

DIV	0.094*** (0.009)	0.092*** (0.008)	0.090*** (0.010)	0.089*** (0.010)	0.105*** (0.018)	0.103*** (0.018)
R-squared	0.147	0.147	0.145	0.148	0.195	0.198
Adjusted R-squared	0.137	0.137	0.131	0.134	0.164	0.167
F	21.656	21.656	18.681	18.375	8.024	7.820
P-value (F)	0.000	0.000	0.000	0.000	0.000	0.000
Observations	1071	1071	750	750	321	321

Note: p-values in parentheses: \* p<0.1, \*\* p<0.05; \*\*\* p<0.01.

Source: own calculation.

The additional second test using the quantile regression results in Table 7. We present the results of the estimating equation (1) for different values of each quantile (10<sup>th</sup> quantile until 90<sup>th</sup> quantile or Q1 until Q9). We could use quantile regression to examine the explanatory variables' impact at different conditional distribution levels. Together, these studies show the importance of using empirical techniques that extend beyond isolating the average effect of input variables on an outcome variable of interest (Canyon & He, 2017). Many previous studies have yet to demonstrate this set of findings before, especially in Indonesia.

We find no evidence of female commissioners when using standard linear regression methods. In contrast, at around the 50<sup>th</sup> quantile board, sex diversity in the commissioner board is positively and significantly associated with firm performance (at the 10% level). Adversatively, we find board sex diversity in the commissioner board is negatively and significantly associated with firm performance at around the 80<sup>th</sup> quantile and the 90<sup>th</sup> quantile (at the 1% level). As shown in Table 7, the coefficients of our board sex diversity measures in commissioner boards are insignificant in many quartiles, such as the four lower quartiles (10<sup>th</sup> quantile, 20<sup>th</sup> quantile, 30<sup>th</sup> quantile, and 40<sup>th</sup> quantile), 60<sup>th</sup> quantile, and 70<sup>th</sup> quartile. Almost the same results were obtained when female commissioners' diversity was measured using numbers; that is, board sex diversity in the commissioner board is negatively and significantly associated with firm performance in Q8 and Q9 (at the 1% level).

Female directors affect not only the conditional average performance of firms (Table 6) but also the dispersion of firm performance (Table 7). Specifically, the effect of board gender diversity is more significant in conditional low, median, and high-performing firms. In Table 7, we can find the associations of our board sex diversity measures in director board and firm performance are not significant in many more quartiles than commissioner board when female directors are measured by ratio, but in contrast when numbers measure female. Female directors are only positively and significantly associated with firm performance in Q3 (at the 1% level) when female directors' diversity is measured by ratio. Meanwhile, we find that board sex diversity in the director board is positively and significantly associated with firm performance in the 20<sup>th</sup> quantile, 30<sup>th</sup> quantile, 40<sup>th</sup> quantile (at the 5% level), and 90<sup>th</sup> quantile (at the 1% level) when female directors measured by number.

The female board as governance attribute has a quantitatively different effect across the response variable distribution. The female commissioners and the female directors' links are more vital in conditionally high-performing firms. The female managerial ability significantly impacts firm performance at the right tail of the performance distribution. Overall, consistent with Conyon and He (2017) and Charles et al. (2018), our results indicate that BGD has a different effect on firm performance over the different points of the conditional distribution.

Table 7  
**Quantile Regression Results**

Variables	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
<b>Female in Ratio</b>									
Constanta	-0.278 (0.251)	-0.181 (0.164)	-0.107 (0.176)	-0.050 (0.149)	0.021 (0.143)	0.04 (0.163)	0.058 (0.178)	0.162 (0.171)	0.274 (0.338)
FCOM	-0.003 (0.028)	0.009 (0.009)	0.017 (0.011)	0.014 (0.009)	0.017* (0.009)	0.006 (0.011)	-0.003 (0.009)	-0.034*** (0.013)	-0.064*** (0.024)
FDIR	0.020 (0.035)	0.016 (0.015)	0.028*** (0.010)	0.019 (0.013)	0.009 (0.009)	0.007 (0.009)	0.005 (0.012)	0.007 (0.020)	0.005 (0.050)
<b>Controls</b>									
<b>Female in Numbers</b>									
Variables	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Constanta	-0.272 (0.290)	-0.172 (0.191)	-0.072 (0.183)	-0.055 (0.175)	0.022 (0.166)	0.046 (0.167)	0.041 (0.167)	0.141 (0.262)	0.216 (0.403)
FCOMNUM	0.001 (0.011)	0.002 (0.003)	0.003 (0.003)	0.001 (0.002)	0.003 (0.002)	-0.000 (0.002)	-0.004 (0.003)	-0.009*** (0.003)	-0.016** (0.007)
FDIRNUM	0.009 (0.008)	0.007** (0.003)	0.006** (0.003)	0.006** (0.003)	0.004 (0.003)	0.004 (0.003)	0.004 (0.004)	0.008 (0.007)	0.020** (0.010)
<b>Controls</b>									

Note: Total observations are 1071. P-values in parentheses: \*  $p < 0.1$ , \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .  
 Source: own calculation.

The additional third test uses fractions in proportion and number to find out the association of board sex diversity in many numbers of female members to performance related to critical mass theory. A description of each fractional division of proportions and numbers of females in boards is in Appendix 1. The fraction for proportion in the ratio is divided into 10%, 20%, 30%, and more than 30% (using dummy variables, one of the total female members meets the ratio and 0 if they do not). The fraction for proportion in numbers is divided into one person, two persons, three persons, and more than three persons for female boards (using dummy variables, one of the total female members meets the number and 0 if they do not). The testing result of ordinary least squares with heteroskedasticity-robust standard errors is presented in Appendix 1.

The critical mass test shows that the number of female commissioners (DFCOM) and directors (DFDIR) with amounts 1, 2, and 3 does not affect company performance. Still, more than three people female commissioners powerfully negatively affect company performance. Female commissioners do not affect firm performance in any percentage (10%, 20%, 30%, and more than 30%). Differences with female directors positively affect firm performance when female directors reach more than 30%. Meanwhile, the

combination of female commissioners and female directors compared to the total number of members of the board of commissioners and directors shows an influence on company performance when there are 20% or more than three persons.

## **Discussion**

We do not find a significant association between the board sex diversity in the board of commissioners with firm performance for a sample of manufacturing Indonesia firms (as developing economics). Female commissioners do not influence firm performance during the manufacturing firm's standard and COVID pandemic periods. Because the appointment of females in boards is still limited to tokens, that is supported by data about the decreasing average number of female Commissioners continued during the study period (see Table 4). Another reason is that the duties of the board of commissioners are to provide supervision without conflict of interest and to provide suggestions to directors, recommendations, and supervision in making objective decisions and acting independently in monitoring and evaluating the directors' performance. The supervisory role of the commissioner does not necessarily affect the company's performance; thus, this causes the female board of commissioners to have no direct association with company performance.

In some test results using quantile regressions (see Table 7) and OLS with splitting the number (see Appendix 1), a large number (more than three persons) of female commissioners negatively influences firm performance, which means company management can strive for efficiency by reducing the number of female commissioners. We need to interpret these results with caution. More than three persons of female commissioners could not consider a source of inefficiency for companies to carry out the oversight process within the company because making it a target for reducing the number during times of crisis. The reduction in the maximum number of female commissioners during the 2020-2021 period (namely from 5 members equals 83.3% to 3 members equals 66.7%) also explains the different situations many companies face (see Table 3). For example, a pharmaceutical company named PT Tempo Scan Pacific Tbk. The number of commissioners tends to be stable (2015: four persons, 2016: six persons, 2017-2021: five persons), but the number of female commissioners shows a decreasing trend (2015: three persons, 2016: four persons, 2017-2019: three persons, 2020-2021: two persons). The decrease in female commissioners coincided with the COVID-19 pandemic and the change in president commissioners from female to male since the 2020 financial report. These two coincidences show that other elements can be considered determinants of firm performance.

Meanwhile, the proportion of female directors is higher than female commissioners, thus showing the effect on performance. Female directors influenced firm performance in the standard period, during the pandemic period, and had a more substantial effect before the pandemic period. The influence

of female directors on performance follows the multi-perspective theory discussed earlier. The increasing average number of female Directors is good news for increasing the equality of women and men, but on average, the value is still relatively small (see Table 4). The lack of a female board causes the role of females to be less visible in company performance in many quartiles (See Table 7).

Testing the critical mass proportion and number found some exciting findings about female directors. A large percentage (more than 30 percent) of female directors influence firm performance. The 30 percent figure is enough to replace the role of women who are only tokens. It is confirmed with the critical mass threshold that the proportion of female boards can facilitate an advantage for the firm. This threshold finding confirms that the positive effect of board sex diversity on financial performance increases when there is at least a critical mass of 30% of women on a corporate board so that women present a favorable environment to capitalize on innovative ideas arising from board sex diversity (Torchia et al., 2011; Wiley & Monllor-Tormos, 2018), cause a fundamental change in the boardroom and enhance corporate governance (Erkut et al., 2008; Konrad et al., 2008). Board composition is needed to determine the advantages and disadvantages of board diversity.

It is necessary to strive for the diversity of board types (i.e., commissioners or directors) so that companies get more benefits by considering this. The board of directors diversity affects the company's performance, while the diversity of the board of commissioners has no effect. Related to corporate governance theory, the leading cause is the role of the board of directors, which is more operational, strategic planning, and decision-making process compared to the board of commissioners. The difference in roles looks like the board of directors manages the resources, while the board of commissioners supervises the directors. In addition, BOD reduces environmental interdependence and uncertainty (resource dependency theory), triggers positive developments for the company related to heterogeneity level that will impact the strategic planning and decision-making process (upper-echelon theory), the positive effect of board sex diversity on financial performance increases when there are more than 30% of women on a corporate board (critical mass theory).

The topic of gender diversity as part of governance theory is a mechanism for achieving better performance (besides the mechanisms of independent commissioners, institutional ownership, managerial ownership, and auditing by the big four public accountant companies). Gender diversity has only begun in developing Asian countries such as Indonesia. Meanwhile, diversity has been considered a positive thing in global trends, so some countries implemented female quotas. The development of Asian countries traces the global trend (Deloitte, 2019).

The COVID-19 pandemic period caused essential projects to be delayed (Harymawan and Rahayu, 2022). The virus spread caused an economic shock and presented significant economic-social challenges in Indonesia (UNICEF, 2022). Indonesia's economic growth slowed down in 2020. Social restrictions and activities affected business operations and continuity. Various sectors, business sizes, and

regions reduced production capacity, sold assets, and stopped operations (Setiaji, 2021). Some of the corporate sectors that were most affected were the shoe and garment manufacturing sector, as well as retail (Rifa'i, 2020). This study found consistent results for the Board of Commissioners and Board of Directors variables. This finding shows good external validity because it gives consistent results in different situations (standard and crisis), even though a decrease in commissioners coincides with a crisis.

These findings contribute to the theories used, such as confirming the resource dependency theory, upper echelon theory, and critical mass theory in the associations between board sex diversity (female commissioners and female directors) and firm performance in developing countries' manufacturing companies. Especially for critical mass theory, which states at least a critical mass of 30% of women on a corporate board, this study found that more than the exact diversity value of 30% is needed to have an effect. The diversity value is more than 30%, and more than three persons can influence the company's performance.

## **Conclusions**

The study examined the effect of female boards on firm financial performance in Indonesian manufacturing firms. Many aspects must be considered when choosing a governance configuration and appointing a board chair because this role is become increasingly demanding (Banerjee et al., 2020). The prior research on this research needs to be more conclusive. We use an integrated multi-theoretical approach (principal-agent theory, resource dependency theory, and upper-echelon theory) to better understood corporate governance functions. Our primary research question is whether female commissioners and female directors influence firm performance.

The first result reveals that the company's performance is unrelated to the proportion of female commissioners. Including women on the board of commissioners does not affect the company's performance because the proportion of female commissioners is very low, even lower than that of female directors on company boards. In addition, the majority of companies do not have female commissioners.

The second result revealed that firm performance is positively associated with the proportion of female directors. Including women on the board of directors significantly affects firm performance. Although the proportion of women directors on corporate boards is low, it still impacts accounting-performance measures. Firms that include female personnel on the board may benefit from such practice. The first benefit refers to the principle of firms and policymakers in managing the firm, especially in developing economies. The second benefit refers to the regulators in the countries that plan to set or regulate the female quota. The results of this study can be used as the reason for the inclusion of female directors. Another result is positive firm performance associated with the proportion of female directors in the ordinary and crisis, especially during the COVID-19 pandemic crisis. This observation has never

been done before by the previous researcher. The role of women is significant on the board of directors to reduce environmental interdependence and uncertainty because of female attributes of characteristics (resource dependency theory). Moreover, the contribution of professionalism and adaptation of the female board can trigger positive developments for the company (Upper-Echelon Theory). Their appointment in certain levels of heterogeneity offers several benefits, including a greater connection with the external environment, strategic planning, and improved firm decision-making capabilities.

Female directors need to be appointed based on their prior job experience, skill, and knowledge in the financial and managerial departments of the firm and have female colleagues. Moreover, firms should focus on advancing technology or utilizing talent and entrepreneurship to gain a competitive advantage (An et al., 2020). However, it is still too early to conclude whether female dominance on the board can still produce good performance because data distribution is minimal for the dominance and balanced categories. The development of women's equality will facilitate further research.

Our empirical results provide guidelines to the firm principal and regulators in Indonesia concerning female representation on the board of commissioners and directors. The presence of female directors is a valuable resource for top leaders who can benefit the firm to increase its financial performance (return on assets). Although Indonesia manufacturing firms have the highest sex diversity on boards than other sectors (based on a survey from Economist Intelligence Unit Analysis), manufacturing firms are more likely to have a lower share of female employees overall, as well as company cultures that discourage the promotion of women into top managerial positions and the boardroom (International Finance Corporation, 2019:26). There needs to be a promotion for increasing the percentage of women on company boards of directors.

We acknowledge that this study has several limitations. This research must distinguish the last position level from females in boards holding commissioner and director positions. The author believes the existence of competent women in the critical mass thresholds will lead to more benefits for the company. Subsequent research can show the indirect relationship between the Board of Commissioners and the Women's Board of Commissioners on company performance to determine the association between these variables. Additionally, discovering the upper limit of the threshold is best to be done when there are more female board members in Indonesian firms. Another limitation is that this study only uses one performance measure (i.e., ROA). Meanwhile, performance measures are not limited to ROA. Future studies can use other performance measures, so it is suggested that future research can use other performance measures such as Return on Equity (ROE), Return on Net Operating Assets (RNOA), and other performance measures. Limited contributions related to the absence of the female commissioner's influence on company performance can be influenced by other elements that have yet to be considered in the manufacturing industry. Subsequent research can use elements such as managerial abilities (educational background and political connections).

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## Annex

Table A1  
 OLS Regression Results for critical mass

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Constanta	0.034 (0.092)	0.038 (0.086)	0.026 (0.084)	0.072 (0.088)	0.015 (0.090)	0.077 (0.088)
FCOM			0.005 (0.025)			
FCOMNUM				-0.005 (0.006)		
FDIR	0.045** (0.020)					
FDIRNUM		0.015*** (0.005)				
DFCOM10%	0.005 (0.025)					
DFCOM20%	0.013 (0.012)					

DFCOM30%	0.008						
	(0.009)						
DFCOM>30%	-0.002						
	(0.020)						
DFCOM1		0.011					
		(0.009)					
DFCOM2		-0.017					
		(0.019)					
DFCOM3		-0.024					
		(0.026)					
DFCOM>3		-0.067***					
		(0.023)					
DFDIR10%			-0.006				
			(0.022)				
DFDIR20%			0.012				
			(0.008)				
DFDIR30%			0.011				
			(0.010)				
DFDIR>30%			0.037***				
			(0.012)				
DFDIR1				0.008			
				(0.008)			
DFDIR2				0.019*			
				(0.010)			
DFDIR3				0.029			
				(0.026)			
DFDIR>3				0.126***			
				(0.038)			
DFCOMFDIR10%					0.000		
					(0.009)		
DFCOMFDIR20%					0.018**		
					(0.009)		
DFCOMFDIR30%					0.025		
					(0.023)		
DFCOMFDIR>30%					0.023		
					(0.015)		
DFCOMFDIR1						0.006	
						(0.010)	
DFCOMFDIR2						0.012	
						(0.010)	
DFCOMFDIR3						0.017	
						(0.024)	
DFCOMFDIR>3						0.105***	
						(0.032)	
SIZE	-0.005	-0.005	-0.004	-0.006*	-0.004	-0.006**	
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	
AGE	0.002	0.002	0.002	0.001	0.002	0.001	
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	
LEV	-0.028	-0.027	-0.028	-0.027	-0.028	-0.026	
	(0.020)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	
ICOM	0.038	0.031	0.034	0.020	0.040	0.027	
	(0.031)	(0.031)	(0.030)	(0.030)	(0.030)	(0.030)	

IDIR	-0.025 (0.031)	-0.022 (0.030)	-0.026 (0.030)	-0.019 (0.030)	-0.024 (0.030)	-0.018 (0.030)
ACOM	0.017 (0.011)	0.018* (0.010)	0.019* (0.011)	0.016 (0.011)	0.018 (0.011)	0.016 (0.011)
BIG4	0.033*** (0.010)	0.031*** (0.010)	0.032*** (0.010)	0.031*** (0.010)	0.034*** (0.010)	0.034*** (0.010)
INSOWN	-0.009** (0.003)	-0.009*** (0.003)	-0.009*** (0.003)	-0.010*** (0.003)	-0.009** (0.004)	-0.009*** (0.003)
MANOWN	0.031** (0.013)	0.033*** (0.013)	0.034*** (0.013)	0.035*** (0.013)	0.032** (0.013)	0.034*** (0.013)
DIV	0.094*** (0.009)	0.093*** (0.009)	0.094*** (0.009)	0.092*** (0.009)	0.094*** (0.009)	0.093*** (0.009)
R-squared	0.148	0.154	0.149	0.154	0.148	0.152
Adjusted R-squared	0.136	0.142	0.137	0.142	0.137	0.141
F	18.544	18.431	17.957	17.864	19.669	20.523
P-value (F)	0.000	0.000	0.000	0.000	0.000	0.000
Observations	1071	1071	1071	1071	1071	1071