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**Article**

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# Gender diversity and firm performance: evidence from Malaysia boardrooms

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## ABSTRACT

This study contributes to the literatures on the influence of Malaysia's board of directors' gender diversification requirement (soft law) on women's participation in such positions. In addition, it examines the effect of gender diversification requirement of the board of directors' on firm performance, board size, and board member characteristics. The empirical analysis was based on data taken from the Orbis (Bureau van Dijk) database and annual reports posted on the Bursa Malaysia Stock market for 452 large and very large publicly listed firms for the period 2007–2016. The requirement significantly increased female participation in the board of directors, although the 30% set target was not achieved. The findings show that gender diversification of the board of directors has a negative effect on firm size (total revenue and total asset) in only higher technology intensive manufacturing sector and firms in good competition sectors; it has no effect on other sectors. This negative effect finding is consistent with social identity theory. Gender diversification of the board of directors has no impact on firm efficiency (profit margin, Return on Equity (ROE), Tobin's Q). This result does not support resource dependency and agency theory, or social identity theory. The gender diversity requirement adversely affects the board directors' level of experience and age with no effect on board members' size and educational qualifications. The findings are robust across different econometrics models [fixed effect and Instrumental variables (IV)] that deal with endogeneity issues, and alternative firm size and firm efficiency measurements.

## IMPACT STATEMENT

All communities understood the role of females in economic development. In many countries, Non-Governmental and Governmental organizations are working on gender diversification. This study identifies the effect of gender diversification requirement of Malaysian board of directors on firm performance. This requirement increases female participation in the board of directors. Gender's diversification of the directors had a negative effect on firm size in only higher technology intensive manufacturing sector and firms in good competition sectors; it has no effect on other sectors. In addition, board of directors' gender diversity has no impact on firm efficiency measurement.

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## 1. Introduction

Worldwide, women face substantial challenges in reaching the highest echelon in their careers, particularly at the board of directors'. Across 67 countries in the world, the share of women board directors is 10.3%, with the lowest rate in Morocco (0%) and the highest rate in Norway (42%) (Terjesen et al., 2015). Owing to more diverse and cohesive thinking, gender balanced boards may have the capacity to improve the work environment, productivity, and financial performance. Therefore, the gender quota requirement of the board of directors, may improve economic growth (European Commission, 2012). Norway Minister, Gabrielsen, stated in his speech that, denying an opportunity for women to be in higher positions is a waste of the resources that society invested in educating their daughters (Terjesen & Sealy, 2016).

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In light of the above, many countries have set gender quotas and diversification as requirements for the appointment of board directors. Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, India, Ireland, Israel, Italy, Kenya, Luxembourg, Malawi, Malaysia, Netherlands, Nigeria, Norway, Poland, South Africa, Spain, Sweden, the United Kingdom, and the United States are among the countries actively working on gender diversification. Some of these countries set gender quota requirements with sanctions (hard law), while others explicitly set gender diversification in appointing board directors as a requirement in the Code of Corporate Governance (soft law) (Terjesen et al., 2015). Some studies have argued that soft law is not effective (Gray, 2015; Labelle et al., 2015). However, Sweden, a country with soft law (a requirement in its Corporate Governance Code), is among those who achieved the highest rate of women's representation on the board of directors (Terjesen et al., 2015).

Gender diversity on board has been an issue that is attracting tremendous attention from academicians. Several theoretical arguments exist regarding the relationship between the gender diversity of the board of directors and the performance of firms. However, prior literatures are based on the mixed and sometimes contradictory theories and empirical results, still there is no consensus regarding the association of between the board of directors' gender diversity and firm performance. Dependence theory and agency theory suggest positive relationships between the gender diversity of the board of directors and firm performance (Pfeffer & Salancik, 1978; Hillman et al., 2007; Gallego-Alvarez et al., 2010). In contrast, social identity theory suggests that the board of directors' gender diversity has a negative effect on firm performance (Ancona & Caldwell, 1992). Empirically, some researchers have found a positive relationship between the gender diversity of the board of directors and firm performance (Ntim, 2015; Kılıç & Kuzey, 2016; Reguera-Alvarado et al., 2017; Arvanitis et al., 2022). Other researchers found negative or no statistically significant relationship between the board of directors' gender diversity and firm performance (Marinova et al., 2016; Eckbo et al. 2016; Ferrari et al., 2022; Marquez-Cardenas et al., 2022; Ahern & Dittmar, 2012). The effects of the gender diversity of the board of directors on firm performance results are heterogeneous across countries (Comi et al., 2017). Majority prior studies focus on the case of developed countries (Marinova et al., 2016; Comi et al., 2017; Reguera-Avarado et al., 2017; Ferrari et al., 2022; Arvanitis et al., 2022).

Malaysia has been working on gender equality in appointments at decision-making positions since 2004, wherein the government of Malaysia issued a requirement that at least 30% of such positions in public sector should be filled by women. The Prime Minister of Malaysia, Mr. Najib Razak extended this requirement to the private sector in 2011 (Abdullah, 2014). They also set 30% women's board of directors' target by 2016 in their 2011 Corporate Governance Blueprint (MCCG, 2011). In 2012, Malaysia issued a code of corporate governance that requires boards to set gender diversity as a requirement for appointment of board directors, to take action that helps achieve the target, and to disclose the policy and its performance in their annual report (MCCG, 2012). However, later in 2017, the 30% women board of directors' requirement was reissued; limiting the requirement to only very large firms, i.e. companies in the FTSE bursa Malaysia Top 100 Index (MCCG, 2017). The Malaysian 30% female board of directors' requirement has attracted the attention of many researchers (Abdullah, 2014; Low et al., 2015; Terjesen et al., 2015). Low et al. (2015) considered the gender diversification requirement of the Malaysian board of directors' as a possible reason for Malaysia having a relatively higher share of female directors compared to other Asian countries. The gender diversification rule of the board of directors is mainly used in developed nations, particularly in the European Union (EU). The study undertaken by Syed and Van Buren (2014) concluded that such requirement is difficult to implement in Muslim dominated countries, wherein they suggest taking the relationship between religion, culture, and business into consideration. Therefore, it is fascinating to study the influence of the gender diversification requirement of Malaysia board of directors' on the share of female directors, and its impact on firm performance.

To achieve its objectives, this study focuses on large and very large firms listed on the Bursa Malaysia Stock Market Exchange and the Orbis database. Data on performance measurements such as total assets, total revenue, profit margin, Return on Equity (ROE), Tobin's Q and sector distribution information are taken from the Orbis database. Information on each board member's characteristics such as age, education, sex, and years of experience is taken from the Bursa Malaysia Stock Exchange. This study examines the progress and effect of the gender diversification requirement of Malaysian boards of directors on firm performance, board size, and board members' characteristics.

There are 866 large and very large firms in the Orbis database. This study excluded agriculture, non-profit public organizations, and firms with missing information on firm performance. The study focuses on firms with identical name in the Orbis database and Bursa Malaysia stock market exchange and uses a final sample of 429 firms with a balanced panel for 2007–2016. This study addresses whether the gender diversification requirement of the board influences the share of female directors; and whether it affects firm performance, board size, and board member characteristics. This study used an identification strategy similar to Ahern and Dittmar (2012) that is fixed effects panel data with an IV strategy.

This study contributes to the existing literature in various ways. First, most prior research has focused on hard law in developed countries (Ahern & Dittmar, 2012; Comi et al., 2017; Ferrari et al., 2022). Whereas, this study explores the influence of the board of directors gender diversification requirement (soft law) on the share of female board directors and its effect on firms' performance, particularly in a Muslim dominated developing country. Second, the researcher used an extensive set of firm performance measurements such as firm size (total assets and total revenue) and efficiency [profit margin, Return on Equity (ROE), and Tobin's Q]. Third, this study considers the influence of other factors, such as age, education, and experience of the board of directors. Fourth, this study addressed the issue of impact. Most prior studies used cross-sectional data, wherein it is difficult to address cause-and-effect issues (Hillman et al., 2007; Julizaerma & Sori, 2012; Post & Byron, 2015). Fifth, this study uses a relatively large number of firms and data for a longer duration (10 years).

The findings of this study are summarized as follows: A) although the Malaysian board of directors' gender diversification requirement couldn't achieve its 30% target, it contributed positively to female participation, expressed in terms of having at least one female board director, percentage of female board directors, and the dummy for firms that achieved the 30% female board directors. The more qualified females participated on the board of directors after the requirement. Women appointed as board directors after the requirement were more qualified than their female predecessors in many dimensions. B) Board gender diversification has a negative impact on firm size (total revenue and assets), but has no impact on efficiency (profit margin, ROE, and Tobin's Q). The findings from the instrumental variable estimates are also consistent with those of the fixed effect estimates. C) Board gender diversification requirement has no effect on board size and board of directors' educational qualifications but has a negative effect on their age and experience as a board director. D) The gender diversification requirement of the board of directors has a negative effect on firm size in higher technology-intensive manufacturing sectors and firms in good competition sectors, whereas it has no effect on other sectors. In terms of Tobin's Q, the gender diversification requirement of the board of directors has a positive effect on the technology-intensive manufacturing sector and firms in good competition sectors. The researcher found no sector-based difference in the effect of gender diversification requirement of the board of directors on other firm efficiency measurements. In addition, there is no evidence that the gender diversification requirement of the board of directors has an asymmetric effect in terms of firm size on majority of firm performance measurements.

## 2. Theoretical literature review

Both theoretical and empirical findings on the effect of board directors' gender diversity on firm performance are mixed. Valuable insights into connection between board directors' gender diversity and firm performance are being provided by resource dependence theory, agency theory, and social identity theory (Marinova et al., 2016; Ntim, 2015; Kılıç & Kuzey, 2016; Marquez-Cardenas et al., 2022; Arvanitis et al., 2022). The positive impact of board directors' gender diversity on firm performance is explained using resource dependency theory and agency theory. In contrast, social identity theory suggests that the gender diversity of the board of directors negatively affects firm performance.

According to the resource dependency theory, gender diversity can have a positive effect on firm performance by linking on firm to its external environment and increase firm access to crucial resources (Pfeffer & Salancik, 1978; Hillman et al., 2007; Gallego-Alvarez et al., 2010). In this framework, the diversity of gender on the board of directors is a source of different ideas, perspectives, experiences, and knowledge (Gallego-Alvarez et al., 2010; Lückerath-Rovers, 2013; Reguera-Alvarado et al., 2017). All these additional resources can influence the firm performance positively.

According to agency theory, gender diversity positively affects firm performance. The board directors' gender diversity is increased boardroom independence and better monitoring of managers and this change positively affects firm performance (Gallego-Alvarez et al., 2010). Board directors' gender diversity can improve firm performance by reducing the costs related to agency. Incorporation of women in the board director's position is eradicating the social and labor grievance, and increase ethical commitment (Reguera-Alvarado et al., 2017).

In contrast, of resource dependency and agency theory, the social identity theory suggests that board directors' gender diversity negatively affects firm performance. Based on this theory, people categorize themselves into different groups; this self-categorization may lead conflict and other problems. Gender diversity may slow down decision making process and the probability of reaching consensus. Diversity of top management teams is more costly and difficult (Ancona & Caldwell, 1992). According to Jehn et al. (1999), diversity of top management teams exacerbates different forms of conflict.

### 3. Empirical literature review and hypothesis development

The existing empirical evidences concerning the relationship between board gender diversity and firm performance are mixed. Their findings can classify in to three categories. In the first category, researchers argue that the board of directors' gender diversity has a positive effect on firm performance (Ntim, 2015; Kılıç & Kuzey, 2016; Reguera-Alvarado et al., 2017; Arvanitis et al., 2022). In the second category, researchers found a negative effect of board directors' gender diversity on firm performance (Ahern & Dittmar (2012). In the third category, researchers indicated that board directors' gender diversity has no effect on firm performance (Eckbo et al., 2016; Ferrari et al., 2022; Marinova et al., 2016; Marquez-Cardenas et al., 2022). Comi et al. (2017) study in the case of European countries found heterogeneous results across countries.

With respect to Malaysia, unlike most of the countries that implemented the board of directors gender diversification requirement, Malaysia is a developing country with high gender gap, Muslim dominated, and that issued a soft law. In 2018, the World Economic Forum calculated gender gap index for 149 countries to measure gender-based gaps in access to resources and opportunities (health, education, economic participation, and political empowerment), wherein Malaysia is ranked 101<sup>st</sup>. They calculated index for each indicator and then averaged each sub-index scores to obtain the overall Global Gender Gap Index. The final value ranges between 1 (gender equality) and 0 (gender inequality). As depicted in Table A.5 based on the comparison of 26 countries that implemented board of directors gender diversification requirement, Malaysia is ranked 23<sup>rd</sup>, preceding India, Malawi and Nigeria, in terms of women economic participation and opportunity, and overall gender gap. India set a gender diversification requirement of at least one female of board director, and Nigeria and Malawi set the requirement without any quota (they request female to participate at board of directors level without setting specific number for the share of female), while Malaysia set to achieve minimum of 30% female board of directors target by 2016. The ambitious requirement that Malaysia sets, coupled with its features expressed as a Muslim dominated developing country with high gender gap, is the inspiring factors to study the effectiveness of the board gender diversification requirement for the share female board of directors and its effect on firm performance.

Malaysia initially introduced the concept of board of directors gender diversification requirement in 2004 by setting at least 30% target women at a decision-making level in public sectors. Although not at the board of directors' level, the requirement was successful in bringing women to decision-making positions. Due to the promising result, they rolled it out to private sectors in 2011. The study undertaken to evaluate the effectiveness of the 2004 gender diversification requirement at a decision-making level on the share of female board directors confirmed that the requirement did not bring statistically significant influence (Ahmad-Zaluki, 2012). Malaysia security commission explained that "Gender is not only the aspect of board diversity but has received global attention as an important component of inclusive growth." The commission further indicated the availability of sufficient women with the required qualifications and experience for board of director positions. Further, Abdullah et al. (2016) discussed that girls constitute the majority of university students in Malaysia. As depicted in graph B.2 in [Appendix A](#), based



on the World Bank data on tertiary school enrollment in Malaysia, female students are more likely to enroll.

Malaysia introduced the board of directors' gender diversification requirement effective July 2011 with the goal to achieve 30% women participation by 2016 (MCCG, 2011). Furthermore, in 2012, detailed requirement issued for firms to issue policy on board gender diversification and to disclose it with their effort to achieve the target on their annual report (MCCG, 2012). Malaysia security commission explained that MCCG (2012) as a key deliverable of the MCCG (2011) Blueprint. The requirement applies to all publicly listed firms, including those on Bursa Malaysia stock market exchange. The Bursa Malaysia requires listed firms to include in their annual report a statement about the policy and steps taken to achieve the board of directors' gender diversification and other requirements. Yet, the requirement is soft law, meaning sanction is not attached to enforce it. The requirement is issued to give an opportunity for qualified women to become company board of directors. Malaysia firms did not publicly push back/oppose the requirement.

At the time, the board of directors' gender diversification was introduced, the share of female board directors was 8.2%. The requirement has attracted the attention of many researchers (Abdullah, 2014; Lee et al., 2015; Low et al., 2015; Terjesen et al., 2015; Terjesen & Sealy, 2016). The study undertaken in the case of Malaysia, Singapore, and South Korea concluded the requirement, as the reason for Malaysia having a higher share of female board directors compared to the other two countries (Low et al., 2015). Malaysia was unable to achieve the 30% target, and therefore, the country reset the requirement in 2017 limiting the requirement to very large firms, i.e. companies on the FTSE bursa Malaysia Top 100 index or companies with market capitalization of RM 2 billion or above (MCCG, 2017).

**Hypothesis 1a** (H1a). There is no statistically significant relationship between board directors' gender diversification and firm performance

**Hypothesis 1b** (H1b). There is statistically significant negative or positive relationship between board directors' gender diversification and firm performance

## 4. Research design

### 4.1. Description of data

This study uses two sources of data, the Bursa Malaysia Stock Exchange and Orbis (Bureau van Dijk). Orbis is one of the most powerful data sources worldwide. It contains comprehensive information on millions of listed and unlisted companies across the world. It collects data from more than 160 providers (Acquire media, Asap inform, Bisnode, bizportal, Cerved Cibi, Dat- aPro, ellisphere, EQUFAX, FACTSET, Fitch Solution, Global Data, IBFD, ICAP, Info Credit, NICE information service, private equity information, Global financial intelligence, ZANDERS etc.) and other sources (annual reports, company websites, newswires etc). It provides information such as detailed companies' contact information, industry distribution, current and historical financial information, ratios, credit rating, ownership, and directors. Based on the Orbis classification, very large firms that fulfill at least one of the following requirements – operating revenue greater than or equal to 100 Million Euro (130 Million USD) / total assets greater than or equal to 200 Million Euro (260 Million USD) / and number of employees greater than or equal to 1000. Large firms that fulfill at least one of the following requirements – operating revenue greater than or equal to 10 Million Euro (13 Million USD) / total asset greater than or equal to 20 Million Euro (26 Million USD) / and the number of employees greater than or equal to 150. If information on total revenue, total assets, and the number of employees is unavailable, large firms are defined as firms with 5 Million Euro (6.5 Million USD) capital. Firms with ratios of operating revenue per employee or total assets per employee below 100euro (130 USD) are excluded from this category. This study focuses on large and very large firms assuming that such firms are more likely to respond to gender diversification requirements. 866 large and very large firms are available in the Orbis database for the period 2007–2016. A final sample of 429 firms' balanced panel data is used with a sample of 4290 observations. The final sample was determined by excluding agriculture, non-profit public organizations, firms with missing information on firm performance measurements, and

**Table 1.** Sampling selection.

Selection procedures	Number of firms
The number of firms in the Orbis database	866
Firms with identical names in the Bursa Malaysia and Orbis database or available in both databases at the time data management	692
Agriculture and nonprofit public organization are excluded	(89)
Firms with missing Information are excluded	(174)
Final number of firms	429

focusing on firms with identical names in the Bursa Malaysia and Orbis (Bureau van Dijk) database. Agriculture, and nonprofit public organizations, excluded because their performance measurements are different from the rest, and some of these sectors are subject to government price regulation. Nonprofit organizations are excluded based on their objective, which is nonprofit (Table 1).

The researcher manually collected additional information such as sex, education, age, and years of work experience as a board member, from annual reports posted on the Bursa Malaysia Stock Market Exchange. To identify gender, the researcher used photographs in the bio section of the annual report, or biographical information by identifying pronouns such as she/her, or he/his, whenever photographs were unavailable. If information about gender is missing in one annual report, it is backfilled from later reports. The researcher aggregated the board of directors' level data to the firm level to calculate the number of board directors, percentage of female directors, average age, and experience as a board member. Educational level is classified into four categories – without a degree, degree, more than one degree or master's degree, and doctorate degree. The variables reported in monetary terms are deflated using Malaysia's GDP deflator obtained from the World Bank (WB) with 2011 as the base year.

Total assets, total revenue, profit margin, Return on Equity (ROE), and Tobin's Q are used to measure firm performance. Tobin's Q is the ratio of the firm's market value to asset replacement value. ROE is the ratio of profit before tax to shareholder funds multiplied by 100. The profit margin is the ratio of profit before tax to operating revenue multiplied by 100.

## 4.2. Method of analysis

This section begins with a descriptive analysis of the influence of the 2011 Malaysia's board of directors' quota requirement on the share of female directors, board size, board member characteristics, and firm performance. The researcher then conducts an econometric analysis in which the percentage of female directors is regressed on a dummy for treatment before and after 2011, and the firm fixed effect. Further, the logarithm of real total assets and real total revenue, ROE, profit margin, and Tobin's Q are regressed on the percentage of female directors, firm and year fixed effects, age, education, and year of experience as board members. In addition, IV estimation is used to address endogeneity issues, and the effect of the gender diversification requirement of the 2011 board of directors' on board size and board member characteristics.

### 4.2.1. Descriptive Analysis

This study used descriptive analysis such as mean, percentage, t-test, and graph to show female board director participation, firm size, ROE, Tobin's, and profit margin progress. The researcher also checked the participation growth rate of females in the board of directors' positions over the years. The researcher computes the growth rate  $G$  as defined in Equation (4.1), where  $X_t$  is the number of female directors at year  $t$  and  $X_{t-1}$  is a year before.

$$G = \frac{X_t - X_{t-1}}{(X_t + X_{t-1})/2} \quad (4.1)$$

### 4.2.2. Econometric analysis

Some researchers have argued that soft law is not effective (Labelle et al., 2015). One of the cases referred to in this regard is the 2003 Norway soft law, which had little effect on female participation in the board of directors, as a result, they introduced serious sanctions for non-compliers (hard law) in



2008. Further, the gender diversification requirement of the board of directors' has been set and succeeded mostly in developed countries. Due to cultural and religious influences, it is difficult to implement such laws in Muslim dominated countries (Syed & Van Buren, 2014). As Malaysia's 30 percent women's board of directors requirement target by 2016 failed, they limited the requirement only to very large firms. Therefore, the researcher interested to find out if a soft law of the Muslim dominated and developing country, Malaysia, has any influence on women's participation in the board of directors, though it didn't achieve the 30 percent target. The descriptive statistics revealed progress in the share of female directors, particularly after the implementation of the quota requirement in 2011. Subsequently, to investigate the influence of the 2011 quota requirement, Researcher followed a slightly similar approach to the study undertaken in Europe (Comi et al., 2017). They used an additional year and country dummy to control the shock that is common to all countries and time invariant difference across countries. As this study focuses only on Malaysia, it does not need year and country dummies. The following regression equation was used to estimate this influence

$$Y_{it} = \alpha_i + \beta_1 D_1 + e_{it} \quad (4.2)$$

The dependent variable ( $Y_{it}$ ) is female participation in board of directors' position, and it's captured in three ways. First, it is measured by the percentage of female directors in year  $t$ . Second, dummy for whether firm has at least one female director used to measure female participation in the board of directors. Third, female participation is measured by a dummy more than or equal to 30 percent share of female directors or not.

The independent variable ( $D_1$ ) is the 2011 soft law (Malaysia board of directors' gender diversity requirement). It measured by a dummy variable before or after 2011.  $\alpha_i$  is firm fixed effect and  $e_{it}$  is the error term. Standard errors are clustered at the firm level. Pooled OLS estimation was also used as an alternative technique.

To address the effect of gender diversification of board directors on firm performance, following Ahern and Dittmar (2012), the researcher used fixed effect and IV estimation technique. The pre-request variation of female directors across firms is used as an instrument to capture the exogenous variation proportion of female directors over time in response to the implementation of the gender diversification requirement of the board.

The percentage of female board members in 2010 (the year before the gender quota was set) interacted with year dummies used as instrumental variables. The logic behind using it as an instrumental variable is that firms without female directors are more likely to increase the number of female directors than are firms with at least 30% female directors or at least one female director before the requirement is introduced. It is important to acknowledge that the pre-requirement share of female directors was not randomly selected. Therefore, researchers should be concerned about the correlation between the pre-requirement percentage of female directors in 2010 and the subsequent change in firm performance. To check the existence of a correlation, the researcher compare the characteristics of the 211 firms with no female director against the 241 firms with at least one female director (see Table 2). For all firm performance measurements, the results showed no substantial difference between the two sets of firms. However, firms with large members of the board of directors are more likely to have female members. With regard to the industrial distribution difference between the two sets of firms, both sets of firms are equally distributed among all sectors and no statistically significant difference is found. The use of the firm fixed effect captures that firms with large board of directors are more likely to have female directors.

The effect of the share of female board members on firm performance was estimated using the following equation:

$$Q_{it} = \alpha_i + \gamma_t + \beta_1 FD_{it} + \beta_2 D_{it}X + \sum_s tX\delta_s \quad (4.3)$$

The dependent Variable ( $Q_{it}$ ) is the firm performance measurement such as, total revenue, total assets, profit margin, ROE, and Tobin's Q. Independent variable (FD) is the percentage of female directors.

Consistent with the literature in this area, numbers of control variables ( $D_{it}X$ ) are included such as background of the board of directors (age, experience, and education), industry specific time trends ( $\sum_s tX\delta_s$ ), firm fixed effect ( $\alpha_i$ ), and year fixed effect ( $\gamma_t$ ). In this specification, the firm fixed effect

**Table 2.** The firm characteristics by the share of female board directors in 2010.

Firm characteristics and performance difference between firms with at least one female director and without female director in 2010			
	No female director	Female > 0	Difference
Board size	7.04	7.77	-.73***
Profit margin	5.89	8.26	-2.37
ROE	7.24	8.44	-1.19
Tobin's Q	.58	.69	-.11
Log asset	7.96	7.99	-.03
Log revenue	7.54	7.53	.01
Chemical, rubber, plastic, non-metal product	.12	.15	-.03
Construction	.09	.1	-.005
Food, beverage, tobacco	.08	.05	.03
Gas, water, electricity	.005	.009	-.004
Hotel and restaurant	.01	.03	-.02
Machinery, equipment, furniture, recycling	.17	.2	-.02
Metals and metals product	.11	.08	.03
Other service	.15	.18	-.03
Publishing, printing	.03	.02	.01
Textiles, wearing apparel, leather	.03	.02	.01
Transport	.03	.04	-.01
Wholesale and retail trade	.08	.06	.02
Wood, cork, paper	.08	.06	.02
Observation	210	219	

Notes: firm and board directors characteristics for large and very large Malaysian firm available in Orbis data base and Bursa Malaysia market exchange, \*significant at 10%, \*\*5%, and \*\*\*1%.

**Table 3.** Variable description.

Variable	Description
<b>Dependent variable</b>	
• $Q_{it}$	Firm performance measurements (natural log of assets, log of revenue, profit margin, and Tobin's Q)
<b>Independent variable</b>	
$FD_{it}$	The percentage of female directors
<b>Control Variables</b>	
$D_{it}X$	Control variables such as age, education, and experience of the board of directors
$\sum_s tX\delta_s$	Industry specific time trends
$\alpha_i$	Firm fixed effect
$\gamma_t$	Year fixed effect
<b>Instrumental variable</b>	
2012 dummy $\times$ percent of female director 2010	The percentage of female board members in 2010 interact with year 2012
2013 dummy $\times$ percent of female director 2010	The percentage of female board members in 2010 interact with year 2013
2014 dummy $\times$ percent of female director 2010	The percentage of female board members in 2010 interact with year 2014
2015 dummy $\times$ percent of female director 2010	The percentage of female board members in 2010 interact with year 2015
2016 dummy $\times$ percent of female director 2010	The percentage of female board members in 2010 interact with year 2012

captures the time-invariant firm characteristics that may affect both the share of women on the board of directors and firm performance. The year fixed effect is used to control the aggregate fluctuation in firm performance measurements. In all fixed-effects estimations, the standard error is clustered at the firm level. All variables are defined in Table 3.

## 5. Empirical result and discussion

In this section, first descriptive results then econometric results are presented.

### 5.1. Descriptive result

Figure 1 shows how female participation increased sharply across all participation measurements used (share of female directors, a dummy variable for the presence of at least one female board of directors, a dummy variable for the presence of 30 percent or more female directors), following implementation of the gender diversification requirement for the board of directors in 2011. The share of female board members was increasing at a decreasing rate during the periods under consideration (2007–2011) and was below 10% until 2011. It has been rapidly increased since 2011, reached above 12% by 2016. Firms

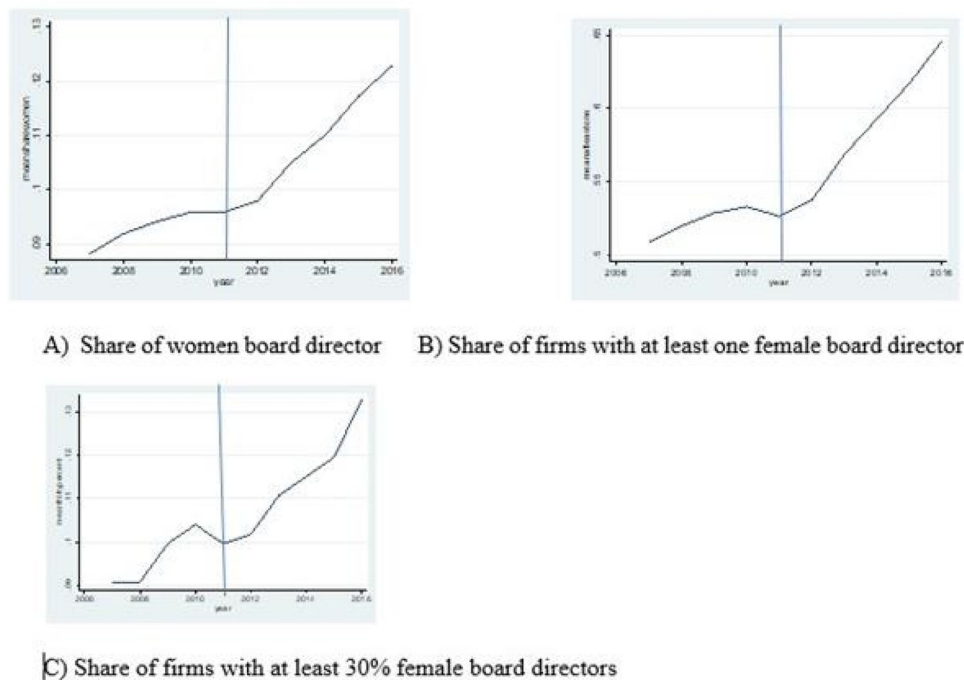


Figure 1. Female participation in Board of Directors.

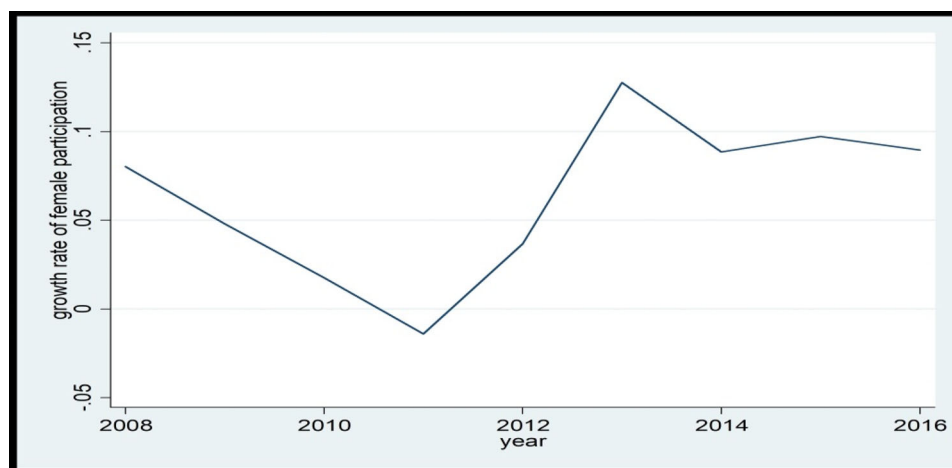


Figure 2. Growth rate of female participation in board of director's position.

with at least one female board director were less than 54% until 2011 and were rapidly increased and reached 65% by 2016. Although no firm publicly protested implementation of this requirement, 35% have ignored it. Firms had at least 30 percent of female board of directors were less than 5% until 2011. It has rapidly increased since 2011, and reaching more than 13% by 2016. However, more than 85% of firms did not achieve the target.

The researcher also checked the participation growth rate of females in the board of directors' positions over the years. Figure 2 shows that the growth rate of female participation in the board of directors declined until 2011, and started increasing thereafter. The figure clearly shows that the gender diversification requirement of board of directors has a positive influence on female participation in the board of directors'.

One may suspect that the response to the gender quota of the board of directors may vary based on the sector. Complex sectors, such as construction, machinery, and equipment, may not respond to the requirement, as they might not be able to find qualified female directors. Abdullah (2014) found that

the retail sector is more likely to appoint female directors, because they can add value through their better understanding of customers. However, as shown in Figure 3, there is no major difference between the various sectors in responding to the gender diversification requirement of the board of directors. Therefore, it is fair to conclude that sector may not be a factor in responding to the gender diversification requirements.

As stated in the discussion above, it is evident that the gender diversification requirement of the board of directors influences the share of female directors. Next, it is important to see if the increased number of female directors has an influence on firm performance, and if the difference in the background of the directors influences firm performance.

As depicted in Table 4, the size of board members remained the same at around seven over the periods under review, while the share of female directors was increasing over time, evidencing that male board directors are being replaced by females. With regards to firm performance, most measurements do not show consistency over time. The firm efficiency measurements such as profit margin, ROE, and Tobin's Q declined in 2008, and then grew. This decline may be related to global crisis. The profit margin and ROE again declined in 2013, and reached a maximum in 2016, when many female directors joined the board. Total assets and revenue grew relatively over the period. The inconsistency in

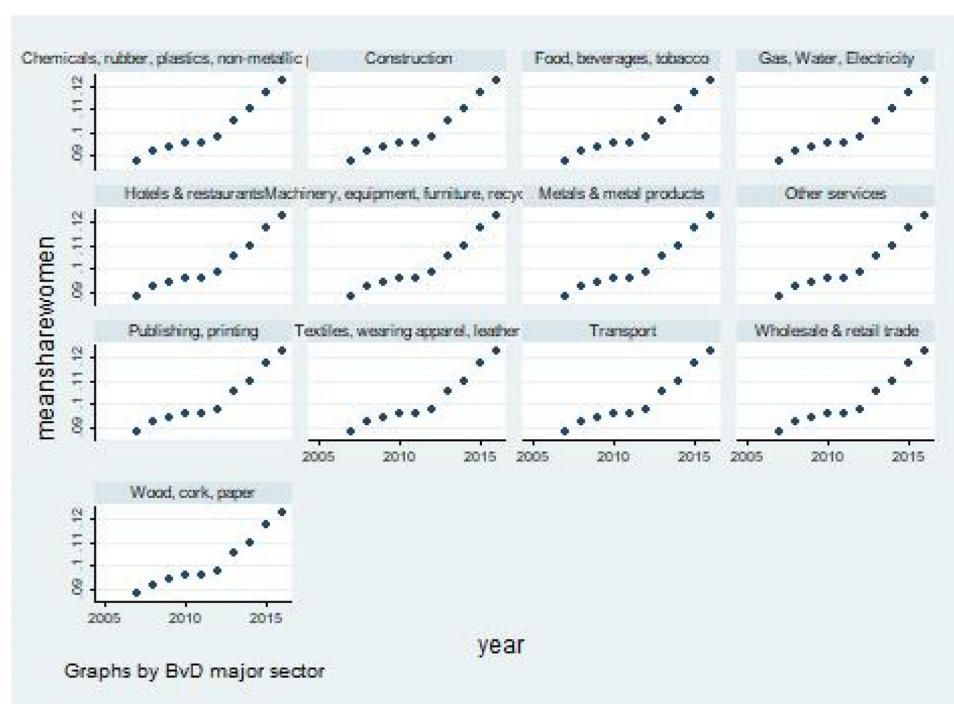


Figure 3. Share of female board directors by sector.

Table 4. Firm characteristics summary statistics by year.

Firm Characteristics	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Board size	7.41 (2.02)	7.45 (1.95)	7.46 (1.96)	7.41 (1.97)	7.35 (1.89)	7.32 (1.89)	7.33 (1.89)	7.25 (1.88)	7.21 (1.8)	7.23 (1.84)
Profit margin	8.92 (15.81)	6.03 (16.11)	6.24 (15.93)	6.24 (15.11)	8.26 (14.8)	8.48 (17.8)	8.19 (15.84)	8.07 (16.7)	7.6 (16)	11 (17.8)
ROE	10.63 (20.42)	7.3 (23.63)	7.15 (18.22)	7.69 (21.47)	8.38 (19.08)	8.63 (33.74)	7.94 (21.17)	6.71 (25.51)	7.25 (20.33)	31.02 (55)
Tobin	0.78 (1.02)	.49 (.69)	.56 (.67)	.63 (.75)	.62 (.81)	.63 (.1)	.75 (1.1)	.81 (1.18)	.82 (1.19)	.8 (1.18)
Log (Asset)	7.86 (1.39)	7.9 (1.42)	7.93 (1.44)	7.98 (1.45)	8.03 (1.47)	8.08 (1.48)	8.15 (1.48)	8.22 (1.49)	8.29 (1.49)	8.27 (1.57)
Log (Revenue)	7.47 (1.38)	7.25 (1.4)	7.44 (1.43)	7.54 (1.44)	7.6 (1.47)	7.63 (1.52)	7.69 (1.5)	7.73 (1.51)	7.72 (1.51)	7.75 (1.51)
Observation	429	429	429	429	429	429	429	429	429	429

Note. Firm characteristics of large and very large Malaysian firms are listed in the Bursa Malaysia market exchange and Orbis data base, and the standard deviation of a variable appears in square brackets.

performance over time, regardless of the composition of board members, therefore, shows that the share of female directors may not have any effect on the majority of firm performance measurements.

Figure 4 shows the evolution of the main characteristics of board members over the periods considered. This shows that experience as a board member, education, and the age of the board of directors increased over time. The number of board of directors without a first degree declined over time, while members with more than one degree or master's degree increased, and the number of doctorate degree holders remained the same. Most board directors have at least a first degree with concentration in fields important for managerial functions, such as accounting, economics, management, and law. Female directors are less experienced, younger, and less educated. The proportion of female members holding a first degree and less is relatively larger while the proportion of males holding a doctorate degree is relatively greater. The education gap between male and female directors has declined over time. Accordingly, after 2014, the percentage of female master's degree holders exceeded that of males, and the number of female doctorate degree holders increased while that of males decreased. Although the gap in

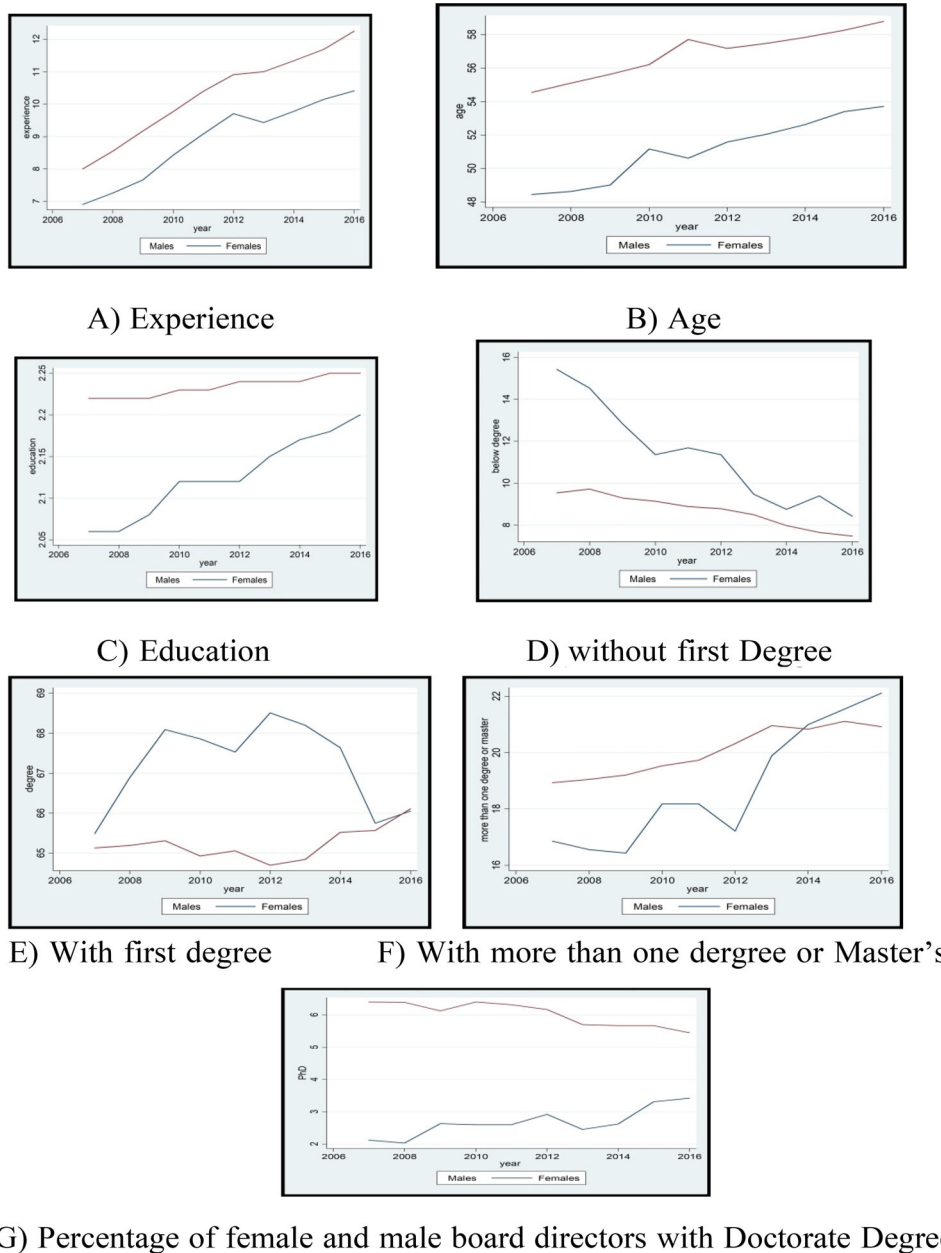


Figure 4. Boards characteristics by gender, 2007–2016.

**Table 5.** Board members characteristics by gender.

Variable	Gender	2007–2008	2009–2011	2012–2015	Difference
Board members characteristics trend					
	(1)	(2)	(3)	2-1	3-2
Age					
Male	54.82	56.51	57.69	1.69*	1.17
Female	48.53	50.08	52.4	1.55	2.15**
Education					
Male	2.22	2.23	2.24	.01	.015
Female	2.06	2.1	2.15	.04	.05**
Experience					
Male	8.27	9.79	11.23	1.5**	1.45**
Female	7.08	8.05	9.77	.96	1.37**

Notes, firm and board director characteristics for large and very large Malaysian firm available in Orbis data base and Bursa Malaysia market exchange, \*significant at 10%, \*\*5%, and \*\*\*1%. Data were classified in to three periods two before the 2011 board director gender diversity requirement and one after.

educational qualification has been declining over time, the overall descriptive result shows that female board members are less qualified.

To provide more insight into the changes in board members' characteristics after the 2011 gender diversification requirement, the researcher used an approach similar to that Ahern and Dittmar (2012) and Comi et al. (2017). Table 5 presents board members' characteristics summary statistics by classifying it into three groups. As firm performance may depend on changes in qualifications, in this section, the researcher seeks to understand the changes in the characteristics of female directors. To see the trend before the introduction of the board gender diversification requirement, and to distinguish the changes in board composition due to implementation of the requirement, this article reports descriptive results separately – one for pre-implementation periods (2007–2008 and 2009–2011) and the other for the post implementation period (2012–2015).

As depicted in Table 5, women's qualifications showed absolute improvement after the implementation of the gender quota requirement. This finding is consistent with that of a study conducted in Norway (Bertrand et al., 2018). There were no statistically significant differences in female members' characteristics (age, experience, and education) between the board gender quota requirement pre-implementation periods. However, all the characteristics changed significantly after the implementation of the 2011 quota. Specifically, after the reform, on average female directors were found to be more educated, older (more matured), and more experienced as board directors. During 2012–2015, compared to the pre-implementation periods, on average, female directors had one year more experience as board directors, with a statistically significant difference from zero. In summary, on average, female directors' qualifications increased after the reform. However, the male board directors' qualification change was consistent before and after the treatment period. The results were similar between pre and post-implementation. In addition, there was no statistically significant change in the educational qualifications of men board directors between the two pre-implementation periods as well as between pre and post-implementation. These facts indicate the nonexistence of a relationship between the characteristics of male directors and the gender requirement of the board of directors, which the changes, therefore, are of natural trend. Generally, the descriptive results show that the quota requirement of board directors can positively change the qualifications of female directors without affecting those male members.

In summary, the descriptive results indicate that, following the implementation of the reform, the share of female directors' increases over time, most of the firm performance measurements do not show a consistent trend and the qualification of female directors' increases without affecting those male directors. However, on average, female directors are less qualified. In addition, female directors have replaced more experienced and older male directors, resulting in a gender diversification requirement for the board of directors reduce board members' average age and experience. As the gender-based education gap rapidly declined after the reform, its effect on education may not have been statistically significant. The inconsistent trend in firm performance, though the share of female directors increases, may indicate that changes in the share of female directors may not affect most firm performance measurements.



## 5.2. Econometric results

### 5.2.1. Effect of board director's gender diversification requirement on female participation

The estimation of  $\beta_1$  reported in Table 6 suggests that the gender diversification requirement of the board of directors lead to a statistically significant increase in female participation in all measurements used (at least one female director, percentage of female board directors, and at least 30% female directors). The result obtained from the Pooled OLS estimation is the same as that obtained from the fixed effects estimation. The percentage of female board directors, the percentage of firms with at least 30% female directors, and the percentage of firms with at least one female board director has increased by 1.69%, 2%, and 7%, respectively. The result of the fixed effect estimate reported in Figure A.1 in Appendix A shows the trend from the fixed effect estimate for female participation at the board director level, confirming that female participation in the board of directors improved rapidly after 2011.

One may rationally think that the women's participation rate on the board of directors might have improved due to changes in women's qualifications. The major requirement to qualify the board of directors is educational qualification. For instance, taking education as a requirement for the board of directors' position into account, the EU considered the availability of sufficiently educated women as one of the factors that set the board members' gender diversification requirement. However, in Malaysia, women are more educated even before gender diversification requirement of the board of directors is implemented. Further, as indicated in Figure A.2 in Appendix A, as per the WBI, the female enrolment rate in universities in Malaysia has been greater than that of males since 1998. In addition, the researcher examined female participation trends in senior and middle level management, and parliament, based on a human development report for Malaysia by the United Nations Development Program (UNDP). Figure A.3 in Appendix A covers the period 2010–2016. Data before 2010 were not available. Contrary to the participation of females on the board of directors, the share of females in senior- and middle-level management, and parliament declined in 2011. After 2011, the share of females in senior- and middle-level management and parliament remained constant, while female participation in parliament started declining from 2014 and female participation in senior- and middle-level management started declines from 2015. The researcher can fairly conclude that, in Malaysia, the improvement in women's participation in the board of directors is due to the implementation of the gender diversification requirement of the board of directors, but not due to a change in qualification.

The gender diversification requirement of the board of directors' could bring statistically significant positive changes in the share of female directors in Malaysia's large and very large firms. The researcher mainly focused on large and very large firms, with the assumption that such firms are more likely to respond to the requirement. However, 35% of the firms do not have at least one female director, and only around 14% of the firms have at least 30% female board directors. This requirement cannot achieve its target even for large and very large firms. Many researchers have argued that some of the main obstacles for gender diversification to achieve its target are cultural and religious influences (being a mother is considered a major female role) (Abdullah et al., 2016; Ahmad-Zaluki, 2012; Ismail & Ibrahim, 2008). Another study revealed that female family responsibilities were the main obstacle for women's career advancement, and female directors reported that they earned less respect from supervisors and managers (Ismail & Ibrahim, 2008).

Since 2004, Malaysia has been working hard to increase women's participation in the labor force, particularly at the decision-making level. Due to cultural and religious factors, their efforts are not effective. They were ranked 101st out of 149 countries in gender equality, and 79th out of 108 countries in female

**Table 6.** Regression estimates of the influence of board of directors' gender diversification requirement on female participation.

	At least one female	Percent of female director	At least 30% female director
Fixed effect regression			
Treated	.07*** (.02)	1.69*** (.37)	.02** (.01)
Firm fixed effect	Yes	Yes	Yes
Observation	4286	4286	4286
Number of firms	429	429	429

Note. Data are yearly observation for year 2007–2016. \*\*\*significant at 1%, \*\*significant at 5%, and \*significant at 10%; the standard error clustered at the firm level.

participation at the decision-making level. Regarding educational qualification, women are more educated in Malaysia. For instance, in 2016, the share of females with at least first degree was 12.3% while that of males was 10.3%, and as indicated in Figure A.2 in Appendix A, the university enrolment rate of females was greater than the males. Educational qualification in Malaysia, therefore, is not a factor hindering women's participation in the board of directors.

### 5.2.2. Effect of board director's gender diversification on firm performance

Table 7 presents the result of the fixed effect estimate of the preferred specification of equation 4.3 for the measures of firm performance considered, namely the logarithm of total assets, the logarithm of total revenue, profit margin, ROE and Tobin's Q. All columns include firm fixed effects, and year fixed effects, while columns 2, 4, 6, 8, and 10 have additional covariants such as industry-specific time trends (the industry classification is based on the 2-digits level of the NACE classification), firm level controls (age, experience as board director, and education level of board directors) to each firm performance measurement. Table 7 presents the results of the fixed effects estimation of the effect of female board representation on firm size. In contrast, the study in case of Norway concludes that the percentage of female board directors has a negative effect on firm size. The coefficients of the percentage of female directors with time and firm fixed effect in column (1) and after taking into consideration other variables such as industry time trend and firm-level controls (education, age, and experience) column (2) are negative and statistically significant. The results show that 1% increase of female directors causes 0.2% decline in total assets. Similarly, a 1% increase of female board directors leads to 0.4% decline in total revenue. However, a change in the percentage of female directors has no effect on any of the three alternative firm efficiency measurements (profit margin, ROE, and Tobin's Q). The cofactors considered (age, education, experience, and industry specific time trend) partially explain the gender-based gap in firm performance. After considering the cofactors into consideration, the gender-based gap in total assets declines from 0.3% to 0.2%, and the total revenue declines from 0.5% to 0.4%.

For the IV estimation, the data cover only the period from 2011 to 2016, because, the variation of female directors across firms in 2010 is used as an instrument to capture the exogenous change in the share of female directors in response to the gender diversification requirement in the board of directors. Fixed effects and IV estimation were used for the period 2011–2016. The first-stage estimation results show a time-serious representation of women on the board of directors. As anticipated, the share of

**Table 7.** Effect of the board of directors' gender diversification on firm performance (fixed effect estimation).

(a)						
Variable	Log asset (1)	(2)	Log revenue (3)	(4)		
Percent of female	-.003** (.002)	-.002* (.002)	-.005*** (.002)	-.004* (.002)		
Firm fixed effect	Yes	Yes	Yes	Yes		
Year fixed effect	Yes	Yes	Yes	Yes		
Firm level control	No	Yes	No	Yes		
Industry-specific time trend	No	Yes	No	Yes		
Observation	4286	4286	4286	4286		
Number of firms	429	429	429	429		
(b)						
Variable	Profit Margin (5)	(6)	Tobin's Q (7)	(8)	ROE (9)	10
Percent of female	-.47 (.62)	-.41 (.56)	.0003 (.003)	.001 (.003)	.14 (.17)	.08 (.16)
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm level control	No	Yes	No	Yes	No	Yes
Industry specific time trend	No	Yes	No	Yes	No	Yes
Observation	4286	4286	4286	4286	4286	4286
Number of firms	429	429	429	429	429	429

Note. The data are yearly observations for 2007–2016, \*\*\*significant at 1%, \*\*significant at 5%, and \*significant at 10%; the standard error is clustered at the firm level.

**Table 8.** The first stage regression.

First stage regression: Dependent variable = percent of female director	
2012 dummy	.88*** (.24)
2013 dummy	2.55*** (.39)
2014 dummy	3.5*** (.46)
2015 dummy	4.7*** (.54)
2016 dummy	5.74*** (.61)
2012 dummy × percent of female director 2010	−.07*** (.03)
2013 dummy × percent of female director 2010	−.17*** (.04)
2014 dummy × percent of female director 2010	−.22*** (.04)
2015 dummy × percent of female director 2010	−.27*** (.04)
2016 dummy × percent of female director 2010	−.33*** (.04)
Firm fixed effects	Yes
F-Statistics	9.8
Observation	2570

*Note.* The data are yearly observations from to 2011–2016, the year 2011 is omitted, and the standard error is clustered at the firm level. The set of instruments in the first stage is the initial share of females on board interacted with year dummies. \*significant at 10%, \*\*5%, \*\*\*1%.

**Table 9.** The effect of board of directors' gender diversification requirement on firm performance (fixed effect and IV estimation, based on sub-sample for 2011–2016).

Variable	Log asset		Log revenue		Profit margin Fixed effect
	Fixed effect	IV	Fixed effect	IV	
Percent of Female	−.003** (.002)	−.01*** (.005)	−.004* (.002)	−.01* (.006)	−.73 (1.03)
Firm fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Observation	2570	2570	2570	2570	2570
Number of firms	429	429	429	429	429

female directors in 2010 predicted a change in female representation on the board of directors, implying that firms with fewer or no female directors are more likely to increase the number of female directors. The estimation indicates that the biggest adjustment to the percentage of female directors has occurred in the year close to the deadline of the requirement (2015 and 2016) (see [Table 8](#)).

[Tables 9](#) and [10](#) show IV estimates, and the result confirmed most of the fixed effect model estimates. Like fixed effect model estimates, IV estimates evidenced that the board gender diversity has a negative effect on firm size (total assets, and total revenue) and the positive effect on Tobin's Q became statistically significant. After taking the endogeneity issue into consideration, the magnitude of the coefficient becomes large. The result is checked using the difference of the 2010 share of female board directors from the 30% threshold interacting with the year dummy, as an instrumental variable, and obtained identical result with the above IV estimate result.

Following the study undertaken in the case of Norway Ahern and Dittmar (2012), the researcher checked the effect of board of directors gender diversification requirement on board characteristics, namely board size, experience, age, and education (see [Table 11](#)). The IV estimation technique was used in a similar manner and the results shows that the requirement has no effect on board size and educational level. This implies that equally qualified females replaced male board members. Due to the implementation of the gender diversification requirement, experience as a board member and age declined significantly. A 1% increase in the share of female board directors leads to 7% decline in experience as a board director. Also, a 1% increase in the share of female board directors leads to 8% decline in age, implying that the female members joined the board were less experienced and younger. The

**Table 10.** The effect of board of directors' gender diversification requirement on firm performance (fixed effect and IV estimation, based on sub-sample for 2011–2016).

Variable	Profit margin IV	ROE Fixed Effect	IV	Tobin's Q	
				Fixed Effect	IV
Percent of female	8.62 (11.8)	.26 (.34)	−4.32 (3.53)	.002 (.003)	.01* (.01)
Firm fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Observation	2570	2570	2570	2570	2570
No of firm	420	420	420	420	420

Note. Data are yearly observation for 2011–2016, \*\*\*significant at 1%, \*\*significant at 5%, and \*significant at 10%; the standard error clustered at the firm level.

**Table 11.** The effect of Board Directors' gender diversification on firm characteristics.

Instrumental variable estimation				
Variable	Board size (1)	Age (2)	Experience (3)	Education (4)
Percent of female	.002 (.01)	−.08** (.04)	−.07*** (.03)	.0003 (.002)
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Observations	429	429	429	429

Note. Data are yearly observation for 2011–2016, set of instruments in the first stage is the initial share of female directors interacted with year dummies. \*significant at 10%, \*\*5%, \*\*\*1%.

educational gap was statistically and economically insignificant. As discussed in the descriptive section, newly joined female directors are more qualified (age, experience, and Education) than existing female directors. On average, female members who replace men are less experienced and younger than men board directors. The gender diversification requirement in the board of directors, therefore, has a negative effect on age and experience as a board director, whereas, it has no effect on educational level, and the gender-based board members' educational gap has declined over time, particularly after the reform. Yet, based on the WB data, since 1998 in Malaysia, the majority of students in universities have been girls, availing educated women for positions such as the board of directors.

The researcher examined the heterogeneous effect of the gender diversification requirement of the board of directors' among different groups of firms. First, researcher investigates whether the gender diversification requirement has an asymmetric effect among sectors. As per the descriptive result, there is no evidence of a sector-based response difference to the gender diversification requirement in the board of directors. These sectors were categorized into four groups. Based on the International Standard Industry classification (ISI Rev.2), the manufacturing sector is categorized into two – medium and higher technology-intensive manufacturing sector (Chemicals, rubber, plastics, non-metal product, machinery, equipment, furniture, recycling, metals and metal products); And lower technology-intensive manufacturing sector (Food, beverage, tobacco, textiles, wearing apparel, leather, wood, cork, and paper). The service sector is also classified into two – construction and engineering related services, and other service sectors (gas, electric, water, hotel, restaurant, publishing, printing, transport, wholesale, retail trade, and other services). As indicated in Table A.1 in Appendix A, there is no difference among the four groups of sectors in responding to the gender diversification requirement.

The result in Table 12 shows that the gender diversification requirement of the board of directors has asymmetric effects between sector groups. Gender diversification requirement of the board of directors has a negative effect on firm size measurements (total revenue and total assets) in the high technology-intensive manufacturing sector, while it has no effect in other sectors (construction, other service sectors, less technology-intensive manufacturing sectors). A 1% increase in the share of female board directors, due to the board of directors' gender diversification requirement, leads to around 3.1% decline in total assets in high technology intensive manufacturing sector than service and less technology-intensive

**Table 12.** The effect of board directors' gender diversification requirement on firm performance across sectors.

Instrumental variable estimation					
Variable	Log asset (1)	Log revenue (2)	Profit margin (3)	ROE (4)	Tobin's Q (5)
Percent of female director	−.031*** (.01)	−.026* (.02)	27.04 (29.83)	−13.9 (9.06)	.036** (.02)
Percent of female director × Other service	.029** (.01)	.021 (.02)	−27.96 (29.97)	13.31 (9.1)	−.038** (.02)
Percent of female director × Construction	.027** (.01)	.0328** (.02)	−27.05 (30.91)	13.67 (9.39)	−.042** (.02)
Percent of female director × less technology intensive	.027** (.01)	.0255* (.02)	−23.64 (30.08)	16.87* (9.14)	−.025 (.02)
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes
Observation	2567	2567	2567	2567	2566

Note. Data are yearly observation for 2011 to 2016. set of instruments in the first stage is the 2010 share females on board interacted with year dummies. The higher technology intensive sector is a reference category, \*significant at 10%, \*\*5%, \*\*\*1%.

**Table 13.** The effect of the board of directors' gender diversification requirement on firm performance across groups of firms classified by competition.

Instrumental variable regression					
Variable	Log asset (1)	Log revenue (2)	Profit margin (3)	ROE (4)	Tobin's Q (5)
Percent of female director	−.034*** (.01)	−.026 (.02)	25.7 (35.4)	−10.75 (10.71)	.038* (.02)
Percent of female director × high concentration	.03** (.01)	.02 (.01)	−27.4 (35.5)	10.08 (10.75)	−.041** (.01)
Percent of female director × moderate concentration	.03** (.01)	.025 (.02)	−26.5 (35.5)	10.5 (10.8)	−.041** (.02)
Year fixed effect	yes	yes	yes	yes	Yes
Firm fixed effect	yes	yes	yes	yes	yes
Observation	2569	2569	2569	2569	2569

Note. Data are yearly observation for 2011–2016. set of instruments in the first stage is the 2010 share females on board interacted with year dummies. Good competition is a reference category, \*significant at 10%, \*\*5%, \*\*\*1%.

manufacturing sectors. The researcher found no sector-based difference in the effect of gender diversification requirement in the board of directors in the two firm efficiency measurements (profit margin and ROE). In terms of Tobin's Q, an additional female board of directors has a positive effect on high- technology- intensive sectors, while it has no effect on the service sector.

Second, this study examines, the potential asymmetric effect among firms in different competition groups. The Herfindahl index (HHI) was used to classify firms in terms of competition, and the 2007 total revenues were used to calculate HHI. The firms are classified into three groups based on the value of HHI – observation below 1/3, between 1/3 and 2/3, and above 2/3 percentile of HHI, firms with HHI greater than 1047.336 are considered high concentration, those with HHI between 921.6693 and 1047.336 are classified as moderate concentration, and those with HHI less than 921.66931 are considered good competition. The formula to calculate the HHI is the sum of the square of each sector participant's market share (measured in terms of total revenue). The results in Tables 13 and 14 show that the gender diversification requirement of the board of directors has an asymmetric effect among a group of firms categorized by competition. The gender diversification requirement of the board of directors has a negative effect on firm size in the sectors with good competition, while it has no effect on other groups. The result of total revenue is also statistically significant at 15% *p*-value. A 1% increase in the share of female board directors, due to the board of directors' gender diversification requirement, leads to around 3.4% decline in total assets of firms in good competition group than firms in moderate competition and high concentration groups. In terms of Tobin's Q, additional female director has a positive effect on firms in good competition group, and negative effect on firms in the moderate and high concentration groups. There is no competition-based difference in the effect of gender diversity requirements of the board of directors on the other two firm efficiency measurements.

The researcher examined the potential asymmetric effect among firms in different size groups (large and very large firms). In this study, following the Orbis database firm size classification, firms with

**Table 14.** The effect of the board of directors' gender diversification requirement on firm performance across large and very large firms.

Instrumental variable estimation					
Variables	Log asset (1)	Log revenue (2)	Profit margin (3)	ROE (4)	Tobin's Q (5)
Percent of female Director	−.01*** (.01)	−.012* (.01)	11.43 (14.46)	−5.34 (4.36)	.01* (.01)
Percent of Female director × Firm size	.01 (.01)	.01 (.01)	−12.66 (14.96)	4.53 (4.51)	−.02* (.01)
Year fixed effect	yes	yes	yes	yes	yes
Firm fixed effect	yes	yes	yes	yes	yes
Observation	2569	2569	2569	2569	2569

Note. The data are yearly observations for 2011–2016. Set of instruments in the first stage is the 2010 share of females on board interacted with year dummies. \*significant at 10%, \*\*5%, \*\*\*1%.

operating revenue greater than or equal to 130 million USD in 2011 were grouped into very large firms. As expected, very large firms are more likely to respond to gender diversification requirements than large firms. Prior to the gender diversification requirement, very large firms had a lower share of female directors than large firms, whereas they had a higher share of female directors after the diversification requirement (see Table A.3 in Appendix A). The findings did not show the asymmetric effect of the gender diversification requirement of the board of directors on firm performance across different firm sizes (see Table 14).

The researcher attempts to identify whether the difference in board members' characteristics of these groups of firms may lead to the heterogeneous effect of the gender diversification requirement of the board of directors on firm performance. First, the researcher examined the difference in characteristics between these groups of firms before and after the gender diversity requirement. Second, the researcher investigated the heterogeneous effect of the gender diversification requirement of the board of directors on board characteristics among different groups of sectors and firm sizes.

As depicted in Tables A.1, A.2 and A.3 in Appendix A, board member characteristics are similar across different groups of sectors and show similar trends over time. Board members in a very large firm are older, more educated, and more experienced than those in large firms, whereas the two groups of firms have parallel time trends. Therefore, the heterogeneous effect of gender diversification requirements on firm performance by sector is not due to differences in the characteristics of board members. The IV estimation result also shows no evidence of a heterogeneous effect of the gender diversification requirement of the board of directors on board characteristics among different groups of sectors. However, in firms with good competitive status, the gender diversification requirement of the board of directors results in less experienced and younger boards of directors encumbering the position. Thus, the facts that less experienced and younger female directors join the board might be a possible reason for the negative effect gender diversification requirement of the board of directors on firm size (see Table 15).

Generally, this study result shows board of directors' gender diversity has no statistically significant effect on firm performance. The negative effect of gender diversity on firm size is only for firms in higher technology-intensive sectors and with good competitive status. For firms with good competitive status, the gender diversification requirement leads less experienced and younger board directors to encumbering the position. So the reason for the negative effect of gender diversity on firm size, firms in good competition status, is related to less experience and age of new female board directors. The majority results of this study provide support for H1a, as well as similar findings of past studies (Eckbo et al., 2016; Ferrari et al., 2022; Marinova et al., 2016; Marquez-Cardenas et al., 2022). Overall, this study's results indicate that the requirement for gender diversity among board directors positively affects the qualifications of female board directors without affecting those male board members. In addition, gender diversity does not affect firm performance for the majority sectors. So the policy maker needs to take into consideration the positive effect of board directors' gender diversity on the qualification of female board directors and the asymmetric effect of gender diversity on firm size in higher technology-intensive and less technology-intensive sectors.



**Table 15.** The effect of the board of directors' gender diversification requirement on board characteristics across sectors and groups of firms based on sectors competition status.

Instrumental variable estimation						
Variable	Age (1)	Education (2)	ExperienceAge		Education (5)	Experience (6)
	(3)		(4)			
Percent of female director	-.07 (.11)	.004 (.01)	-.11 (.07)	-.22* (.13)	-.003 (.01)	-.16** (.08)
Percent of female director	-.04 (.11)	-.01 (.01)	.07 (.07)			
× other service						
Percent of female director	.1 (.11)	-.002 (.01)	.06 (.07)			
× construction						
Percent of female	.03 (.11)	-.003 (.01)	.05 (.07)			
director × less technology intensive						
Percent of female director × high concentration				.15 (.13)	.005 (.01)	.12 (.08)
percent of female director × moderate concentration	.21 (.13)				.004 (.01)	.13 (.08)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observation	2567	2567	2567	2569	2569	2569

## 6. Robustness of the result

To investigate the robustness of the effect of the board of directors' gender diversity requirement on the share of female board directors, three alternative share female board of directors' measurements used: at least one female director, percentage of female board of directors, and at least thirty percent female directors. In addition, pooled OLS estimation is also used. The result obtained from pooled OLS estimation is the same as that obtained from the fixed effect estimation. Statistically significant and positive impact of female board of directors' gender diversity requirement on the percent of female board directors, at least one female board director, and at least thirty percent female board directors, thereby implying the result is fairly robust (see Table 6).

To investigate the robustness of the effect of the board of directors' gender diversity on firm performance two alternative econometric models are used such as fixed-effect and Instrumental Variable (IV) estimation techniques. The fixed-effects regressions do not take into account the presence of possible non-monotonic associations. This indicates that the results may be incorrect. As a result, the researcher investigates the robustness of findings to the existence of potential non-linear relationships, and endogeneity problems. To account for potential additional endogeneity problems that may be caused by omitted variable bias, the Instrumental Variable (IV) method applied. The results obtained from the fixed-effect and IV estimation are consistent (see Tables 9 and 10). There by indicate that the results are not sensitive to endogeneity problem that may be caused by potential omitted variables. The robustness analyses indicate that the results of this study are fairly robust to potential endogeneity problems.

In addition, two alternative firm size measurements are used: the natural logarithm of revenue and assets. The results obtained from two alternative firm size measurements are consistent. Profit margin, Tobin, and ROE are among the three alternative measurements used to measure firm efficiency. The results obtained from three alternative efficiency measurements are consistent. Therefore, it implies that results are fairly robust when using log revenue or log assets as a firm size measure, and when using profit margin, Tobin, and ROE as firm efficiency measures.

## 7. Summary and conclusion

This research deals with the relationship between the gender diversification of the board of directors and firm performance in Malaysia. Malaysia is a developing country with high gender inequality that implement soft law gender diversity requirement of the board of directors. This study focuses on the influence of Malaysia's 2011 gender diversity requirement of the board of directors on the share of female directors, and its effect on firm performance and board member characteristics. Based on 429 large and very large sample firms available in both the Orbis database and the Bursa Malaysia stock market exchange for the period 2007–2016, the fixed effect estimate and instrumental variable were used to investigate the gender diversification requirement of board of directors on firm performance. The percentage of female board members in 2010 interacted with year dummies was used as an instrumental variable.

The results show that Malaysia gender diversification requirement of the board of directors has a positive influence on the share of female directors in large and very large firms. In addition, women were appointed to the boards post requirements were observably more qualified than their female predecessors in many dimensions. The researcher also examined whether the improvement in female participation in the board of directors after 2011 in Malaysia is due to either the gender quota requirement or their qualifications and found that the progress in female participation is the result of the quota requirement. During the period under consideration, educational qualifications did not show progress; and female participation in senior level management, middle level management, and parliament seats did not show improvement that could be comparable with that of the share of female board of directors. Although female participation in board of directors has improved owing to the gender quota requirement, 35% of firms are without at least one female board of directors. Researchers have argued that cultural and religious views are among the factors that hamper the gender diversification requirement of board of directors. Further, the women's board of directors reported that they earned less respect from supervisors and managers.

The results further reveal that the gender diversification of the board of directors has a negative effect on firm size (total revenue, and total assets), while it has no effect on firm efficiency measurements (Tobin's Q, ROE, and profit margin). Malaysia gender diversification requirement of board of directors has a negative effect on the age and experience of board members as directors, whereas, it has no effect on board size and board member educational level. A comparison by sector and competition status indicates that the gender diversification requirement of board of directors has an asymmetric effect on firm performance. The increase in the number of female directors has a negative effect on firm size (total revenue, and total assets) in more technology intensive sectors and sectors with good competitive status while it has no effect on other sectors. The increase in the participation rate of female of directors has a positive effect on more technology-intensive manufacturing sectors and sectors with good competition status in terms of Tobin's Q, whereas it has a negative effect on other sectors. There is no asymmetric effect by sector or sector competition status in the other firm efficiency measurements. In addition, the research did not show an asymmetric effect of gender diversification requirement the board of directors on most firm performance measurements by firm size.

Considering these findings, Malaysia may benefit from the implementation of policy measures. As all the cultural, and religious views lead to the keen obstruction to implementing gender diversification of the board of directors, which considers child care as the major women's responsibility, introducing policies that support families with children (provision of child care service, maternity leave, early release for women with children, flexible working arrangements, telecommuting, and breastfeeding policies) are crucial to improving women's participation in the work force. Furthermore, introducing programs that improve society's perception of women's capabilities may help gain managers' confidence and respect for female directors. Since educated women are sufficiently available on the market in Malaysia, the gap in experience, to bring women to decision making levels, may be filled through training. In addition, policy maker needs to take into consideration the positive effect board directors' gender diversity on qualification of female board directors and asymmetric effect of gender diversity on firm size to higher technology intensive and less technology intensive sectors.

Future research can investigate the effect of Malaysia 2017 the gender diversification requirement of the board of directors to very large firms on firm performance.

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## Author contributions

This article has sing author. All activities like data management, literature review, research design, data analysis, and Interpretation undertake by Dr. Banchayehu Girma Firew under the supervision of her advisor (Professor Tommaso Frattini and Professor Agata Maida).

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## About the author

**Banchayehu Girma Firew (Ph.D)** is an assistant professor at the Debire Birhan University, Debire Birhan, Ethiopia. She specializes in developmental economics. The author has published three papers on gender and development.

## Data availability statement

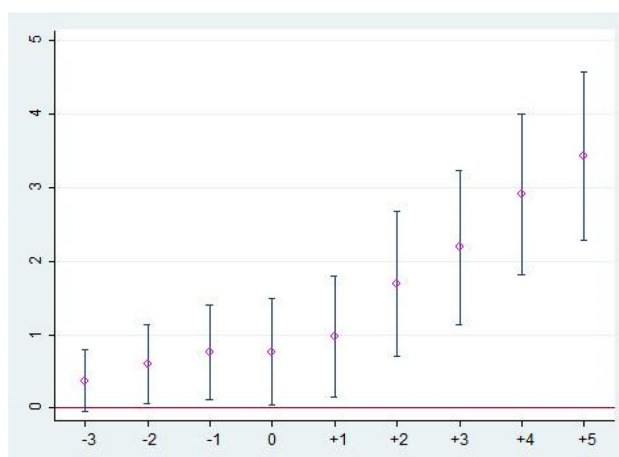
Dataset analyzed in this study are available upon request.

## References

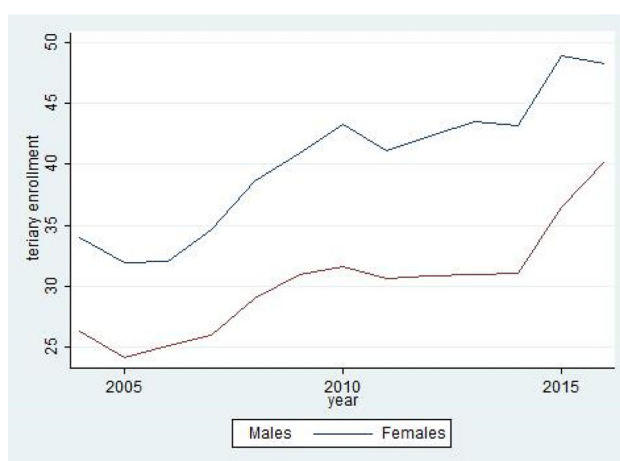
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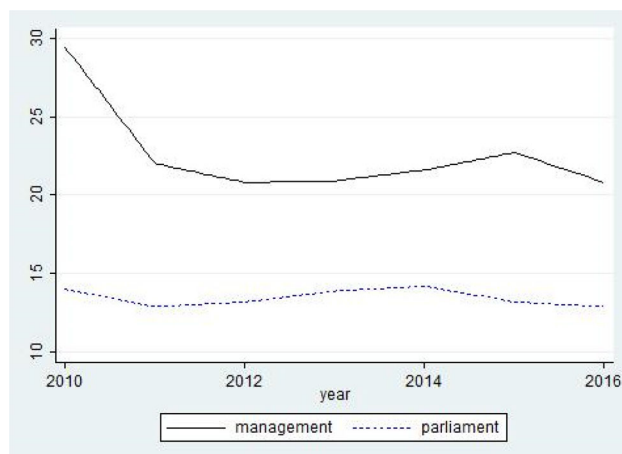
## Appendix A. Gender Diversity and Firm Performance: Evidence from Malaysia Boardrooms



**Figure A.1.** Female participation in Board of Directors level trend related to gender diversification requirement.



**Figure A.2.** Tertiary enrolment rate based on gender.



**Figure A.3.** Share of females in senior and middle-level management, and parliament. *Note.* Based on UNDP report for Malaysia for the period 2010–2016.

**Table A.1.** Descriptive firm characteristics by year across sectors.

Variable	Sector	2007	2008	2009	2014	2015	2016
Share of female BD	1	9.03 (10.39)	9.27 (10.49)	9.24 (10.29)	9.43 (9.53)	10.19 (10.63)	10.9 (10.63)
	2	10.32 (13.44)	11.89 (14.44)	11.85 (13.61)	13.08 (13.06)	13.2 (12.34)	13.2 (12.34)
	3	6.62 (9.94)	6.84 (9.98)	7.28 (10.31)	10.67 (12.56)	11.43 (12.77)	11.91 (13)
	4	9.14 (10.21)	9.38 (10.37)	9.79 (11.2)	11.87 (12.71)	12.71 (12.1)	13.31 (11.83)
Age of BD	1	53.47 (4.99)	53.89 (4.75)	54.49 (4.57)	56.98 (4.79)	56.99 (4.99)	57.6 (5.05)
	2	55.13 (4.63)	55.71 (4.5)	55.85 (4.17)	57.99 (58.68)	58.68 (4.4)	59.13 (3.98)
	3	54.39 (5.53)	54.99 (4.84)	55.23 (4.92)	57.77 (5.12)	58.83 (5.93)	59.07 (6.15)
	4	53.45 (4.98)	54.08 (4.82)	54.6 (4.75)	56.61 (5.44)	57.11 (5.36)	57.69 (5.46)
Education BD	1	2.23 (.28)	2.24 (.28)	2.23 (.28)	2.25 (.3)	2.25 (.31)	2.26 (.35)
	2	2.33 (.29)	2.32 (.28)	2.34 (.3)	2.27 (.27)	2.27 (.27)	2.26 (.27)
	3	2.18 (.32)	2.2 (.32)	2.2 (.3)	2.24 (.3)	2.26 (.37)	2.25 (.37)
	4	2.17 (.31)	2.18 (.31)	2.18 (.31)	2.22 (.32)	2.22 (.31)	2.22 (.31)
Experience	1	7.33 (3.33)	7.85 (3.38)	8.5 (3.46)	10.64 (4.15)	10.83 (4.26)	11.23 (4.32)
	2	9.56 (4.16)	10.05 (4.22)	10.53 (3.93)	12.13 (4.43)	12.34 (4.28)	12.98 (4.54)
	3	8.1 (3.53)	8.47 (3.44)	8.87 (3.54)	11.23 (3.97)	11.84 (4.08)	12.37 (4.62)
	4	7.79 (3.83)	8.39 (3.82)	9.06 (3.65)	11.08 (4.05)	11.52 (4.29)	11.85 (4.69)

Note. Sector 1 represents other service sector 2 represents construction, sector 3 represents the less technology-intensive manufacturing sector, and sector 4 represents the medium and higher technology-intensive manufacturing sector; The standard deviation of a variable appears in square brackets.

**Table A.2.** Descriptive firm characteristic by year across firm.

Variable	Firm	2007	2008	2009	2014	2015	2016
Share of female BD	large	9.09 (10.62)	9.53 (11)	9.7 (11.36)	10.44 (11.29)	11.14 (11.32)	11.55 (11.19)
	very large	8.19 (10.54)	8.4 (10.48)	8.76 (10.33)	12.28 (11.74)	13.03 (12.18)	14 (12.72)
Age	large	52.87 (.5)	53.54 (4.74)	54.1 (4.68)	56.55 (5.21)	57.07 (5.64)	57.55 (5.62)
	very large	55.85 (4.55)	56.12 (4.41)	56.36 (4.26)	58.19 (4.54)	58.47 (4.23)	59.13 (4.45)
Education	large	2.19 (.3)	2.19 (.3)	2.19 (.3)	2.21 (.31)	2.22 (.32)	2.21 (.33)
	very large	2.25 (.3)	2.27 (.31)	2.26 (.29)	2.29 (.29)	2.3 (.3)	2.31 (.31)
Experience	large	7.36 (3.44)	7.94 (3.51)	8.6 (3.45)	10.87 (4.09)	11.27 (4.32)	11.71 (4.58)
	very large	9 (3.98)	9.43 (3.92)	9.87 (3.88)	11.55 (4.16)	11.79 (4.11)	12.15 (4.53)



**Table A.3.** Descriptive firm characteristics by year across firms' competition status.

	Sector competition status	2007	2008	2009	2014	2015	2016
Share of female BD	High concentration	8.6 (11.4)	9.06 (11.54)	9.52 (11.79)	12.33 (12.44)	12.77 (13.01)	13.23 (12.75)
	Moderate concentration	9.3 (10.61)	9.68 (11.22)	9.94 (12.28)	11.84 (11.68)	12.47 (11.4)	13.01 (11.38)
	Good competition	8.53 (9.76)	8.81 (9.6)	8.98 (10.15)	8.56 (9.72)	9.65 (10.1)	10.27 (10.82)
Age	High concentration	54.31 (5.42)	54.9 (4.9)	55.33 (4.77)	57.41 (5.06)	57.78 (5.23)	58.55 (5.15)
	Moderate concentration	53.73 (4.96)	54.3 (4.78)	54.7 (4.6)	56.77 (5.07)	57.38 (5.08)	57.86 (5.09)
	Good competition	53.29 (4.78)	53.78 (4.63)	54.39 (4.64)	57.08 (5.06)	57.41 (5.6)	57.69 (5.82)
Education	High concentration	2.25 (.31)	2.26 (.3)	2.27 (.31)	2.31 (.29)	2.29 (.29)	2.3 (.29)
	Moderate concentration	2.19 (.31)	2.19 (.3)	2.2 (.31)	2.21 (.31)	2.22 (.3)	2.21 (.29)
	Good competition	2.19 (.29)	2.19 (.3)	2.18 (.28)	2.2 (.3)	2.22 (.35)	2.22 (.39)
Experience	High concentration	7.61 (3.3)	8.1 (3.19)	8.62 (3.09)	10.89 (3.78)	11.28 (3.99)	11.88 (4.18)
	Moderate concentration	8.33 (4.06)	8.9 (4.09)	9.49 (3.88)	11.32 (4.23)	11.71 (4.33)	12.06 (4.75)
	Good competition	7.54 (3.57)	8.12 (3.68)	8.76 (3.8)	10.97 (4.33)	11.24 (4.47)	11.55 (4.71)