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Examination of the Role of Peer Effect on Board Diversity Among US-Listed Companies

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by

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ABSTRACT OF THE DISSERTATION

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Professor Todd Gormley, Chair

Traditionally, government mandates and investor activism influence board diversity in the United States. This study proposes peer effects as a third important determinant of board diversity. The results suggest that companies consider the progress made by their peers when deciding their own diversity. Interestingly, companies only match the performance of their peers and will spend comparable efforts in improving their diversity according to their peer's progress. Meanwhile, the peer effect has grown stronger in recent years, and companies are more likely to track the performance of mid-level peers. The results provide evidence on a new channel that can affect board diversity and additional evidence on how peer performance affects firms' decisions.

Chapter 1: Introduction

Female leadership has been persistently underrepresented in US companies, even though there are increasing awareness and activism on the topic. Although women constitute nearly 47% of the total labor force in the US, female directors only account for less than 20% of total board representation (US Bureau of Labor Statistics, 2022). There is noticeable inequality in diversity in firm leadership. Interestingly, nearly all major companies claim they are actively promoting and improving diversity. Female directorship is commonly used as a key statistic to demonstrate their commitment and achievement in diversity. This statistic is then reviewed and compared by different stakeholders. For instance, many companies establish a mandatory quota for female board representation to appease their stakeholders, but this does not always lead to optimal results (Solal & Snellman, 2019). This leads to one question: will companies try to match or mimic the diversity practice of their peers to make them more presentable and attractive to stakeholders?

The increasing diversity in board representation is often attributed to two factors, which are mandatory legislation and investors' awareness. First, many states have enacted legislation to improve diversity in the workplace and push for more balanced board representation. For instance, California has adopted a quota for female directors. Second, new investment trends such as ESG investment and the demands of investors have pushed for more activism toward board diversity. Bebchuk & Hirst (2019) suggest that The Big Three institutional investors in the United States account for more than 20% of the ownership of all listed companies and 25% of the voting power. Gormley et al. (2021)

found out that "The Big Three" institutional investors (BlackRock, Vanguard, and State Street) launched campaigns in 2017 to encourage gender diversity on corporate boards and resulted in significantly higher female directorship. Therefore, institutional shareholder holdings could significantly influence board diversity, at least after 2016.

In this paper, I argue that board diversity is affected by a third and previously uncovered factor, peer effects. Specifically, companies will adjust their progress on board diversity based on the progress of their competitors. Many existing studies have asserted that firms do not make decisions solely based on their own characteristics. They often consider the action of their competitors and peers, especially when the optimal decision is hard to reach. For instance, Conlisk (1980) pointed out that imitation could be a cheaper way to make decisions, if the decision-makers cannot determine the true optimal level and simply decide to follow the cloud. In the case of corporate diversity, there is no clearly determined optimal board diversity and board turnover normally does not happen quite often. It would be beneficial to observe what other peers do and then make decisions based on the peers' actions toward optimal board diversity level.

Typically, the impact of an individual factor could be examined by linear regression, which is widely used in the field and generally effective. However, in the case of peer effects, simple OLS could be problematic and lead to simultaneity bias, which renders the results questionable. Here, this study adopts an instrumental variable approach to remove the bias and estimate the impact of peer effects.

The peers are determined by two sources in this study. The first source is the GIC sub-industry code provided since all companies in the same subindustry can be generally considered as close competitors. The second source is the peer list provided by Institutional

Shareholder Service. This peer list is more refined than a simple subindustry classification, but the availability is mostly limited to large and more reputable companies.

A simple OLS between the fraction of female representation on a firm's board and the average percentage of females on its peers' boards reveals a coefficient estimate of 0.99 for the peer factor and is statistically significant at 5%. This shows that there could be a potential positive peer effect in board diversity and the size of the coefficient indicates a matching effort among comparable companies. However, a simple OLS is likely to be biased in estimating the peer effect.

Simultaneity bias is a common issue affecting exogeneity in examining peer effects. In this case, if an actual relationship exists between the individual firm and peer averages, straightforward regressions will incur an endogeneity problem. An increase in peer average female board representation will increase self-representation, and vice versa, which results in a cycle. The straightforward regression cannot capture the relationship accurately. In addition, omitted variable bias is also present since many determinants of board diversity is not directly observable or quantifiable. For instance, it is difficult to quantify the influence of shareholder activism trend, which can affect self-board representation and be correlated with peer averages.

Using an instrumental variable (IV) approach, I address both the simultaneity bias and omitted variable bias. The instrument is The Big Three ownership of individual companies over the years. I use average Big Three ownership of the peers to predict peer average female directorship percentage point in the first stage. As pointed out by Gormley et al. (2021), Big Three institutional investors start to have significant influences over corporate board diversity since 2017. Evidently, it should satisfy the relevant condition. In

addition, since Big Three ownership invests in nearly all US-listed companies, average Big Three institutional ownership in peers are common and should not affect the diversity performance of the company in interest. In other words, companies are unlikely to make their own diversity decisions based on The Big Three ownership of their peers. Therefore, the exclusion restriction should also be satisfied.

The control variables for the IV regressions are assets, return on equity, and book-to-market ratio, which are common financial performance indicators. The Big Three institutional investor ownership of the company is also included to reflect the relevance condition. In this firm-level analysis, I further have firm and year-fixed effects to control for other time-varying and firm-specific factors not accounted for.

The results show a positive peer effect of diversity among US-listed companies. The first stage regression reveals that a 1% increase in Big Three ownership increases female directorship percentage points by 0.37%. When estimating the impact of Big Three institutional investors separately in the first stage, a positive relationship remains for all three and thus shows higher ownership leads to more female directorship percentage. From 2014 to 2019, an 1% increase in peer board female directorship percentage points can increase a company's female directorship percentage point by 1.08%. The relationship remains robust when substituting aggregated Big Three ownership with individual Big Three ownerships. Overall, companies seem to closely match their competitors' progress in diversity.

Splitting the dataset by year, the instrument appears to be only valid for years between 2017 to 2019 and the first-stage regression fails to produce a significant coefficient estimate for the instrument from the year 2014 to 2016. Such results are consistent with the

findings from Gormley et al. (2021), which argued that the campaigns for diversity were launched in 2017 and the influences of The Big Three institutional investors were relatively limited before. Since 2017, there has been a matching effort according to peers and the coefficient for peer average female directorship point is 0.89%. The results again indicate companies are trying to match female board representation closely with their peers.

I further modified the instrument to reflect the timeline of campaigns from Big Three institutional investors more closely. Since the campaigns of Big Three institutional investors were launched in 2017, I use the ending ownership in 2016 as the instrument to predict peer effects in 2017, 2018, and 2019 respectively. The peer effects are 0.832%, 0.864%, and 0.915%, respectively, for 2017, 2018, and 2019. The results indicate that the peer effects remain strong and continue growing after the campaigns in 2017. US-listed companies are paying more attention to their board diversity and are actively demonstrating their commitments.

Many previous studies have mentioned the connection between board diversity and firm size. Companies of different sizes might react to the same mechanism differently. In this case, it is interesting to examine whether companies of different sizes will react to the progress of their peers in diversity differently. For instance, it is curious to examine whether smaller companies have more incentives to mimic the performance of large companies. To test this, I perform four separate regressions by splitting data into four quartiles by peer size. Specifically, the peer average measures are constructed only by peers in a certain range of size. The goal is to examine whether a firm is more likely to mimic/follow peers of certain sizes.

The results reveal that the companies are most likely to mimic their small-to medium-sized peers and weakest for largest peers. An increase in the 1% peer female directorship percentage point can incur a positive peer effect of 1% for small-to-medium-sized companies, and the coefficient is not significant for the largest companies. It is probably easier for companies to match their medium-sized peers, which have similar resources and capabilities to themselves. Large peers tend to be more scrutinized and devote more resources to diversity, which can be difficult to imitate.

Nonetheless, the results do have certain caveats since the first-stage regressions of some subsamples produce statistically significant coefficient estimates with alternate signs. These first-stage estimates could suggest other mechanisms interacting with size and board diversity.

The magnitude of the peer effect is economically important. The near 1% coefficient estimates indicate that companies are trying to mimic the diversity progress of the peer companies and have little intention of surpassing them. The findings are similar when I use the peer company lists provided by ISS, even though the list is unbalanced. There are some discrepancies, but the major takeaways remain the same.

The findings contribute to the existing pool of studies on the performance and incentives of board diversification. Previous studies point out that two major incentives for board diversification are government mandates and investors' activism. First, some governments mandate board diversity through legislation. This might not always be effective. Hwang et al. (2020) pointed out that government mandates on board diversification tend to lead to tokenism. Second, many studies have pointed out the connection between institutional ownership and corporate governance (Appel et al., 2019;

Lewellen & Lewellen, 2020; Gormley et al., 2021). Large institutional investors prefer to monitor issues that can be observed and measured at scale (Appel et al., 2019; Kahan & Rock, 2019). This makes board diversification a favorable metric for corporate governance and measured outcome of shareholder activism (Gormley et al., 2021). The third reason behind board diversification is the reinforcing effect of current diversity. For instance, existing female representation on board can push for more female representation in the future period (Guldiken et al., 2019; Field et al., 2020).

This study provides insights into an alternative reason behind board diversification that is not previously identified. The companies acknowledge the board diversification of their peers and will attempt to match their efforts. This is possibly due to board diversification being an easily measurable corporate governance, which receives a lot of attention from stakeholders (Gormley et al., 2021). The results show that positive peer effects exist, and companies of different characteristics all have incentives to show the same level of improvement in board diversity as their peers. The first-stage regression results provide supporting evidence on the connection between investor activism/institutional ownership and corporate governance documented in studies such as Gormley et al. (2021). The second stage tends to yield a coefficient of nearly 1.0, which indicate matching effort and could indicate that institutional investors have implemented universal targets for all companies and have little incentive to push for more diversity (Coles et al., 2008; Duchin et al., 2010).

In addition, this study also contributes to the studies of peer effects in finance. Peer interaction is a hard-to-observe but influential factor in the world of finance. For instance, the word-of-mouth effects have been widely documented by studies such as DeMarzo et

al. (2003), Hong et al. (2005), and Cohen et al. (2008). Peer effects can significantly affect the decision-making of executives and companies. Goel & Thakor (2005) pointed out that corporate investments (i.e., mergers) can be distorted by envy from agents. Shue (2013) found out that managerial decision-making is significantly affected by peer networks, and firm policies tend to be much more similar for MBA graduates from the same sections. Furthermore, financial policy and capital structure are also affected by peer effects. Less successful firms have more incentives to imitate more successful firms (Leary & Roberts, 2014). The findings in this study further confirm the importance of peer effects in finance and that managers incorporate peer performance into their decision-making.

The rest of this study is organized as follows. The second section describes data sources and summary statistics. The third section presents major empirical identification strategies and analysis results. The fourth section discusses the implications and concludes.

Chapter 2: Data and Summary Statistics

This study collects board composition data from Institutional Shareholder Services, which contains the total number of board directors and the number of female board directors from 2014 to 2019. The dataset contains around 3,000 largest companies in the United States. I use this data to calculate the female director share for each company each year.

Besides board composition, Institutional Shareholder Services also provide ownership data from The Big Three institutional investors (BlackRock, Vanguard, and State Street). The database records large blockholder ownership for all US public companies and the blockholders include notable institutional investors (i.e., Big Three) and other large companies. I identify Big Three institutional investors by name. For instance, I assigned all funds with a name that contains the word "BlackRock" and various abbreviations (i.e., BLK) and capitalization choices (i.e., "Blackrock") to BlackRock. I aggregated ownership percentage points from all funds related to any one Big Three institutional investors to construct The Big Three ownership percentage points variable in this study.

In addition to board diversity data, I collect financial statement data and other general information from Compustat and CRSP to construct common financial metrics such as book value of assets, return on equity, and book-to-market ratio, which is used as control variables.

I use two methods to identify the peers of any firm in the dataset. The first method is to use GIC sub-industries code provided to identify all companies in the sub-industries as peers. The sub-industries codes provide quite detailed coverage of the more refined segments in each industry, and each firm in the dataset is able to get even coverage of peers. The second method is to use the peer list provided by Institutional Shareholder Service for performance benchmarks. The peers are more accurate in this list, but the peer coverage is very unbalanced and many observations are forced to be dropped. I use the first method to analyze the main results and the second to conduct robustness analysis.

To remove outliers, I trim the top and bottom 0.5% of financial metrics. The dataset contains 6,117 firm-year observations from 2014 to 2019. Table 1 presents some summary statistics for the key variables of this study. In addition to total big-three ownership, individual ownership is also calculated and included in the dataset.

Table 1: Data Description and Summary Statistics

This table provides summary statistics for all major variables used in the study. Big Three ownership, BlackRock, Vanguard, and State Street are measured by year for each company. Female directorship percentage point is the percentage point of female board directors out of all directors. Average female directors is the average of peer female directorship percentage point. Average Big Three is the peer average Big Three ownership by year. Assets, ROE, and BTM are all financial statement items.

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
BigThreeOwnership	6,117	0.179	0.0887	0	0.349
BlackRock	6,117	0.0866	0.0451	0	0.224
Vanguard	6,117	0.0654	0.0400	0	0.182
State Street	6,117	0.0274	0.0189	0	0.170
FemalePercentage	6,117	0.186	0.110	0	0.750
AverageFemale	6,117	0.187	0.0548	0	0.500
AverageBigThree	6,117	0.112	0.0441	0	0.308
Log_Assets	6,117	8.387	1.557	5.221	12.75
ROE	6,117	0.117	0.244	-1.593	1.968
BTM	6,117	0.462	0.324	-0.200	2.037

Variables	Description
Female Directorship	Percent of Directors that are Women
Peer Average	Equally Weighted Average of Female Board Directorship Points of All Peers
Peer Average Big-Three	Equally Weighted Average of Big-Three Ownership of All Peers
Assets	Book Value of Year-Ending Assets
ROE	Return on Equity Based on Ending Values
BTM	Book-to-Market Ratio at Year-End
Big Three	Self Big-Three Ownership

The results show that the average Big Three ownership of the companies in the dataset amount to 17.9% and BlackRock tends to have the highest ownership out of Big Three. The ownership percentage point is slightly higher compared to the number in studies such as Gormley et al. (2021), which suggested the average Big Three ownership is around 13%. This is likely because the firms recorded in the Institutional Shareholder Services are larger and more well-known companies, which are more favored by institutional investors. The average ROE is 11.6%, and the average book-to-market ratio 0.464.

Table 2 provides a correlation matrix for the variables in Table 1. Female percentage points are positively correlated with peer average female percentage points, size, profitability, and Big Three ownership. This satisfies common intuition since larger and better-performing firms tend to have more resources to focus on diversity.

Table 2: Correlation Matrix

This table provides pair-wise correlation of all major numerical variables collected. The correlation aims to provide some insights into how variables are related linearly and to better understand the data.

	1	2	3	4	5	6	7
1 FemalePercentage	1						
2 Log_Assets	0.269^{***}	1					
3 ROE	0.099^{***}	0.094^{***}	1				
4 BTM	-0.118^{***}	0.032^{*}	-0.294^{***}	1			
5 BigThreeOwnership	0.045^{***}	-0.070^{***}	-0.026^{*}	0.041^{**}	1		
6 AverageFemale	0.490^{***}	0.141^{***}	0.050^{***}	-0.067^{***}	0.051^{***}	1	
7 AverageBigThree	0.132^{***}	0.059^{***}	0.031^{*}	0.031^{*}	0.358^{***}	0.267^{***}	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Chapter 3: Empirical Analysis

3.1 Specifications

A common method to measure the association between two variables, in this case, female directorship points and peer average female directorship points, is through OLS. Simple OLS results between the two variables are provided in Table 3. The regression results are depicted in the equation below.

$$Female\ Directorship_{i,t} = \beta_0 + \beta_1 * Peer\ Average_{i,t} + c_1 * Log(Assets_{i,t}) + c_2 * ROE_{i,t} + c_3 * BTM_{i,t} + c_4 * Big\ Three_{i,t} + \varepsilon_{i,t} \qquad (\mathbf{1})$$

The results show that the coefficient estimate for the peer average female directorship point is around 0.99, which shows that board diversity tends to match peer diversity (Table 3, Column 1). The results are significant and do not change much when including the control variables (Column 2).

However, OLS can be flawed in this case due to the simultaneity bias. If the peer effect truly exists between firms and peers, a change in board diversity will also change diversity in peers, and vice versa. The bi-directional causality could make OLS biased and thus is not suitable for the purpose.

I use the instrumental variable approach to remove the endogeneity issue described above. The regression equation is shown below.

$$Peer\ Average_{i,t} = \alpha + \delta_1 * Peer\ Average\ Big\ Three_{i,t} + c_1 * Log(Assets_{i,t}) + c_2 * ROE_{i,t} + c_3 * BTM_{i,t} + c_4 * Big\ Three_{i,t} + \varepsilon_{i,t} + u_{i,t} \qquad (\mathbf{2})$$

$$Female\ Directorship = \beta_0 + \beta_1 * Peer\ \widehat{Average}_{i,t} + c_1 * Log(Assets_{i,t}) + c_2 * ROE_{i,t} + c_3 * BTM_{i,t} + c_4 * Big\ Three_{i,t} + \varepsilon_{i,t} \quad (3)$$

The instrument is The Big Three ownership of peer companies. From previous studies, Big Three ownership can significantly affect board diversity, especially after 2016 (Gormley et al., 2021). The Big Three institutional investors are some of the largest investors of all US public companies due to the surging popularity of index investing. Over the last two decades, their influences over the companies have grown substantially and their activism is able to push changes. In 2017, State Street became the first of The Big Three to launch its "Fearless Girl" Campaign to encourage more female board representation, and the other two Big Three members soon followed later in that year. It is reasonable to expect that their actions should have meaningful impacts. Thus, peer average Big Three ownership should be related to peer female directorship point, which satisfies the relevant condition under IV.

The instrument also meets the exclusion restriction of IV. Big Three institutional investors invest in nearly all listed companies in the United States and have a sufficiently diversified portfolio in all industries. The Big Three institutional investors generally invested in all listed companies, regardless of the firm's specific performance, to help the institutional investors gain a market-wide coverage of equities. While institutional ownership is known to have a significant impact on board diversity directly (Gormley et al., 2021), it is unclear why their ownership of peer firms would affect a company's diversity, except through a peer effect. The Big Three's influences on board diversity should follow the same guidelines in different companies. In other words, firms likely do

not rely on a change in Big Three ownership of peer companies to make diversity decisions, nor does change in peer Big Three ownership have a direct impact on board diversity of this particular company. However, because Big Three ownership does have a direct impact , self-Big Three ownership is added as a final control variable to make the instrument valid.

The variation of Big Three ownership is mostly driven by index composition of the companies (Gormley et al., 2021). For instance, S&P 500 components are more likely to have higher Big Three ownership than smaller, industry indexes due to their larger index presence on the market. In addition, the stock's float-adjusted market cap is another potential determinant of its Big Three ownership. The largest stocks in total market cap might not have the highest weights in indexes, if they have a large amount of holdings that are not publicly available (Appel et al., 2020). Big Three ownership tends to increase with the publicly available market cap. Therefore, previous evidence does not point out a clear relationship between Big Three ownership and board diversity.

Another concern for the instrument is that it is difficult to separate the social interaction effects discussed in Manski (1993), where the firm responds to other firms' actions, and the context effects, where a firm's behavior has influenced the characteristics of its peers. Specifically, if a firm's competitive positioning is relevant for its board structure decisions and if the relative institutional ownership of its peers reflects this competitive positioning, the contextual effects might occur and the validity of the instruments might be jeopardized. While it is possible that this could be the case for some firms, previous research has not found competitive positioning or any other factor other than government mandate and institutional ownership to be a significant driver behind board diversity. The concern for contextual effect should be limited.

A panel IV approach is implemented by controlling for year and firm-fixed effects. Additional control variables include size, ROE, BTM, and Big Three ownership percentage points of the company in interests.

3.2 Baseline Results

The first question to solve in the analysis is how an increase in peer average female board representation affects the female board representation of a particular company in the sector. Previous studies have not addressed this question and I first use equation (1) to fit an OLS model to extract preliminary insights. This is a simple regression between self-female board representation and peer-average female board representation.

Table 3: Basic Linear Regression

These are the results from simple OLS. The dependent variable is peer average female directorship points, and the independent variables include Big Three ownership, logarithmic of total assets, return on equity, and book-to-market ratio of each company. Column (1) is a simple linear regression between peer average female directorship points and Big Three ownership and Column (2) includes all the additional control variables. The results are consistent and a positive relationship is found between Big Three ownership and peer average.

	(1)	(2)
	1	2
VARIABLES	Female Percentage	Female Percentage
Average Female	0.99***	0.91***
	(0.02)	(0.02)
Big Three Ownership		0.05***
		(0.01)
Log_Assets		0.01***
		(0.00)
ROE		0.01***
		(0.00)
BTM		-0.03***
		(0.00)
Constant	0.00	-0.10***
	(0.00)	(0.01)
Observations	6,117	6,117
R-squared	0.24	0.29

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The OLS results presented in Table 3 show that, without instruments, the peer effect on board diversity is positive. The impact is quite substantial. For instance, Column (2) shows that the average female directorship percentage tends to increase by 0.91 percentage points as peers increase their own percentage points by one. The relationship is significant at 5%, with or without the control variables.

The results indicate that there is positive peer effect regarding female board representation. Companies tend to try to closely mimic the improvement in board representation of their peers. The results are consistent with expectations. Nonetheless, such results are for reference only as problems such as simultaneity bias exist in the identification. When factoring into the instruments, the sign of the coefficient estimate of average female directorship percentage points of peer companies might change.

As mentioned in the research methodology section, a more optimal method to test the peer effects in board representation is the instrumental variable method, which can remove the simultaneity bias inherent in peer effects. In this case, the instrument is the peer average big-three ownership, which is used to estimate the peer average female directorship points. The discussion of instrument choices and methods has already been presented in the previous section. The baseline IV results are shown in Table 4. The table contains both results for The Big Three ownership as a whole or separately.

The IV results show very similar results compared to OLS results, but the peer effects appear to be slightly larger. Table 4 shows the baseline IV results. Columns (1) and (2) estimate the peer effects without the control variables. The coefficient estimate of the average Big Three in the first stage, shown in Column (1), is 0.45, which indicates a one percentage point increase in peer average Big Three ownership can increase peer average

female directorship percentage by 0.45 percentage points. The F-Stat of the simple model is 9.35 in the standalone model and it will increase to 270 with the control variables. The instrument is thus strong.

Table 4: Base IV Regression

This table illustrates the base setup of the IV regression. Column (1) and (3) show the first-stage results. In the first stage, the dependent variable is peer average female directorship point and the independent variables is the peer average Big Three ownership, which is the instrument variable. Column (1) shows this simple setups and Column (3) includes additional control variables such as logarithmic of total assets, return on equity, and book-to-market ratio. Column (2) and (4) show the second-stage results. The peer average female directorship point is based on first-stage results and the inference should be unbiased. Column (2) has no control variables and Column (4) include all three controls.

	(1)	(2)	(3)	(4)
	1-1	1-2	2-1	2-2
VARIABLES	Average Female	Female Percentage	Average Female	Female Percentage
Average Big Three	0.45***		0.37***	
	(0.02)		(0.03)	
Big Three Ownership			-0.02**	0.01
			(0.01)	(0.01)
Average Female		1.01***		1.08***
		(0.07)		(0.10)
Log_Assets			0.05***	-0.00
			(0.00)	(0.01)
ROE			-0.01**	0.00
			(0.00)	(0.01)
BTM			-0.00	-0.00
			(0.00)	(0.01)
Constant	0.14***	-0.01	-0.25***	0.01
	(0.00)	(0.01)	(0.02)	(0.05)
Observations	6,117	6,117	6,117	6,117
R-squared	0.15		0.24	
Number of Firm_FE	1,617	1,617	1,617	1,617
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The second stage, shown in Column (2), yields a significant coefficient estimate of 1.06, which indicates a response to board diversity similar to the scale of peer changes. Recall from Table 2 that the standard deviation of female directorship percentage for all companies in the sample is approximately 11%. Therefore, one standard deviation change in average peer ownership can result in a corresponding 11.66 percentage point change in the female directorship percentage of any particular company. The impact of peer effect is

thus quite sizable and noticeable. The size of the second stage coefficient estimate of peer average female directorship percentage point is intriguing. This shows a matching effort for any particular company in response to its peers. The company tends not to deviate from the improvement/deterioration of peers.

The relationship does not change much by adding the four control variables (size, profitability, valuation, and self-Big-Three ownership). Column (3) and Column (4) show the results of IV regressions with full control variables. The first stage coefficient of peer average Big Three ownership decreases to 0.37 while the second stage coefficient estimate of peer average female directorship percentage point increases slightly to 1.08. The overall interpretation remains unchanged. Institutional ownership is conducive to diversity improvement and companies will react according to the diversity progress of their peers.

The results provide supporting evidence toward recent studies such as Gormley et al. (2021), which argued that The Big Three has an immersive impact on a firm's diversity decisions. This is proved by the first-stage results. In addition, the results also show a positive peer effect existed in US-listed companies and companies will improve their board diversity closely based on the decisions of their peers. By the size of the coefficient estimate, a company will not deviate from the progress (positive or negative) made by its peers on diversity efforts. Peer performance is definitely a reference point. Thus, the IV results are consistent with OLS results.

3.3 Cross-Sectional Analysis

The previous results show that, on an average level, peer effect is a significant factor for board diversity for all US-listed companies, but it is unclear whether such effects

exist for different kinds of companies. For instance, small-cap companies might behave differently than large-cap companies due to the different resources and public exposure they have. Larger companies are generally more scrutinized and can mobilize more resources in initiating changes. It is thus interesting to further explore the peer effects by different time periods or different firm-specific characteristics. One major finding from Gormley et al. (2021) is that institutional investors only pay significant attention to board diversity after 2016. If such a finding is true, the instruments should not work well for the regressions before 2017. To test this, I apply the IV regression for data between 2014 to 2016 and between 2017 to 2019. The methodologies are still the same as in Table 4. The results are presented in Columns (1) to (4) in Table 5.

The instrument of peer average big-three ownership fails to show a significant first stage result for data between 2014 to 2016, which indicates a weak relationship between institutional ownership and board diversity. Both first and second-stage regressions yield statistically non-significant coefficient estimates. In Columns (3) and (4), the IV for the year between 2017 to 2019 becomes significant and positive. The corresponding second-stage results also indicate a 1-for-1 change for any firm and its peers, which is consistent with the size indicated by all data.

Therefore, I find supporting evidence on the timing of intervention on board diversity from major institutional investors. The influences of peer effects are only significant for the periods starting in 2017, but not before. First-stage regression failed to yield significant coefficients for the data from 2014 to 2016. This is probably because the influence of Big Three ownership is only substantial after their campaign in 2017. The

findings are consistent with Gormley et al. (2021), who argued that Big Three institutional investors started campaigns toward board diversity after 2016.

Table 5: Segment Data by Time

This table extends on previous table. It further splits data into 2 segments by time. Column (1) and (2) conduct the same IV regression as done in the last two columns in Table 4. Column (1) and (2) are based on the data between 2014 to 2016 and Column (3) and (4) are based on the data from 2017 to 2019. The aim is to test whether regression results change by time. The dependent variable is peer average female directorship point and the instrument variable is the peer average Big Three ownership. The control variables include logarithmic of total assets, return on equity, and book-to-market ratio.

	(1)	(2)	(3)	(4)
	2014-2016 1	2014-2016 2	2017-2019 1	2017-2019 2
VARIABLES	Average Female	Female Percentage	Average Female	Female Percentage
Average Big Three	-0.01		0.23***	
	(0.07)		(0.02)	
Big Three Ownership	0.29***	2.11	-0.05***	0.01
	(0.04)	(10.93)	(0.01)	(0.01)
Log_Assets	0.02***	0.14	0.05***	0.00
	(0.00)	(0.88)	(0.00)	(0.01)
ROE	-0.01	-0.03	-0.01**	0.00
	(0.00)	(0.20)	(0.01)	(0.01)
BTM	-0.00	-0.02	0.01	-0.00
	(0.00)	(0.11)	(0.00)	(0.01)
Average Female		-5.98		0.89***
		(37.56)		(0.17)
Constant	-0.07*	-0.35	-0.23***	-0.01
	(0.04)	(2.78)	(0.04)	(0.07)
Observations	2,458	2,458	3,659	3,659
R-squared	0.12		0.15	
Number of Firm_FE	1,307	1,307	1,477	1,477
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A follow-up analysis on the timing of the impact of big-three institutional investors on board diversity is presented in Table 6, which conducts IV regression for each year after 2016. The above analysis has already shown that a positive peer effect exists in board diversity practice and the peer effect is most noticeable for year after 2016, after Big Three institutional investors have started their campaigns. It is interesting to explore whether the effects become stronger every year, which is expected due to the increased attention for diversity in recent years. All three years show positive and significant first and second-

stage coefficient estimates. More importantly, the peer effect seems to increase year by year. The size of peer average female directorship points increased from 0.832 in 2017 to 0.915 in 2019, which could indicate increasing attention on board diversity from the big-three institutional investors. Therefore, the peer effect seems to grow stronger since 2016

Table 6: Using Big Three Ownership in 2016 As the IV

This table further conducts a cross-sectional analysis by time. The IV regressions are performed on each year but instrument variable is modified to be the peer average Big Three Ownership in 2016 to understand the impact of a different cutoff period. The dependent variables and control variables remain unchanged from Table 4 and Table 5.

VARIABLES	(1) 2017 1 Average Female	(2) 2017 2 Female Percentage	(3) 2018 1 Average Female	(4) 2018 2 Female Percentage	(5) 2019 1 Average Female	(6) 2019 2 Female Percentage
Log_Assets	0.003***	0.016***	0.002**	0.016***	0.004***	0.014***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
ROE	0.001	0.018	-0.007	0.035***	0.004	0.018
	(0.007)	(0.013)	(0.006)	(0.013)	(0.006)	(0.012)
BTM	-0.005	-0.035***	-0.019***	-0.026***	-0.018***	-0.031***
	(0.005)	(0.010)	(0.004)	(0.009)	(0.004)	(0.011)
Big Three Ownership 2016	-0.051***	0.084***	-0.035	0.056	0.029	-0.015
	(0.016)	(0.030)	(0.022)	(0.043)	(0.018)	(0.037)
Average Big Three 2016	0.335***		0.291***		0.201***	
	(0.037)		(0.036)		(0.035)	
Average Female		0.642***		0.840***		0.937***
		(0.218)		(0.238)		(0.358)
Constant	0.135***	-0.071*	0.175***	-0.109**	0.172***	-0.097
	(0.009)	(0.038)	(0.011)	(0.051)	(0.010)	(0.071)
Observations	1,144	1,144	1,127	1,127	1,008	1,008
R-squared	0.079	0.252	0.084	0.261	0.068	0.232

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results so far have indicated that a positive peer effect in board diversity exists in the US listed companies. The results have already shown that firms have incentives to follow closely on the diversity practice progress and would match competitors' effort in this perspective. This would be true for all companies on an average level. However, the above results provide little evidence of how peer effect is related to firm performance. For instance, it is unclear whether firm size or peer size is an important factor in peer effects

and firm practice. The next two tables examine how firm size interacts with peer effects of diversity in US-listed companies.

Table 7: Segment Firms by Size

This table is a cross-sectional analysis by firm size. The average peer measures are constructed by four quartiles of peers by size. For instance, the peer average Big Three ownership and female directorship points are constructed only with peers of the smallest size quartile. The remaining methodologies follow the same strategies as demonstrated in Columns (3) and (4) in Table 4. The 1st quartile is the smallest 25% percentile and the 4th quartile represents the largest 25% percentile.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	1st Q Average Female	1st Q Female Percentage	2nd Q Average Female	2nd Q Female Percentage	3rd Q Average Female	3rd Q Female Percentage	4th Q Average Female	4th Q Female Percentage
Average Big Three	0.58***		0.46***		0.42***		0.40***	
	(0.06)		(0.05)		(0.04)		(0.04)	
Big Three Ownership	0.05**	0.00	0.00	-0.01	-0.05***	0.06**	-0.10***	0.01
	(0.02)	(0.05)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
ROE	-0.01**	0.01	-0.01	0.01	-0.01	0.02**	0.00	-0.02*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
BTM	-0.00	0.01	0.00	-0.00	0.01*	-0.02*	-0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Average Female		1.02***		1.04***		1.00***		1.15***
		(0.17)		(0.16)		(0.16)		(0.15)
Constant	0.11***	-0.04	0.13***	-0.01	0.14***	0.00	0.17***	-0.00
	(0.01)	(0.03)	(0.01)	(0.03)	(0.01)	(0.03)	(0.01)	(0.03)
Observations	1,529	1,529	1,530	1,530	1,529	1,529	1,529	1,529
R-squared	0.24		0.17		0.14		0.12	
Number of Firm_FE	490	490	516	516	497	497	427	427
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

First, I examine how a firm's own size interacts with the peer effects. Intuitively, larger companies have more public exposure and larger incentives to show progress in peer diversity than smaller companies, which generally lack resources and publicity. Table 7 splits data into four subgroups by quartiles of size (book value of assets) and performs the same IV regressions as in Table 3 to examine how firm size interacts with peer effects. Columns (1) to (8) correspond to the results of four different quartiles of firm size (not the

size of peer firms). For the table here and in later tables, the 1st quartile is the smallest 25% percentile and the 4th quartile represents the largest 25% percentile.

The results show that firms of all sizes have strong and closely matching incentives to match the diversity efforts of their peers. Across the table, the coefficient estimates for the average peer female directorship percentage point is between 1 to 1.15. Larger companies show a slightly stronger peer effect in diversity compared to smaller companies but the differences are quite limited. Therefore, the results show that the peer effect is both statistically significant and economically important for companies of different sizes and all these companies are reluctant to fall behind in diversity compared to their peers.

Second, the size of peer companies also matters. Specifically, I am interested in whether firms would try to mimic larger peers or smaller peers. It is interesting since firms with different sizes could have quite different performances and the difficulty in matching peer performance thus differs. To achieve this, I split peers for each company into four quartiles by size and performed regression based on peer measures constructed on each of the four quartiles of data. The results are presented in Table 8.

Unlike the results above, results based on different sizes of peers show considerable differences. The coefficient estimates of average peer female directorship points are 0.65, 1.00, and 0.33, respectively, for the first three quartiles while regression based on the fourth quartiles of peers fails to provide statistically significant coefficient estimates. Thus, companies are most likely to mimic the diversity performance of small-to-medium sizes of peers (2nd quartile) and are least likely to mimic the largest peers. There is a noticeable preference for smaller companies. One possible explanation behind the results could be that it is generally more difficult to imitate larger companies, which are under the heaviest

public scrutiny and have the most incentives to improve board diversity. The average performance (equally weighted) is mostly affected by medium-sized companies, which have more room to improve and can spare adequate resources.

Table 8: Segment Peers by Size

This table computes average Big Three ownership and average female director percentage point by only taking accounts of peers in certain size quartiles. For instance, Columns (1) and (2) are computed based on the smallest ¼ of the peers while Columns (7) and (8) are based on the largest ¼. Here, I rank the peers first and then remove missing values, which lead to the imbalanced data by quartile.

VARIABLES	(1) 1st Q Average Female	(2) 1st Q Female Percentage	(3) 2nd Q Average Female	(4) 2nd Q Female Percentage	(5) 3rd Q Average Female	(6) 3rd Q Female Percentage	(7) 4th Q Average Female	(8) 4th Q Female Percentage
Average Big Three	0.21***		0.11***		0.12***		0.06**	
	(0.02)		(0.02)		(0.03)		(0.02)	
Big Three Ownership	0.00	0.01	0.02	0.00	0.02	0.04**	0.01	0.06***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
Log Assets	0.05***	0.02**	0.05***	0.01	0.06***	0.04***	0.05***	0.09***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.02)
ROE	-0.01***	0.01	0.00	-0.01	0.01	-0.01	-0.01*	-0.01
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
BTM	-0.01**	0.00	-0.01**	0.01	0.00	-0.00	0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Average Female		0.65***		1.00***		0.33**		-0.55
		(0.10)		(0.18)		(0.17)		(0.47)
Constant	-0.32***	-0.09	-0.23***	-0.09	-0.35***	-0.25***	-0.21***	-0.46***
	(0.04)	(0.06)	(0.04)	(0.07)	(0.04)	(0.07)	(0.04)	(0.11)
Observations	6,018	6,018	5,285	5,285	5,285	5,285	6,018	6,018
R-squared	0.11		0.06		0.08		0.06	
Number of Firm_FE	1,597	1,597	1,495	1,495	1,495	1,495	1,597	1,597
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A final analysis in this section is a modification from the previous analysis to examine whether firms are more likely to mimic more or less profitable peers. It is interesting to examine how firms select their benchmark. Table 9 presents the results of IV regressions based on peer average performance by different quartiles of profitability. The results show that, similar to size, firms are more likely to track and match the performance

of peers with lower-to-medium levels of profitability. It is possible that the best-performing firms present too large a hurdle for average companies to imitate. The most preferred is still the 2nd quartile.

Table 9: Segment Peers by Profitability

This table computes average Big Three ownership and average female director percentage point by only taking accounts of peers in certain ROE quartiles. For instance, Columns (1) and (2) are computed based on the smallest ¼ of the peers while Columns (7) and (8) are based on the largest ¼.

VARIABLES	(1) 1st Q Average Female	(2) 1st Q Female Percentage	(3) 2nd Q Average Female	(4) 2nd Q Female Percentage	(5) 3rd Q Average Female	(6) 3rd Q Female Percentage	(7) 4th Q Average Female	(8) 4th Q Female Percentage
Average Big Three	0.17***		0.08***		0.09***		0.07***	
	(0.02)		(0.03)		(0.03)		(0.02)	
Big Three Ownership	0.01	0.01	-0.00	0.03	0.03	0.04**	0.03**	0.05**
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
Log Assets	0.05***	0.02**	0.06***	0.00	0.05***	0.05***	0.07***	0.07***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
ROE	-0.01***	0.01	-0.00	0.00	0.01	-0.01	-0.01**	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
BTM	0.00	-0.01	-0.01	0.00	-0.01	-0.00	0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Average Female		0.74***		1.05***		0.35		-0.06
		(0.13)		(0.34)		(0.23)		(0.26)
Constant	-0.26***	-0.10	-0.30***	-0.03	-0.25***	-0.28***	-0.37***	-0.37***
	(0.04)	(0.06)	(0.05)	(0.12)	(0.04)	(0.07)	(0.04)	(0.11)
Observations	6,018	6,018	5,285	5,285	5,285	5,285	6,018	6,018
R-squared	0.08		0.04		0.04		0.08	
Number of Firm_FE	1,597	1,597	1,495	1,495	1,495	1,495	1,597	1,597
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3.4 Robustness Analysis

In this section, I perform IV regressions again on key regression results based on different metrics to ensure the results are robust across different specifications. In the results so far, I use GICS sub-industry classification to identify peers, which is a convenient

way to link comparable companies. There are many other alternatives. Here, I use the peer list provided by Institutional Shareholder Services to re-calculate the peer average metrics used in the regressions. Note that the peer list is used for executive compensation purposes but should be sufficient to identify peers. The peer list should be more accurate at identifying more closely comparable companies but the list itself is very unbalanced. Larger companies might have a large pool of peers while smaller companies might be omitted or only have a few peers. This would lead to a quite biased presentation of peer performance for many companies. Overall, it is a less comprehensive peer identification strategy than GICS sub-industry classification but should still be sufficient.

Table 10 presents the baseline IV regressions based on the peers constructed by the ISS peer list. The number of total observations in the regression drops from 6,117 to 3,456 due to an incomplete peer list. As mentioned earlier, this is a drawback of using the ISS list, where the sample is mostly limited to more well-known companies and the peer average calculation often lacks sufficient observations. Nonetheless, the results are mostly consistent with Table 3. On average, female directorship points will increase by 1.67 percentage points per every one percentage point in peer average female directorship percentage. There is a slight variation for different specifications (without control variables or separate Big Three ownership) but the signs stay unchanged, and the range does not deviate much from the range in Table 3.

The major results from this study are remarkably consistent under different proxies of institutional ownership, a different method of peer average calculations (equal weights or market weights), and different sets of control variables. Although not all results are shown in the tables, the impacts of peer influences are always positive and would not

deviate much from 1.0. Higher big-three ownership will also lead to better diversity. These effects are only significant after 2016.

Table 10: Robustness Analysis Using Alternative Measure of Peers

This table follows the same methodologies as in Table 4 but the construction of peer measure is different. In Table 4, the peer measures are based on the GISC-subindustry code, but here the peer measure is based on the peer list provided by Institutional Shareholder Service (ISS).

	(1)	(2)	(3)	(4)
	1-1	1-2	2-1	2-2
VARIABLES	Average Female	Female Percentage	Average Female	Female Percentage
Log Assets			0.06***	-0.04
			(0.00)	(0.04)
ROE			0.00*	-0.01
			(0.00)	(0.01)
BTM			-0.01**	-0.01
			(0.00)	(0.01)
Average Big Three	0.11***		0.07***	
	(0.02)		(0.02)	
Big Three Ownership		0.00	-0.00	0.00
		(0.02)	(0.01)	(0.02)
Average Female		1.30***		1.67***
		(0.30)		(0.60)
Constant	0.20***	-0.07	-0.37***	0.26
	(0.00)	(0.07)	(0.02)	(0.23)
Observations	3,456	3,456	3,456	3,456
R-squared	0.01		0.18	
Number of Firm_FE	868	868	868	868
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Chapter 4: Conclusion

There are two major takeaways from this study. First, this study identifies a third channel on how board diversity is determined in the US publicly listed companies. Previous studies (Appel et al., 2019; Hwang et al., 2020; Lewellen & Lewellen, 2020; Gormley et al., 2021) have identified that government mandates and investors' activism are the two major influencing factors of board diversity. However, firms are located in different states and have different ownership structures. These two factors alone are not sufficient to explain the different levels of board diversity among publicly listed US companies. Based on the results, I propose and prove peer effect as a third factor that can significantly influence board diversity. Second, I also found out that companies always try to match the progress of their peers of board diversity, no more, no less. The progress in corporate governance is matched among peers.

The role of the peer effect has been previously studied in other areas of corporate finance, such as capital structure (Leary & Roberts, 2014). In the context of board diversity, companies do consider the performance of their peers at improving/downgrading their own diversity performance. Results from this study have shown that companies generally match the efforts of their peers. The peer effect has a universal impact on firms of different sizes and different levels of prior diversity. Interestingly, firms will tend to spend matching effort compared to their peers and are generally reluctant to deviate from peer progress.

The benchmark choices of peer companies are also interesting. Among all peers, firms are most likely to imitate companies with medium size and profitability. These companies resemble more closely to the average performance and have fewer outliers. For

instance, industry leaders have much more resources to improve board diversity than regular companies, which makes imitation difficult.

The entire results are consistent with the financial intuition. Companies would not want to fall behind their major competitors in board diversity to attract bad publicity. These companies would also not want to spend excessive amounts of resources on tracking peer performance and would select more reasonable benchmarks in medium-sized and averagely profitable companies. Nonetheless, this study can only examine the peer effects after 2016, when the Big Three began to campaign for diversity. Prior to the year, the instrument does not work. By the results obtained since 2016, the peer effect of board diversity appears to grow stronger due to increasingly more attention on the issue from various stakeholders (i.e., investors, public).

In this study, I examine the peer effects of diversity on US-listed companies by analyzing the changes in female directorship on board. In recent years, there has been an increasing trend of diversity, and female board representation is becoming more popular. The results in this study show that firms are indeed paying more attention to diversity and are actively monitoring the progress of their peers. In most cases, firms will spend a matching effort to improve diversity, especially on more measurable metrics such as the number of female directors on board. In many of the IV regressions, the coefficient estimate for peer average female directorship points is 1, which indicates a matching effort in peer effects.

In addition, I uncovered that the peer effect only become significant after 2016 when The Big Three institutional investors launched campaigns to advocate board diversity. The results are supporting evidence for works such as Gormley et al. (2021). Whether or

not tokenism exists, the prior existence of female directorship does lead to better diversity in later stages. The findings also show that the companies seem to have the most incentive to track and mimic the diversity performance of smaller-to-medium-sized peers and/or lower-to-mediumly profitable peers. Larger and better-performing companies are generally not the references for peer performance.

The results cannot answer two key questions. First, it is unclear whether the peer effect is only positive or whether board diversity can fall into a vicious cycle. The dataset contains firm-year observations from 2014 to 2019 when the general trend for diversity is improving. The results cannot answer what would happen if peer average female directorship points start to decline. Second, the peer effect is also likely affected by other firm-specific characteristics and general drivers of firm diversity. While this study has already examined some interactions in cross-sectional analysis, it is difficult to cleanly separate the influences.

Overall, the positive peer effects and around 1.0 coefficient estimate of peer average female directorship point indicate that firms do not want to be left behind. They also do not want to spend extra effort on diversity, which could be costly and time-consuming. Their motives for improvement could be due to publicity and pressure from institutional shareholders and other stakeholder groups. Nevertheless, peer effect remains one of the important determinants behind modern board diversity.

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