# Female Directors and Corporate Risk Taking: Evidence from U.S. REITs

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# Abstract

**Female Directors and Corporate Risk Taking: Evidence from U.S. REITs**
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While gender differences in risk preferences and the benefits of gender diversity have been extensively documented, there is currently no research that combines the two concepts to measure managerial overconfidence in the context of REITs. In this paper, we study the impact of board gender diversity on the risk management decisions of 158 U.S. REITs over the 2004 to 2018 period. Gender diversity is measured using two distinct variables to independently reflect both the gender and the diversity dimensions, respectively expressed by the Blau diversity index and the number of female directors on the Board. Risk is proxied by four different measures, namely the portfolio's green share as well as its level of geographical diversification, sectoral diversification, and net property trading. We find significant risk-reduction benefits associated with gender diversity, confirming that women are less overconfident than men, even in a managerial context. We contribute to the existing research by showing that the combination of both a female CEO and a sufficient number of female directors, whether in relative or absolute terms, is necessary to significantly influence corporate investment risk decisions.

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# Introduction

Research from around the world has increasingly shown that diversity benefits individuals, organizations, and society. This is especially true given the gender differences in risk preferences that have long been documented in the behavioral finance literature. If women are less overconfident than men, then a company promoting gender diversity should experience risk-reduction advantages in addition to the numerous benefits brought by diversity through talent attraction, innovation, reputation, and financial performance. Yet in 2019, only 26% of S&P 500 directors were women, which still represents a 10% increase since 2009, and a mere 2% had a woman serving as CEO (Stuart, 2019).

In this paper, we study the impact of board gender diversity on the risk management decisions of 158 U.S. REITs over the 2004 to 2018 period. Gender diversity is measured using two distinct variables to independently reflect both the gender and the diversity dimensions, and risk is proxied by four different measures. We conduct our analyses using REITs because of their unique benefits that make them an ideal means to examine investment decisions at the property level. This allows us to investigate the question of risk taking in a managerial context, for which the literature remains scarce to this day. REITs are also advantageous for studying the implications of the underlying properties' environmental performance. Given that the real estate sector has one of the highest carbon footprints, green buildings have gained increasing investor and academic attention. Indeed, the global stock of real estate currently contributes 30% of the world's annual greenhouse gas (GHG) emissions and consumes around 40% of our energy (Bosteels & Sweatman, 2016). Furthermore, the tremendous reduction in GHG emissions that is required in order to comply with the 2050 targets set by the Paris Climate Agreement give rise to a number of climate-related risks and opportunities. There is a rapidly increasing body of research that depict the risk-reduction benefits of green buildings, which is why we select it as our first proxy for risk management strategies. We also construct two variables for diversification by geography and property type, respectively, using the well-known Hirschman-Herfindahl index (HHI). We then calculate the REITs' net trading activity as it is perhaps the most documented effect of investor overconfidence.

Consistent with our hypotheses and with the current literature we find significant risk-reduction benefits associated with gender diversity, also confirming that women are less overconfident than men in a managerial context. Notably, we contribute to the existing research by showing that the combination of both a female CEO and a sufficient number of female directors, whether in relative or absolute terms, is necessary to significantly influence these decisions. As expected, we report statistically significant associations with every risk measure but diversification by property type. Our results are robust to the inclusion of several control variables after clustering for firm fixed-effects and property type fixed-effects. The remainder of the paper is structured as follows: the next section summarizes the current body of research on board gender diversity and investor overconfidence, followed by a few specifications with regards to the particularities of REITs. In the third section, we describe our variables, data, and regression models. We then present our results and interpret their implications before providing some concluding remarks.

# Literature review

## The case for more women in the boardroom

Every year since 1988, there have been more women than men on U.S. college campuses. Today, American women earn close to 60% of undergraduate and master's degrees and hold over 50% of all management- and professional-level jobs (Warner et al., 2017). Nonetheless, the gender gap

still remains at the senior leadership level: only 25 S&P companies have a female CEO, and 26% of S&P 500 directors are women (Stuart, 2019). Such numbers are especially noteworthy given the central role played by the board of directors with regards to corporate strategic leadership (Carlson, 2012). As a result, the question of gender diversity on corporate boards has gained increasing attention from academics in recent years. Arguments for boardroom gender diversity are generally of ethical or economic nature (Carlson, 2012). The ethical argument is "based on equity and fairness, which suggests that women and men should have an equal opportunity to attain leadership positions, including corporate board memberships" (Banahan & Hasson, 2018). Alternatively, the business case for gender diversity claims that organizations can benefit from developing and promoting women (Catalyst, 2004). There are four main areas in which gender diversity and inclusion have a significant impact: (1) talent, (2) innovation and group performance, (3) reputation and responsibility, and (4) financial performance (Catalyst, 2020a).

First, companies with a higher level of gender diversity are more successful at attracting and retaining talent (Banahan & Hasson, 2018; Madera et al., 2019; International Labour Organization, 2019; Maurer & Qureshi, 2021). Indeed, "expanding the perceived pool of director candidates to an under-tapped population of highly qualified women leaders opens a new source of managerial talent" (Banahan & Hasson, 2018). Furthermore, diverse organizations that are supported by HR practices and policies aimed at gender diversity are associated with lower levels of collective employee turnover (Maurer & Qureshi, 2021). Diverse workplaces also maximize talent and productivity through increased employee job satisfaction and commitment (McCallaghan et al., 2019; Perry & Li, 2019). Looking at absenteeism, Bourke and Espedido (2019) find that a 10% increase in perceived inclusion improves work attendance by almost one additional day per year. Second, a diversity of perspectives is crucial for fostering innovation (Lorenzo et al., 2017; International Labour Organization, 2019). A recent report by the International Labour Organization (2019) reveals that companies with an inclusive business culture and set of policies are 59% more likely to achieve "greater creativity, innovation and openness" and 38% more likely to report a better assessment of "consumer interest and demand". Importantly, homogenous groups are more susceptible to groupthink while diverse teams benefit from a wider variety of perspectives (Gaither et al., 2018; Homan, 2019; Catalyst, 2020a). Numerous studies find that cultivating a diversity of mindsets significantly improves creativity, problem solving and conflict resolution (Reynolds & Lewis, 2017; Lee et al., 2018).

Diversity also benefits companies through improved reputation and ethical value, particularly during economic downturns (Sakunasingha et al., 2018; International Labour Organization, 2019; Rabl et al., 2020). Additionally, gender-diverse boards are associated with more effective risk-management practices (Catalyst, 2020a). For instance, Shin et al. (2020) find that female board representation improves investment efficiency, as female directors are less likely to over-invest compared to their male counterparts. Adding women to the board also reduces the overconfidence of male CEOs, further improving investment efficiency (Chen et al., 2019a; Chen et al., 2019b). Moreover, the presence of female board directors strengthens the board's monitoring and advising role, resulting in more investment in higher-quality audits, fewer financial reporting mistakes and less controversial business practices such as fraud and earnings manipulation (Lai et al., 2017; Wahid, 2019; Fan et al., 2019, Shin et al., 2020; Catalyst, 2020a). Importantly, boardroom gender diversity is linked to better environmental, social and governance (ESG) performance (Banahan & Hasson, 2018). Banahan and Hasson (2018) examine gender-diverse boards and their non-diverse counterparts in the S&P 500 index and find that diverse boards outperform their peers based on ESG metrics, indicating better sustainability practices. Notably, they report the same trend for the combined ESG score as well as for individual environmental and social scores. On environmental

matters specifically, "companies with diverse boards were two to three times more likely to receive a higher score than non-diverse boards" (Banahan & Hasson, 2018). The authors argue that this relationship can be explained by improved risk management and a deeper understanding of key stakeholders. Their argument is supported by Loop and DeNicola (2019), who claim that women directors are more likely to consider that social issues like human rights, climate change and inequality have an important role in corporate strategy. Consistent with the longer-term nature of ESG performance, they add that women are also more likely than men to attribute problems with company culture to an "excessive focus on the short term" (Loop & DeNicola, 2019).

Finally, a vast body of research highlights the link between gender diversity and improved profitability and financial health, especially in times of crisis (Catalyst, 2020b; Ceseña et al., 2020). In a recent report, Kersley et al. (2019) examine this profitability premium by comparing companies with at least 20% of women in senior management against those with 15% of less female executives, covering over 3,000 firms globally on a sector-adjusted basis. They find that companies in the higher threshold generate a cash flow return on investment 2.04% higher than the lower basket as well as an EBITDA margin spread of 229 basis points between the two groups (Kersley et al., 2019). Numerous other studies show a positive relationship between corporate gender diversity and firm performance, as measured using return on assets, return on equity and Tobin's Q (Conyon & He, 2017; Zhang, 2020). A report by the International Monetary Fund reviewing over 2 million European firms reveals that, by replacing only one man with a woman in the senior team, companies could boost their ROA by as much as 20 basis points, and even up to 34-40 basis points in knowledge-intensive and high-tech industries (Christiansen et al., 2016). Similar trends are also found when looking at return on equity and return on sales (Eastman & Seretis, 2018; Morgan Stanley, 2019).

## Gender differences in risk preferences

To gain a deeper understanding of the business case for boardroom gender diversity, we must look at what makes women different than men in a corporate setting. Indeed, the behavioral finance literature highlights prevalent differences in terms of gender. The general argument is that women are considered more risk averse than men, who tend to exhibit relatively more overconfidence in a decision-making context. For instance, Bengtsson et al. (2005) investigate gender differences in exam behavior and find that male students are relatively more overconfident than their female counterparts, as they are more inclined to attempt a bonus question that could considerably increase their overall grade. Consequently, female students are slightly better at passing the exam due to increased prudence while male students, who are relatively more overconfident, strongly outperformed at getting the highest grade (Bengtsson et al. 2005).

Several studies show that not only is the gender gap in overconfidence highly task dependent, but it is greatest for tasks perceived as masculine (Deaux & Farris, 1977; Lenney, 1977, Lundeberg et al., 1994). Therefore, in male-dominated industries such as finance, men tend to exhibit more overconfidence than women (Prince, 1993; Barber & Odean, 2001). Prince (1993) shows that men are more inclined to feel competent in money handling and to take risks in order to gain wealth. Lewellen et al. (1977) find that "men spend more time and money on security analysis, rely less on their brokers, make more transactions, believe that returns are more highly predictable, and anticipate higher possible returns than do women" (Barber & Odean, 2001). These findings are in line with Odean's (1998) model of overconfidence, which argues that overconfident investors overestimate the precision of their financial knowledge as well as the probability that they are right when others, such as brokers, are wrong. These differences of opinion are what causes

overconfident players to trade excessively, which lowers their expected returns (Odean, 1998; Barber & Odean, 2000, Eichholtz & Yönder, 2015). Additionally, their overconfidence leads them to hold relatively risker portfolios than rational investors (Odean, 1998; Chuang & Lee, 2006). Because these traders overestimate the accuracy of their information and, thereby, their expected gain, their portfolios are under-diversified and sub-optimal in terms of risk sharing between risky and risk-free assets (Odean, 1998; Barber & Odean, 2000). Similarly, Hirshleifer and Luo (2001) find that overconfident investors underestimate the level of risk associated with their investments and, as a result, trade more often than their counterparts.

The theory thus predicts that overconfident investors (1) trade excessively, (2) hold riskier portfolios, and (3) experience lower risk-adjusted returns. In parallel, the behavioral literature demonstrates that (1) men are generally more overconfident than women and (2) these gender differences are more significant in male-dominated industries such as finance. Therefore, taken together, the research predicts that men should trade more than women while experiencing lower returns through excessive trading and risk taking. Barber and Odean (2001) use gender as a proxy for investor overconfidence to test whether it leads to excessive trading and lower returns. Using account data to analyze stock investments of U.S. households, they find that men trade 45% more than women and that trading decreases their net returns by 0.94% more per year compared to women (Barber & Odean, 2001). Further segmenting between married and single households, the authors report an even more pronounced gender effect between single men and women: the difference in trading activity increases to 67% and the gap in net returns reaches 1.44%, while these results are significantly lower for married households as "one spouse may make or influence decisions for an account opened by the other" (Barber & Odean, 2001).

The overconfidence model holds not only for individual investors but for corporate board directors as well, although there are fewer studies that focus on overconfidence in a firm setting. Notably, Malmendier and Tate (2005) investigate managerial overconfidence in a corporate investment context and reveal that overconfident CEOs invest more than their non-overconfident counterparts. The effect is even more pronounced when there are more internal funds available. Their findings are supported by Eichholtz and Yönder (2015), who conduct a similar analysis on a sample of U.S. REITs. The authors find that REITs with overconfident CEOs have a propensity to invest more and that they "acquire more assets and are less likely to sell assets" when their cash-to-assets ratio increases (Eichholtz & Yönder, 2015). They also show that overconfident managers make suboptimal investment decisions, resulting in lower investment performance as measured by net operating income and gain on sale of real estate (Eichholtz & Yönder, 2015). Additionally, Levi et al. (2014) examine a sample of M&A bids initiated by S&P 1500 firms to investigate gender differences in excessive trading activity. Consistent with women being less overconfident than men, the authors find that firms with female directors are less likely to make acquisitions and that they pay a lower bid premium when they do acquire, as they are less prone to empire building (Levi et al., 2014). Similarly, another study on publicly traded Korean firms demonstrates that "the presence of female directors effectively reduces over-investment […] due to their risk- averse, conservative, and prudent nature" (Shin et al., 2020).

## Studying managerial overconfidence with REITs

To this day, the body of real estate literature on the effects of overconfidence on trading activity and risk remains scarce. This is partly due to the lack of available direct real estate data, for which REITs present an ideal alternative with a number of distinct benefits. Notably, their individual investments can be identified with precision, offering a direct look at investment activity and

performance, both at the company and asset level (Eichholtz & Yönder, 2015). Because this is not feasible for most other corporations, much of the research on managerial overconfidence is conducted using M&A data. Similarly, it is generally not possible to evaluate the size or value of individual investment projects for most firms, while this information is readily available for REITs (Eichholtz & Yönder, 2015). Additionally, REITs are legally required to hold at least 75% of their assets in real estate but effectively invest nearly all their capital in it. Therefore, it can be concluded that the investment projects undertaken by REITs are primarily related to the acquisition, operation, and disposition of real estate assets. This is particularly useful because the timing and pricing of all these individual real estate transactions are subsequently reported, allowing researchers to build a variety of measures of corporate investment activity and performance (Eichholtz & Yönder, 2015).

These unique advantages also make REITs an ideal vehicle to investigate the financial implications of environmental performance. For most other corporations, it is not possible to measure the greenness of individual projects and, as a result, most research on the topic is focused on ESG scores. Here also, REITs offer a special opportunity because environmental certification data is available at the individual property level. For instance, Eichholtz et al. (2012) investigate the benefits of green buildings on the operating and stock performance of U.S. REITs. To do so, the authors use data on LEED and Energy Star certified buildings to calculate the share of green properties for each REIT and find that the greenness of REITs is associated with improved operating performance measured by return on assets, return on equity and the ratio of funds from operations to total revenue (Eichholtz et al., 2012). Importantly, they show that a REITs with a higher share of green properties have a lower market beta, "which may be related to their reduced exposure to shocks in energy prices and environmental legislation" (Eichholtz et al., 2012). The authors also suggest that holding environmentally certified properties could be a means for REITs to lower their exposure to reputational risk occurring from the scrutiny of institutional investors with regards to the sustainability of their operations (Eichholtz et al., 2012). Subsequent research also shows the increased resilience of green buildings. Eichholtz et al. (2013) examine a sample of properties during the Great Financial Crisis and find that the economic premium for green buildings persists throughout the period with certified properties displaying higher rents and occupancy rates, suggesting that investors assign a lower risk premium to more energy-efficient and sustainable buildings. In explaining their results, the authors claim that "rated buildings may provide a hedge against higher energy prices, but also against the shifting preferences of both tenants and investors with respect to environmental issues" (Eichholtz et al., 2013). Investments in environmentally certified buildings can therefore be viewed as a risk management strategy given the protection that they offer against market risk, reputational risk, and legislative risk.

Lastly, there is an important point to note with regards to the relationship between diversification and risk when using REITs to examine managerial overconfidence. Diversification is predominantly viewed as an effective tool to limit exposure to any single asset or risk, and its benefits as a risk-management strategy have been extensively proven (Segal, 2021). While this relationship is true for individual investors and fund managers, the same conclusion cannot be made for REITs. Notably, Min and Cheok. (2011) study the impact of diversification strategies on various measures of operational performance and risk on a sample of Asian REITs using Hirschman-Herfindahl indices (HHI). Looking at diversification by property type, the authors do not report any significant effects on cash flows, expenses, and risk premiums. However, in terms of geographical diversification, they find that "REITs with assets distributed across different countries incur higher total expenses, interest expenses, general and administrative expenses and capital expenditure", as well as higher risk premiums (Min & Cheok, 2011). Frutig and Das (2020)

report similar results when examining the link between systematic risk and geographical diversification on a sample of lodging REITs. The authors find a negative relationship between geographical focus measured by the HHI and the company's beta, indicating "that REITs with geographically concentrated hotel portfolios experience significantly lower systematic risk" (Frutig & Das, 2020). Therefore, in the specific context of REITs, higher diversification is not positively linked to financial performance and risk reduction. On the contrary, geographical focus emerges as a risk management strategy. Consequently, because geographical diversification is associated with increased risk taking in investment decisions, it can be used as a proxy for managerial confidence in REITs.

# Data and method

## Measures

### Board gender diversity

As proxies for gender diversity of the board of directors, we begin by calculating $ln(Women)$, which stands for the natural logarithm of the number of female directors. We then follow Campbell and Mínguez-Vera (2008) and Reguera-Alvarado et al. (2017) and compute another measure of gender diversity that takes into account both the number of gender categories (two: men and women) as well as the evenness of the distribution of board members between them. These two attributes of diversity, namely 'variety' and 'balance', can be combined into 'dual concept' measures of diversity (Stirling, 1998). Based on this concept of diversity we calculate a second variable, $Blau$, representing the Blau diversity index measured as follows:

$$(1)\ Blau_{i,t} = 1 - \sum_{j=1}^{n} P_j^2$$

where $P_j$ is the percentage of board members in each gender category and $n$ is the total number of board members for REIT $i$ at time $t$. For gender diversity, values of the Blau index range from 0 to of 0.5, reaching the maximum when the board has an equal number of men and women. A version of this index was initially proposed by Simpson (1949) to measure the level of special diversity in an ecosystem.

### Portfolio greenness

To measure the green share of property portfolios, we follow the research by Eichholtz et al. (2012) on the financial performance of green buildings in the United States. The authors characterize green buildings as "those certified by the US Green Building Council's (USGBC) LEED program, or buildings that have received an Energy Star certificate from the Environmental Protection Agency (EPA)" (Eichholtz et al., 2012). LEED and Energy Star are widely viewed as the leading certification programs and aim to promote energy-efficiency and sustainability in the development and redevelopment of real estate properties around the world. To build our measure of portfolio greenness for each REIT, we sum the square feet of all properties certified as green for each year and standardize the sum by the total square feet of the property portfolio owned by the same REIT in the corresponding year, as shown in the following formula:

$$(2)\ Green\_Share_{i,t}^{g} = \frac{\sum_l Sqft\ of\ certified\ property_{i,l,t}^{g}}{\sum_l Sqft\ of\ property_{i,l,t}} \times 100$$

where $l$ stands for property $l$ and $g$ is the certification, which is either LEED or Energy Star, for REIT $i$ at time $t$.

**Portfolio diversification**

To quantify the degree of diversification by REITs, we follow the existing literature and employ Herfindahl's (1950) index and Hirschman's (1964) index, or HHI, which is analogous to the Blau index when applied in the context of investment concentration. Using this index, we create two variables that measure the level of diversification by region and by property type, respectively, for each REIT and each year. The HHI equations are as follows:

$$(3)\ HHI\_Region_{i,t} = \sum_{j=1}^{n} S_j^2$$

$$(4)\ HHI\_Type_{i,t} = \sum_{j=1}^{n} S_j^2$$

where $n$ is the number of properties in a portfolio and $S_j$ denotes the proportion of aggregate properties in the respective geographical region and property type categories weighted by square footage for REIT $i$ at time $t$. A larger HHI indicates a higher degree of investment focus within the portfolio, with a maximum value of 1 for a completely focused REIT.

**CEO investment decisions**

Consistent with the research on overconfidence and more specifically with Eichholtz and Yönder (2015), we measure CEO investment decisions using the trading activity conducted by their respective REITs. First, we calculate $Acquisitions$ and $Dispositions$ using the total square footage of properties purchased and sold in each year to proxy $Purchases$ and $Sales$, respectively, and the total square footage of properties in the portfolio of REIT $i$ at time $t$ to proxy for $RE$. We then subtract $Dispositions$ from $Acquisitions$ to create our proxy for investment activity, $Net\_Trading$. The equations are written as follows:

$$(5)\ Acquisitions_{i,t} = \frac{Purchases_{i,t}}{RE_{i,t}}$$

$$(6)\ Dispositions_{i,t} = \frac{Sales_{i,t}}{RE_{i,t}}$$

$$(7)\ Net\_Trading_{i,t} = Acquisitions_{i,t} - Dispositions_{i,t}$$

## Sample and data

The complete dataset is comprised of U.S. REITs available in the SNL Financial Real Estate database between 2004 and 2018, inclusively. To avoid survivorship bias, we also include REITs

that began or ceased operations during the sample period. The REITs' financial data are taken from S&P Global Market Intelligence's Compustat database on an annual basis. We then use BoardEx to obtain board and CEO data. The BoardEx dataset provides information about board members and executives from public and private firms across the United States and Europe, including their comprehensive demographic, academic, and professional profiles. Consistent with Eichholtz and Yönder (2015), we obtain annual data on the properties sold and purchased by these REITs from SNL Financial Real Estate in order to compute the HHI by region and by property type as well as the net trading activity. Replicating the method previously developed by Eichholtz et al. (2012), we also match the property dataset to LEED-and Energy Star-certified buildings using databases from the USGBC and EPA, respectively, to obtain the year of certification for each property. Then, using their corresponding acquisition and disposition year from the SNL database, we build an annual snapshot of each REIT portfolio and identify the properties that are either LEED- or Energy Star-certified, generating a dataset of the level of greenness of REIT portfolios. Importantly, we only count the property as green for a given year if it was held in the portfolio over the entire year. For example, if a REIT acquired a building in 2010 and sold it in 2012, it would be counted as green in 2011 only. After matching green building data with gender, financial and property trading data, our sample covers a total of 158 distinct REITs.

Table 1 presents the descriptive statistics for the sample. Panel A shows the three measures of gender diversity. Notably, 3% of REIT-years have a female CEO, and the mean Blau index for the sample is 0.17 within a possible range of 0 to 0.50. As shown in Figure 1, the level of board gender diversity has been consistently increasing over the sample period, while the proportion of REITs with a female CEO tends to vary between years. We then show the four proxies for risk management decisions in Panel B of Table 1. The average share of green buildings within our sample of REIT-years is 4%, with values ranging from 0 to 75% of the portfolio. As shown in Figure 2, the mean proportion of green buildings held by U.S. REITs has also been increasing over team, approaching 8% in the most recent years. The average HHIs by region and by property type are 0.40 and 0.80, respectively, showing that REITs are generally more diversified geographically while they tend to focus on fewer real estate asset classes. We also demonstrate that REITs tend to acquire more than they sell, as show by the positive mean net trading activity of 6%. Finally, Panel C of Table 1 shows our control variables. For financial controls we use the logarithm of total assets, the debt-to-assets ratio, and the market-to-book ratio, and we lag all variables by one year. We also control for the CEO's tenure and include a dummy variable that takes the value of 1 if the REIT had a female CEO at any point in time over the sample period.

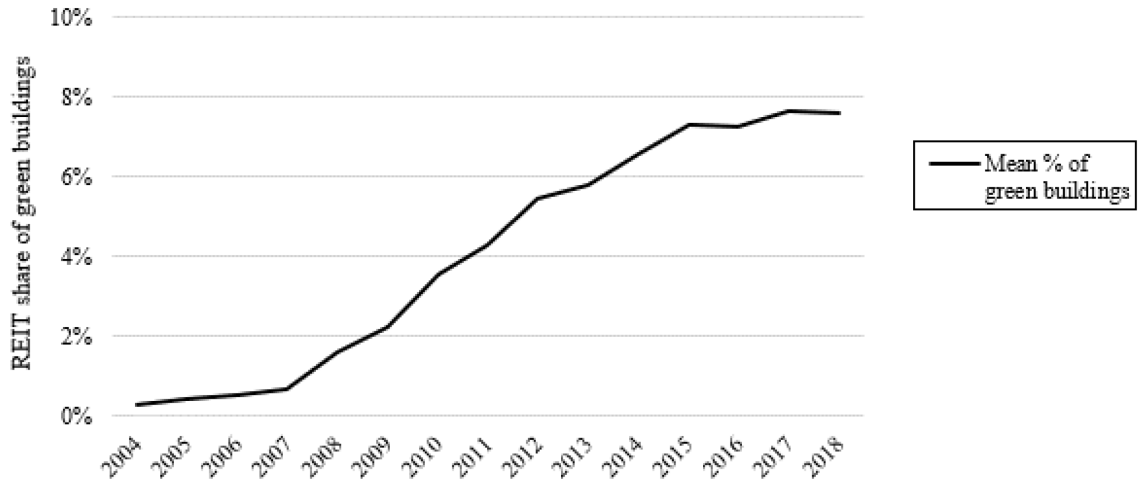
**Table 1** - Descriptive statistics

| Variables | Obs. | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|
| Panel A - Gender Diversity | | | | | |
| *Female_CEO* | 4,152 | 0.03 | 0.16 | 0.00 | 1.00 |
| *Blau* | 3,026 | 0.17 | 0.15 | 0.00 | 0.50 |
| *ln(Women)* | 3,026 | 0.54 | 0.47 | 0.00 | 1.61 |
| Panel B - Risk | | | | | |
| *Green_Share* | 2,921 | 0.04 | 0.11 | 0.00 | 0.75 |
| *HHI_Region* | 4,909 | 0.40 | 0.34 | 0.04 | 1.00 |
| *HHI_Type* | 4,909 | 0.80 | 0.24 | 0.16 | 1.00 |
| *Net_Trading* | 4,909 | 0.06 | 0.37 | -1.00 | 1.00 |
| Panel C - Control Variables | | | | | |
| *ln(Total Assets)* | 3,374 | 7.46 | 1.57 | -0.76 | 10.50 |
| *Debt_Ratio* | 3,372 | 0.49 | 0.21 | 0.00 | 1.67 |
| *MtB_Ratio* | 2,190 | 1.51 | 0.95 | 0.35 | 14.77 |
| *ln(Tenure)* | 2,727 | 7.60 | 0.00 | 7.60 | 7.61 |
| *F_CEO_Period* | 5,166 | 0.06 | 0.25 | 0.00 | 1.00 |

*Notes:* Table 1 presents the descriptive statistics. Gender diversity is defined using three measures: Female CEO (dummy), Blau diversity index (decimal), and the number of women directors (logarithmic). Panel B variables, all presented and decimals and defined by square footage, are used as a proxy for risk management decisions and overconfidence. Control variables include totale assets (logarithmic), debt ratio (decimal), market-to-book ratio (decimal), CEO tenure (years, logarithmic), and the presence of a female CEO at any point in time over the sample period (dummy). All financial controls are lagged. The data range from 2004 to 2020.

**Figure 1** - The evolution of board gender diversity

**Figure 2** - The evolution of green buildings share




## Regression models

In order to investigate the effect of gender on risk management decisions associated with overconfidence, we regress the four risk proxies against the two measures of gender diversity, $Blau$ and $ln(Women)$. The former focuses on the diversity component of gender while the latter reflects the impact of the presence of women specifically. Importantly, we are interested in the interact between the two variables. We posit that the presence of a female CEO might not have as much impact on investment decisions if she is not supported by a gender diverse board and, inversely, that the positive effects of gender board diversity are reinforced when put into action by a female CEO. We also three different sets of OLS (Ordinary Least Squares) regressions, with increasingly more controls to test the robustness of the initial model. In all three models with control for firm fixed effects and property type fixed effects, with standard errors robust to heteroskedasticity and clustered by both firm and year. The equations are as follows:

$$(8.1)\ Risk_{i,t} = Female\_CEO_{i,t} + Gender_{i,t} + Female\_CEO_{i,t} * Gender_{i,t} + X_{i,t} + \varepsilon_{i,t}$$

$$(8.2)\ Risk_{i,t} = Female\_CEO_{i,t} + Gender_{i,t} + Female\_CEO_{i,t} * Gender_{i,t} + Y_{i,t} + \varepsilon_{i,t}$$

$$(8.3)\ Risk_{i,t} = Female\_CEO_{i,t} + Gender_{i,t} + Female\_CEO_{i,t} * Gender_{i,t} + Z_{i,t} + \varepsilon_{i,t}$$

Where $Risk$ is first proxied by $Green\_Share$, followed by $HHI\_Region$, $HHI\_Type$, and $Net\_Trading$. Similarly, $Gender$ is measured by either $Blau$ or $ln(Women)$. The control variables are denoted by the vector $X$, $Y$, or $Z$. In equation 8.1, $X$ includes the lagged logarithm of total assets, lagged debt-to-asset ratio, and lagged market-to-book ratio, as well as the logarithm of the CEO's tenure. In equation 8.2 we also interact the initial controls with $Female\_CEO$ to create vector $Y$. In equation 8.3, we further include $F\_CEO\_Period$ in vector $Z$ to control for the presence of a female CEO in any given sample year.

Given that investments in green buildings are considered less risky, we anticipate a positive relationship between $Green\_Share$ and $Gender$. In the context of REITs, geographical investment focus is generally viewed as a risk reduction measure. We therefore expect that $HHI\_Region$ will be positively related to $Gender$, though we do not anticipate any significant relationship with $HHI\_Type$ given the mixed results in the existing literature. Finally, since

overconfident investors tend to acquire more and sell less, we hypothesize a negative relationship between $Net\_Trading$ and $Gender$.

# Results and discussion

## Portfolio green share

Tables 2 and 3 show the regression results when employing $Green\_Share$ as the proxy for risk against the two measures of gender diversity, $Blau$ and $ln(Women)$, respectively. In both tables, columns (1) and (2) relate to equation 8.1, columns (3) and (4) to equation 8.2, and columns (5) and (6) to equation 8.3.

**Table 2** - Regression results: Blau diversity index and portfolio green share

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Female_CEO* | 74.236 | 115.723 | 76.376 | 131.596 | 78.84 | 132.625 |
| | [91.284] | [116.159] | [81.823] | [89.455] | [81.722] | [89.771] |
| *Blau* | 0.027 | 0.02 | 0.027 | 0.02 | 0.026 | 0.027 |
| | [0.027] | [0.028] | [0.027] | [0.028] | [0.029] | [0.030] |
| *Female_CEO * Blau* | | 0.550* | | 0.697* | | 0.807* |
| | | [0.310] | | [0.343] | | [0.420] |
| *ln(Total Assets)* | 0.009 | 0.009* | 0.008 | 0.009 | 0.009 | 0.008 |
| | [0.005] | [0.005] | [0.006] | [0.005] | [0.006] | [0.005] |
| *Debt_Ratio* | -0.064* | -0.064* | -0.061* | -0.062* | -0.063* | -0.062* |
| | [0.034] | [0.034] | [0.034] | [0.034] | [0.035] | [0.034] |
| *MtB_Ratio* | -0.016 | -0.017 | -0.016 | -0.016 | -0.016 | -0.016 |
| | [0.011] | [0.011] | [0.011] | [0.011] | [0.011] | [0.011] |
| *ln(Tenure)* | 1.739 | 1.784 | 1.701 | 1.793 | 1.684 | 1.774 |
| | [2.822] | [2.842] | [2.826] | [2.855] | [2.833] | [2.852] |
| *F_CEO_Period* | | | | | -0.019 | 0.014 |
| | | | | | [0.028] | [0.015] |
| *Female_CEO * ln(Tenure)* | -9.766 | -15.25 | -10.043 | -17.351 | -10.367 | -17.488 |
| | [12.004] | [15.284] | [10.764] | [11.781] | [10.750] | [11.823] |
| *Female_CEO * ln(Total Assets)* | | | 0.016 | 0.033 | 0.017 | 0.033 |
| | | | [0.032] | [0.030] | [0.032] | [0.030] |
| *Female_CEO * Debt_Ratio* | | | -0.204 | -0.234 | -0.203 | -0.232 |
| | | | [0.243] | [0.234] | [0.244] | [0.234] |
| *Female_CEO * MtB_Ratio* | | | -0.042 | -0.064 | -0.045 | -0.063 |
| | | | [0.075] | [0.057] | [0.074] | [0.057] |
| *F_CEO_Period * Blau* | | | | | 0.039 | -0.118 |
| | | | | | [0.081] | [0.092] |
| Constant | -13.189 | -13.531 | -12.896 | -13.596 | -12.766 | -13.453 |
| | [21.448] | [21.596] | [21.479] | [21.697] | [21.530] | [21.672] |
| Year-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 993 | 993 | 993 | 993 | 993 | 993 |
| Adjusted R-squared | 0.392 | 0.397 | 0.392 | 0.399 | 0.392 | 0.399 |

*Notes:* Robust standard errors are shown in brackets. Statistical significance is denoted by: *** p<0.01, ** p<0.05, * p<0.1

**Table 3** - Regression results: Number of female directors and portfolio green share

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Female_CEO* | 74.144 | 118.349 | 76.243 | 125.263 | 78.243 | 126.578 |
| | [90.194] | [86.151] | [81.215] | [73.597] | [79.899] | [73.532] |
| *ln(Women)* | 0.008 | 0.005 | 0.008 | 0.005 | 0.008 | 0.008 |
| | [0.010] | [0.010] | [0.010] | [0.010] | [0.010] | [0.010] |
| *Female_CEO * ln(Women)* | | 0.186* | | 0.209* | | 0.252* |
| | | [0.095] | | [0.098] | | [0.121] |
| *ln(Total Assets)* | | | | | -0.018 | 0.02 |
| | | | | | [0.025] | [0.016] |
| *Debt_Ratio* | 1.769 | 1.801 | 1.728 | 1.757 | 1.705 | 1.754 |
| | [2.826] | [2.853] | [2.831] | [2.853] | [2.837] | [2.851] |
| *MtB_Ratio* | 0.008 | 0.009* | 0.008 | 0.009 | 0.008 | 0.008 |
| | [0.005] | [0.005] | [0.006] | [0.005] | [0.006] | [0.005] |
| *ln(Tenure)* | -0.064* | -0.065* | -0.061* | -0.061* | -0.063* | -0.060* |
| | [0.034] | [0.034] | [0.034] | [0.034] | [0.035] | [0.034] |
| *F_CEO_Period* | -0.016 | -0.017 | -0.016 | -0.016 | -0.016 | -0.016 |
| | -0.011 | -0.011 | -0.011 | -0.011 | [0.011] | [0.011] |
| *Female_CEO * ln(Tenure)* | -9.754 | -15.595 | -10.025 | -16.502 | -10.287 | -16.678 |
| | [11.860] | [11.334] | [10.684] | [9.687] | [10.510] | [9.680] |
| *Female_CEO * ln(Total Assets)* | | | 0.016 | 0.023 | 0.016 | 0.023 |
| | | | [0.032] | [0.024] | [0.031] | [0.025] |
| *Female_CEO * Debt_Ratio* | | | -0.206 | -0.272 | -0.207 | -0.271 |
| | | | [0.242] | [0.225] | [0.242] | [0.226] |
| *Female_CEO * MtB_Ratio* | | | -0.042 | -0.063 | -0.044 | -0.062 |
| | | | [0.075] | [0.059] | [0.075] | [0.059] |
| *F_CEO_Period * ln(Women)* | | | | | 0.011 | -0.046 |
| | | | | | [0.021] | [0.029] |
| Constant | -13.415 | -13.655 | -13.101 | -13.326 | -12.93 | -13.298 |
| | [21.477] | [21.684] | [21.517] | [21.682] | [21.556] | [21.665] |
| Year-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 993 | 993 | 993 | 993 | 993 | 993 |
| Adjusted R-squared | 0.392 | 0.398 | 0.392 | 0.4 | 0.391 | 0.401 |

*Notes:* Robust standard errors are shown in brackets. Statistical significance is denoted by: *** p<0.01, ** p<0.05, * p<0.1

We find statistically significant results in all three models for the interaction between the presence of a female CEO and both the level of gender diversity and the number of women on the board. Consistent with the literature, notably Eichholtz et al. (2012), we find that women are more inclined than men to invest in green buildings, which are perceived as less risky by investors. Notably, we show that a 1% increase in the Blau diversity index is associated with an increase in portfolio green share of up to 0.81% when the CEO is a woman. Additionally, the lack of significance of the main effects confirms our hypothesis that neither a female CEO nor a gender diverse board cannot singlehandedly impact the greenness of their property portfolio. The combination of both, however, is enough to effect a significant change within the REIT's portfolio composition, which might be a reflection of a more progressive corporate culture. Indeed, responsible corporate practices such as investments in green buildings and gender diversity efforts are a reflection of deeper ESG integration within the corporate strategy. This could raise potential endogeneity issues, which we are able to eliminate here as our results remain robust to the inclusion of the $F\_CEO\_Period$ dummy.

## Diversification by geography and sector

Estimation results for geographical diversification are presented in a comparable fashion in Tables 4 and 5. Similarly to portfolio green share, we find statistical significance for the gender diversity interaction variable but not for the main effects. As shown in columns (4) and (6) of both tables, our results are robust to the addition of further control variables, and we maintain statistical significance below the 5% level when employing the number of women as the measure of gender diversity.

**Table 4** - Regression results: Blau diversity index and geographical diversification

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Female_CEO* | 9.042 | 83.526 | 49.008 | 146.724 | 88.967 | 141.375 |
| | [202.293] | [201.878] | [169.306] | [168.671] | [163.731] | [168.557] |
| *Blau* | -0.149 | -0.166 | -0.145 | -0.159 | -0.189 | -0.188 |
| | [0.127] | [0.128] | [0.129] | [0.129] | [0.133] | [0.134] |
| *Female_CEO * Blau* | | 1.130* | | 1.332** | | 0.841* |
| | | [0.569] | | [0.539] | | [0.420] |
| *ln(Total Assets)* | | | | | -0.11 | -0.077 |
| | | | | | [0.092] | [0.097] |
| *Debt_Ratio* | -8.959 | -8.872 | -8.869 | -8.692 | -8.862 | -8.735 |
| | [7.676] | [7.690] | [7.680] | [7.70] | [7.80] | [7.802] |
| *MtB_Ratio* | -0.039*** | -0.037** | -0.040*** | -0.039*** | -0.038** | -0.038** |
| | [0.013] | [0.013] | [0.013] | [0.013] | [0.013] | [0.013] |
| *ln(Tenure)* | -0.179* | -0.178* | -0.182* | -0.184* | -0.187* | -0.186* |
| | [0.096] | [0.096] | [0.097] | [0.097] | [0.099] | [0.099] |
| *F_CEO_Period* | 0.062 | 0.061 | 0.059 | 0.06 | 0.059 | 0.06 |
| | -0.045 | -0.046 | -0.048 | -0.048 | [0.048] | [0.048] |
| *Female_CEO * ln(Tenure)* | -1.19 | -11.042 | -6.486 | -19.42 | -11.764 | -18.705 |
| | [26.603] | [26.549] | [22.262] | [22.186] | [21.534] | [22.172] |
| *Female_CEO * ln(Total Assets)* | | | 0.014 | 0.043 | 0.027 | 0.042 |
| | | | [0.038] | [0.039] | [0.040] | [0.039] |
| *Female_CEO * Debt_Ratio* | | | 0.125 | 0.075 | 0.094 | 0.068 |
| | | | [0.334] | [0.280] | [0.301] | [0.275] |
| *Female_CEO * MtB_Ratio* | | | 0.087 | 0.045 | 0.058 | 0.039 |
| | | | [0.157] | [0.122] | [0.134] | [0.119] |
| *F_CEO_Period * Blau* | | | | | 0.692* | 0.529 |
| | | | | | [0.347] | [0.339] |
| Constant | 68.759 | 68.09 | 68.083 | 66.738 | 68.029 | 67.063 |
| | [58.368] | [58.470] | [58.395] | [58.546] | [59.307] | [59.326] |
| Year-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 893 | 893 | 893 | 893 | 893 | 893 |
| Adjusted R-squared | 0.329 | 0.332 | 0.328 | 0.331 | 0.332 | 0.333 |

*Notes:* Robust standard errors are shown in brackets. Statistical significance is denoted by: *** p<0.01, ** p<0.05, * p<0.1

**Table 5** - Regression results: Number of female directors and geographical diversification

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Female_CEO* | 10.347 | 98.459 | 51.22 | 124.868 | 77.394 | 120.263 |
| | [206.707] | [161.744] | [172.808] | [150.062] | [154.805] | [149.102] |
| *ln(Women)* | -0.051 | -0.056 | -0.049 | -0.055 | -0.065 | -0.065 |
| | [0.041] | [0.041] | [0.041] | [0.041] | [0.042] | [0.042] |
| *Female_CEO * ln(Women)* | | 0.470** | | 0.455** | | 0.312** |
| | | [0.164] | | [0.157] | | [0.112] |
| *ln(Total Assets)* | | | | | -0.112 | -0.069 |
| | | | | | [0.097] | [0.099] |
| *Debt_Ratio* | -9.04 | -8.909 | -8.939 | -8.845 | -9.038 | -8.923 |
| | [7.665] | [7.675] | [7.668] | [7.685] | [7.801] | [7.789] |
| *MtB_Ratio* | -0.037** | -0.036** | -0.038** | -0.037** | -0.036** | -0.036** |
| | [0.013] | [0.013] | [0.013] | [0.013] | [0.014] | [0.014] |
| *ln(Tenure)* | -0.180* | -0.181* | -0.184* | -0.183* | -0.190* | -0.186* |
| | [0.096] | [0.095] | [0.097] | [0.096] | [0.099] | [0.099] |
| *F_CEO_Period* | 0.063 | 0.062 | 0.061 | 0.061 | 0.061 | 0.061 |
| | -0.046 | -0.046 | -0.048 | -0.048 | [0.049] | [0.049] |
| *Female_CEO * ln(Tenure)* | -1.362 | -13.018 | -6.779 | -16.516 | -10.227 | -15.9 |
| | [27.184] | [21.272] | [22.722] | [19.745] | [20.360] | [19.617] |
| *Female_CEO * ln(Total Assets)* | | | 0.016 | 0.018 | 0.015 | 0.017 |
| | | | [0.039] | [0.030] | [0.034] | [0.029] |
| *Female_CEO * Debt_Ratio* | | | 0.133 | 0.025 | 0.084 | 0.022 |
| | | | [0.340] | [0.243] | [0.290] | [0.238] |
| *Female_CEO * MtB_Ratio* | | | 0.087 | 0.04 | 0.059 | 0.035 |
| | | | [0.157] | [0.115] | [0.132] | [0.113] |
| *F_CEO_Period * ln(Women)* | | | | | 0.218* | 0.153 |
| | | | | | [0.115] | [0.108] |
| Constant | 69.362 | 68.364 | 68.607 | 67.885 | 69.351 | 68.475 |
| | [58.284] | [58.359] | [58.307] | [58.434] | [59.315] | [59.224] |
| Year-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 893 | 893 | 893 | 893 | 893 | 893 |
| Adjusted R-squared | 0.329 | 0.335 | 0.328 | 0.333 | 0.333 | 0.334 |

*Notes:* Robust standard errors are shown in brackets. Statistical significance is denoted by: *** p<0.01, ** p<0.05, * p<0.1

Consistent with our hypothesis and with the existing research, we establish a positive relationship between gender and geographical concentration. Given the risk-reduction attributes of geographical focus in the context of REITs, these results confirm that women tend to be more risk averse than men in their corporate investment decisions. Specifically, we find that when there is a female CEO, a 1% increase in the logarithm of the number of female directors leads to a 0.31% to 0.47% increase in the regional HHI. For a 1% increase in the Blau diversity index combined with the presence of a female CEO, the increase in geographical focus ranges between 0.84% and 1.33%. We also show that the total assets and debt ratio are inversely related to the HHI, indicating that investment capital and borrowing capacity are necessary for REITs to pursue geographical diversification.

Tables 6 and 7 present the same analysis applied to property type diversification. The results do not show any statistically significant effect of the two gender diversity variables on the sectoral diversification of REITs. This is consistent with Min and Cheok. (2011), who also report no significant effects of diversification by property type on risk premiums. The sectoral diversification of REITs does not appear to be related to any of the financial controls either.

**Table 6** - Regression results: Blau diversity index and property type diversification

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Female_CEO* | -62.54 | -48.134 | -123.252 | -115.72 | -122.811 | -119.115 |
| | [91.812] | [81.466] | [124.665] | [128.050] | [134.350] | [124.954] |
| *Blau* | 0.043 | 0.04 | 0.038 | 0.037 | 0.051 | 0.051 |
| | [0.094] | [0.097] | [0.097] | [0.098] | [0.10] | [0.10] |
| *Female_CEO * Blau* | | 0.219 | | 0.103 | | 0.059 |
| | | [0.270] | | [0.239] | | [0.427] |
| *ln(Total Assets)* | | | | | -0.116 | -0.114 |
| | | | | | [0.071] | [0.078] |
| *Debt_Ratio* | -6.692 | -6.675 | -6.767 | -6.754 | -7.017 | -7.008 |
| | [6.265] | [6.280] | [6.286] | [6.301] | [6.386] | [6.398] |
| *MtB_Ratio* | 0.009 | 0.01 | 0.011 | 0.011 | 0.012 | 0.012 |
| | [0.011] | [0.011] | [0.012] | [0.012] | [0.012] | [0.012] |
| *ln(Tenure)* | -0.084 | -0.084 | -0.088 | -0.088 | -0.103 | -0.103 |
| | [0.082] | [0.082] | [0.085] | [0.085] | [0.081] | [0.081] |
| *F_CEO_Period* | 0.044 | 0.044 | 0.046 | 0.046 | 0.042 | 0.042 |
| | -0.039 | -0.039 | -0.039 | -0.039 | [0.039] | [0.039] |
| *Female_CEO * ln(Tenure)* | 8.224 | 6.319 | 16.251 | 15.255 | 16.205 | 15.716 |
| | [12.073] | [10.707] | [16.412] | [16.859] | [17.696] | [16.452] |
| *Female_CEO * ln(Total Assets)* | | | -0.053 | -0.051 | -0.053 | -0.052 |
| | | | [0.031] | [0.031] | [0.035] | [0.032] |
| *Female_CEO * Debt_Ratio* | | | 0.257 | 0.253 | 0.282 | 0.28 |
| | | | [0.187] | [0.184] | [0.197] | [0.195] |
| *Female_CEO * MtB_Ratio* | | | -0.019 | -0.023 | -0.026 | -0.028 |
| | | | [0.065] | [0.064] | [0.068] | [0.066] |
| *F_CEO_Period * Blau* | | | | | 0.042 | 0.031 |
| | | | | | [0.235] | [0.30] |
| Constant | 51.577 | 51.447 | 52.137 | 52.034 | 54.041 | 53.972 |
| | [47.608] | [47.726] | [47.772] | [47.887] | [48.533] | [48.620] |
| Year-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 893 | 893 | 893 | 893 | 893 | 893 |
| Adjusted R-squared | 0.257 | 0.256 | 0.257 | 0.256 | 0.264 | 0.263 |

*Notes:* Robust standard errors are shown in brackets. Statistical significance is denoted by: *** p<0.01, ** p<0.05, * p<0.1

**Table 7** - Regression results: Number of female directors and property type diversification

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Female_CEO* | -62.484 | -75.25 | -122.828 | -132.663 | -130.288 | -133.799 |
| | [91.693] | [107.550] | [123.443] | [137.024] | [132.956] | [134.419] |
| *ln(Women)* | 0.02 | 0.021 | 0.019 | 0.02 | 0.027 | 0.027 |
| | [0.031] | [0.031] | [0.031] | [0.031] | [0.032] | [0.032] |
| *Female_CEO * ln(Women)* | | -0.068 | | -0.061 | | -0.026 |
| | | [0.107] | | [0.114] | | [0.120] |
| *ln(Total Assets)* | | | | | -0.08 | -0.084 |
| | | | | | [0.081] | [0.086] |
| *Debt_Ratio* | -6.669 | -6.688 | -6.747 | -6.76 | -6.955 | -6.964 |
| | [6.244] | [6.234] | [6.264] | [6.262] | [6.325] | [6.333] |
| *MtB_Ratio* | 0.008 | 0.008 | 0.01 | 0.01 | 0.01 | 0.01 |
| | [0.011] | [0.011] | [0.012] | [0.012] | [0.012] | [0.012] |
| *ln(Tenure)* | -0.084 | -0.084 | -0.088 | -0.088 | -0.1 | -0.1 |
| | [0.082] | [0.082] | [0.084] | [0.084] | [0.081] | [0.081] |
| *F_CEO_Period* | 0.043 | 0.043 | 0.045 | 0.045 | 0.042 | 0.042 |
| | -0.039 | -0.039 | -0.039 | -0.039 | [0.039] | [0.039] |
| *Female_CEO * ln(Tenure)* | 8.217 | 9.905 | 16.195 | 17.496 | 17.19 | 17.654 |
| | [12.057] | [14.154] | [16.251] | [18.044] | [17.507] | [17.70] |
| *Female_CEO * ln(Total Assets)* | | | -0.053 | -0.053 | -0.054 | -0.054 |
| | | | [0.032] | [0.031] | [0.033] | [0.032] |
| *Female_CEO * Debt_Ratio* | | | 0.255 | 0.27 | 0.29 | 0.295 |
| | | | [0.185] | [0.193] | [0.203] | [0.205] |
| *Female_CEO * MtB_Ratio* | | | -0.019 | -0.013 | -0.018 | -0.017 |
| | | | [0.065] | [0.072] | [0.073] | [0.075] |
| *F_CEO_Period * ln(Women)* | | | | | -0.045 | -0.04 |
| | | | | | [0.101] | [0.109] |
| Constant | 51.415 | 51.559 | 51.995 | 52.091 | 53.58 | 53.652 |
| | [47.451] | [47.378] | [47.604] | [47.591] | [48.064] | [48.125] |
| Year-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 893 | 893 | 893 | 893 | 893 | 893 |
| Adjusted R-squared | 0.257 | 0.257 | 0.257 | 0.257 | 0.265 | 0.264 |

*Notes:* Robust standard errors are shown in brackets. Statistical significance is denoted by: *** p<0.01, ** p<0.05, * p<0.1

## Net trading activity

Finally, we regress $Net\_Trading$ against our measures of gender diversity and present the results in Table 8 and 9. Looking at columns (2) and (4) in Table 8, we find a negative correlation between the gender interaction variable and net trading activity at the 5% significance level when using the Blau index as the measure for gender diversity. As shown in column (6), however, we lose statistical significance when we incorporate the $F\_CEO\_Period$ dummy. When gender is instead defined by the number of female directors, the interaction with the presence of a female CEO remains robust to all three models, with statistical significance reaching the 1% level for equations 8.2 and 8.3.

**Table 8** - Regression results: Blau diversity index and net trading activity

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Female_CEO* | -148.827 | -228.401* | -71.023 | -131.251 | -87.932 | -129.569 |
| | [166.505] | [125.024] | [165.426] | [155.063] | [158.890] | [155.309] |
| *Blau* | -0.054 | -0.036 | -0.037 | -0.028 | -0.019 | -0.019 |
| | [0.061] | [0.060] | [0.060] | [0.060] | [0.061] | [0.061] |
| *Female_CEO * Blau* | | -1.208** | | -0.821** | | -0.669 |
| | | [0.520] | | [0.353] | | [0.384] |
| *ln(Total Assets)* | | | | | 0.051 | 0.024 |
| | | | | | [0.081] | [0.085] |
| *Debt_Ratio* | -7.106 | -7.199 | -6.883 | -6.992 | -6.876 | -6.977 |
| | [4.242] | [4.202] | [4.248] | [4.236] | [4.223] | [4.218] |
| *MtB_Ratio* | -0.039*** | -0.040*** | -0.043*** | -0.043*** | -0.044*** | -0.044*** |
| | [0.012] | [0.012] | [0.012] | [0.011] | [0.011] | [0.011] |
| *ln(Tenure)* | -0.02 | -0.021 | -0.023 | -0.022 | -0.021 | -0.022 |
| | [0.067] | [0.066] | [0.071] | [0.072] | [0.073] | [0.074] |
| *F_CEO_Period* | 0.011 | 0.013 | 0.014 | 0.014 | 0.015 | 0.014 |
| | -0.022 | -0.023 | -0.028 | -0.028 | [0.028] | [0.027] |
| *Female_CEO * ln(Tenure)* | 19.572 | 30.097* | 9.264 | 17.236 | 11.497 | 17.011 |
| | [21.903] | [16.441] | [21.791] | [20.415] | [20.928] | [20.450] |
| *Female_CEO * ln(Total Assets)* | | | 0.117*** | 0.099*** | 0.112*** | 0.100** |
| | | | [0.036] | [0.033] | [0.034] | [0.034] |
| *Female_CEO * Debt_Ratio* | | | -0.413* | -0.383* | -0.402** | -0.381* |
| | | | [0.197] | [0.187] | [0.180] | [0.182] |
| *Female_CEO * MtB_Ratio* | | | -0.092** | -0.066 | -0.079* | -0.064 |
| | | | [0.039] | [0.050] | [0.044] | [0.053] |
| *F_CEO_Period * Blau* | | | | | -0.294 | -0.164 |
| | | | | | [0.276] | [0.296] |
| Constant | 54.373 | 55.088 | 52.707 | 53.536 | 52.655 | 53.423 |
| | [32.298] | [31.996] | [32.341] | [32.253] | [32.150] | [32.116] |
| Year-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 893 | 893 | 893 | 893 | 893 | 893 |
| Adjusted R-squared | 0.089 | 0.096 | 0.1 | 0.102 | 0.1 | 0.1 |

*Notes:* Robust standard errors are shown in brackets. Statistical significance is denoted by: *** p<0.01, ** p<0.05, * p<0.1

Based on our results in Table 9, we find that in the presence of a female CEO, a 1% increase in the logarithm of the number of women on the board decreases net investment trading activity by 0.40% to 0.43% while a 1% increase in the Blau index leads to a reduction net trading ranging between -0.82% and -1.21%. Taken together, these results confirm the widely documented claim that men are more overconfident than women and that overconfidence can be proxied by net investment trading activity. Importantly, we support the findings of Eichholtz and Yönder (2015) with regards the specific context of managerial overconfidence in REITs. Additionally, the coefficients for total assets show significance at the 1% level in all three models and both measures of gender diversity. The negative relationship between the REIT portfolios' total assets and net trading activity suggests that, as REITs grow, they tend to acquire more properties while making fewer dispositions. This might be due to empire building behaviour, especially when combined with overconfident CEOs and directors.

**Table 9** - Regression results: Number of female directors and net trading activity

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Female_CEO* | -148.333 | -227.038 | -70.62 | -140.252 | -84.299 | -139.334 |
| | [167.587] | [165.176] | [163.342] | [109.786] | [141.770] | [109.859] |
| *ln(Women)* | -0.018 | -0.013 | -0.013 | -0.008 | -0.005 | -0.006 |
| | [0.020] | [0.019] | [0.019] | [0.018] | [0.019] | [0.019] |
| *Female_CEO * ln(Women)* | | -0.420* | | -0.430*** | | -0.400*** |
| | | [0.236] | | [0.127] | | [0.122] |
| *ln(Total Assets)* | | | | | 0.067 | 0.013 |
| | | | | | [0.084] | [0.085] |
| *Debt_Ratio* | -7.135 | -7.251 | -6.901 | -6.99 | -6.83 | -6.978 |
| | [4.244] | [4.187] | [4.252] | [4.207] | [4.213] | [4.188] |
| *MtB_Ratio* | -0.038** | -0.039*** | -0.042*** | -0.044*** | -0.044*** | -0.044*** |
| | [0.013] | [0.012] | [0.012] | [0.012] | [0.012] | [0.012] |
| *ln(Tenure)* | -0.021 | -0.02 | -0.024 | -0.025 | -0.02 | -0.025 |
| | [0.067] | [0.066] | [0.071] | [0.074] | [0.073] | [0.075] |
| *F_CEO_Period* | 0.012 | 0.013 | 0.015 | 0.015 | 0.015 | 0.014 |
| | -0.022 | -0.022 | -0.028 | -0.024 | [0.027] | [0.024] |
| *Female_CEO * ln(Tenure)* | 19.507 | 29.918 | 9.21 | 18.417 | 11.011 | 18.294 |
| | [22.045] | [21.730] | [21.516] | [14.442] | [18.673] | [14.453] |
| *Female_CEO * ln(Total Assets)* | | | 0.117*** | 0.115*** | 0.118*** | 0.115*** |
| | | | [0.035] | [0.020] | [0.030] | [0.020] |
| *Female_CEO * Debt_Ratio* | | | -0.411* | -0.309* | -0.388** | -0.308 |
| | | | [0.197] | [0.164] | [0.167] | [0.180] |
| *Female_CEO * MtB_Ratio* | | | -0.092** | -0.048 | -0.076 | -0.047 |
| | | | [0.039] | [0.065] | [0.047] | [0.068] |
| *F_CEO_Period * ln(Women)* | | | | | -0.115 | -0.032 |
| | | | | | [0.097] | [0.088] |
| Constant | 54.59 | 55.481 | 52.841 | 53.524 | 52.307 | 53.432 |
| | [32.315] | [31.882] | [32.377] | [32.030] | [32.081] | [31.891] |
| Year-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm-fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 893 | 893 | 893 | 893 | 893 | 893 |
| Adjusted R-squared | 0.089 | 0.098 | 0.1 | 0.109 | 0.101 | 0.107 |

*Notes:* Robust standard errors are shown in brackets. Statistical significance is denoted by: *** p<0.01, ** p<0.05, * p<0.1

# Conclusion

While gender differences in risk preferences as well as the benefits of gender diversity have been extensively documented, there is currently no research that combines the two concepts to measure managerial overconfidence in the context of REITs. Such an analysis is particularly relevant today, as corporations are increasingly recognizing the value of women at the executive level while though there is still room for improvement. Additionally, given the material impact of the real estate sector on climate change, the topic of green buildings has attracted growing academic and investor attention over recent years. To this end, REITs offer unique advantages in terms of transparency and granularity that allow us to conduct various analyses that would not be possible for other types of corporations.

In this paper, we mainly build on Eichholtz et al. (2012) and Eichholtz and Yönder (2015) and investigate the impact of female directors and board gender diversity on the risk management decisions of 158 U.S. REITs over the 2004 to 2018 period. We assess the benefits of gender

diversity in two different ways to reflect both dimensions, first measuring the impact of diversity itself expressed by the Blau diversity index and then studying the gender effect through the number of female directors on the board. We create four different proxies for risk, namely the portfolio's green share as well as its level of geographical diversification, sectoral diversification, and net property trading. Using area-weighted REIT data at the property level on an annual basis, we construct two HHIs based on region and property type, respectively, to create the two diversification variables. We then compute the REITs' net level of trading activity by subtracting dispositions from acquisitions, weighted by total portfolio square footage. Finally, we match the property-level data with green building certification data, where a property is considered green if it is certified by either LEED or Energy Star.

We first document that board gender diversity has steadily increased over the 2004-2018 period for our sample of U.S. REITs, indicating an optimistic trend towards gender equality in the corporate world. Likewise, we show that the share of green properties within the REIT portfolios has also been on the rise during the period, sitting at close to 8% in the most recent years, which is also encouraging. Most importantly, we contribute to the literature by showing that gender diversity does have an impact on investment risk management decisions, but that the combination of both a female CEO and a sufficient number of female directors, whether in relative or absolute terms, is necessary to significantly influence these decisions. Consistent with the existing body of research, we find that women are less overconfident than men, even in a managerial context. Our interactive measure of gender diversity is positively related to investments in green buildings and to geographical investment focus, which are both perceived as less risky. We also find a negative relationship with net property trading, one of the most commonly accepted measures of investor overconfidence. As expected, we do not uncover any relationship between gender diversity and diversification by property type. Our results are generally robust to heteroskedasticity and endogeneity, although there could be remaining limitations that warrant further research.

# References


Banahan, C., & Hasson, G. (2018). Across the board improvements: gender diversity and ESG performance. In *Harvard Law School Forum on Corporate Governance and Financial Regulation (6 September)*.

Barber, B. M., & Odean, T. (2000). Trading is hazardous to your wealth: The common stock investment performance of individual investors. *The journal of Finance*, *55*(2), 773-806.

Barber, B. M., & Odean, T. (2001). Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics*, *116*(1), 261–292.

Bengtsson, C., Persson, M., & Willenhag, P. (2005). Gender and overconfidence. *Economics Letters*, *86*(2), 199–203.

Bosteels, T., & Sweatman, P. (2016). Sustainable Real Estate Investment–Implementing the Paris Climate Agreement: An Action Framework. *A Joint Report of the Climate Strategy and Partners (Investor Group on Climate Change, IIGCC, Investor Network on Climate Risk, UPEP FI, PRI and RICS)*.

Bourke, J., & Espedido, A. (2019). Why inclusive leaders are good for organizations, and how to become one. *Harvard Business Review Digital Articles*, *1*(1), 2-5.

Campbell, K., & Mínguez-Vera, A. (2008). Gender diversity in the boardroom and firm financial performance. *Journal of Business Ethics*, *83*(3), 435–451.

Carlson, S. S. (2012). Women Directors: A Term of Art Showcasing the Need for Meaningful Gender Diversity on Corporate Boards Corporate Boards. *Seattle Journal for Social Justice*, *11*(1), 337–391.

Catalyst. (2004). *The bottom line: Connecting corporate performance and gender diversity*. Catalyst.

Catalyst. (2020a). *Why Diversity and Inclusion Matter*. Catalyst.

Catalyst. (2020b). *Why Diversity and Inclusion Matter: Financial Performance (Appendix)*. Catalyst.

Ceseña, N., Erb, M., Frauenheim, E., & Kazi, C. (2020). Hidden Pieces of the D&I Puzzle. *Great Place to Work.*

Chen, J., Leung, W. S., Song, W., & Goergen, M. (2019a). When women are on boards, male CEOs are less overconfident.

Chen, J., Leung, W. S., Song, W., & Goergen, M. (2019b). Why female board representation matters: The role of female directors in reducing male CEO overconfidence. *Journal of Empirical Finance*, *53*, 70-90.

Christiansen, L. E., Lin, H., Pereira, M. J., Topalova, P., & Turk, R. (2016). *Gender diversity in senior positions and firm performance: Evidence from Europe*. International Monetary Fund.

Chuang, W. I., & Lee, B. S. (2006). An empirical evaluation of the overconfidence hypothesis. *Journal of Banking & Finance*, *30*(9), 2489-2515.

Conyon, M. J., & He, L. (2017). Firm performance and boardroom gender diversity: A quantile regression approach. *Journal of Business Research*, *79*, 198-211.

Deaux, K., & Farris, E. (1977). Attributing causes for one's own performance: The effects of sex, norms, and outcome. *Journal of Research in Personality*, *11*(1), 59–72.

Eastman, M. T., & Seretis, P. (2018). Women on boards and the human capital connection. *MSCI Research Insight*.

Eichholtz, P., & Yönder, E. (2015). CEO Overconfidence, REIT Investment Activity and Performance. *Real Estate Economics*, *43*(1), 139–162.

Eichholtz, P., Kok, N., & Quigley, J. M. (2013). The economics of green building. *Review of Economics and Statistics*, *95*(1), 50-63.

Eichholtz, P., Kok, N., & Yönder, E. (2012). Portfolio greenness and the financial performance of REITs. *Journal of International Money and Finance*, *31*(7), 1911-1929.

Fan, Y., Jiang, Y., Zhang, X., & Zhou, Y. (2019). Women on boards and bank earnings management: From zero to hero. *Journal of Banking & Finance*, *107*, 105607.

Frutig, B. S., & Das, P. (2020). Does Geographic Focus Reduce Systematic Risk in Hotel REITs?. *Journal of Hospitality Financial Management*, *28*(1), 2.

Gaither, S. E., Apfelbaum, E. P., Birnbaum, H. J., Babbitt, L. G., & Sommers, S. R. (2018). Mere membership in racially diverse groups reduces conformity. *Social Psychological and Personality Science*, *9*(4), 402-410.

Herfindahl, O. C. (1950). Concentration in the steel industry. 1950. *Columbia University*.

Hirschman, A. O. (1964). The paternity of an Index, *American Economic Review*.

Hirshleifer, D., & Luo, G. Y. (2001). On the survival of overconfident traders in a competitive securities market. *Journal of Financial Markets*, *4*(1), 73-84.

Homan, A. C. (2019). Dealing with diversity in workgroups: Preventing problems and promoting potential. *Social and Personality Psychology Compass*, *13*(5), e12465.

International Labour Organization (2019). *Women in business and management: the business case for change.* ILO – Geneva.

Kersley, R., Klerk, E., Boussie, A., Sezer Longworth, B., Anamootoo Natzkoff, J., & Ramji, D. (2019). The CS Gender 3000 in 2019: the changing face of companies. *Credit Suisse Research Institute, October 10, 2019.*

Lai, K. M., Srinidhi, B., Gul, F. A., & Tsui, J. S. (2017). Board gender diversity, auditor fees, and auditor choice. *Contemporary Accounting Research*, *34*(3), 1681-1714.

Lee, H. W., Choi, J. N., & Kim, S. (2018). Does gender diversity help teams constructively manage status conflict? An evolutionary perspective of status conflict, team psychological safety, and team creativity. *Organizational Behavior and Human Decision Processes*, *144*, 187-199.

Lenney, E. (1977). Women's self-confidence in achievement settings. *Psychological Bulletin*, *84*(1), 1–13.

Levi, M., Li, K., & Zhang, F. (2014). Director gender and mergers and acquisitions. *Journal of Corporate Finance*, *28*, 185-200.

Lewellen, W. G., Lease, R. C., & Schlarbaum, G. G. (1977). Patterns of Investment Strategy and Behavior Among Individual Investors. *The Journal of Business*, *50*(3), 296–333.

Loop, P., & DeNicola, P. (2019). You've committed to increasing gender diversity on your board. Here's how to make it happen. *Harvard Business Review, Jan/Feb 2019*.

Lorenzo, R., Voigt, N., Schetelig, K., Zawadzki, A., Welpe, I., & Brosi, P. (2017). The mix that matters: Innovation through diversity. *The Boston Consulting Group*, *26*.

Lundeberg, M. A., Fox, P. W., & Punćochaŕ, J. (1994). Highly Confident but Wrong: Gender Differences and Similarities in Confidence Judgments. *Journal of Educational Psychology*, *86*(1), 114–121.

Madera, J. M., Ng, L., Sundermann, J. M., & Hebl, M. (2019). Top management gender diversity and organizational attraction: When and why it matters. *Archives of Scientific Psychology*, *7*(1), 90.

Malmendier, U., & Tate, G. (2005). CEO overconfidence and corporate investment. *The journal of finance*, *60*(6), 2661-2700.

Maurer, C. C., & Qureshi, I. (2021). Not just good for her: A temporal analysis of the dynamic relationship between representation of women and collective employee turnover. *Organization Studies*, *42*(1), 85-107.

McCallaghan, S., Jackson, L. T., & Heyns, M. M. (2019). Examining the mediating effect of diversity climate on the relationship between destructive leadership and employee attitudes. *Journal of Psychology in Africa*, *29*(6), 563-569.

Min, S., & Cheok, C. (2011). *Diversification as a Value-Adding Strategy for Asian REITs : A Myth or Reality ? 14*(2), 184–207.

Morgan Stanley, *Rise of the SHEconomy*, September 23, 2019.

Odean, T. (1998). Volume, volatility, price, and profit when all traders are above average. *Journal of Finance*, *53*(6), 1887–1934.

Perry, E. L., & Li, A. (2019). Diversity climate in organizations. In *Oxford Research Encyclopedia of Business and Management*.

Prince, M. (1993). Women, men, and money styles. *Journal of Economic Psychology*, *14*(1), 175–182.

Rabl, T., del Carmen Triana, M., Byun, S. Y., & Bosch, L. (2020). Diversity management efforts as an ethical responsibility: How employees' perceptions of an organizational integration and learning approach to diversity affect employee behavior. *Journal of Business Ethics*, *161*(3), 531-550.

Reynolds, A., & Lewis, D. (2017). Teams solve problems faster when they're more cognitively diverse. *Harvard Business Review*, *30*.

Sakunasingha, Benjalux, Pornsit Jiraporn, and Ali Uyar. "Which CSR activities are more consequential? Evidence from the Great Recession." *Finance Research Letters* 27 (2018): 161-168.

Segal, T. (2021). *Diversification – What is Diversification?*. Investopedia. Available at https://www.investopedia.com/terms/d/diversification.asp

Shin, Y. Z., Chang, J. Y., Jeon, K., & Kim, H. (2020). Female directors on the board and investment efficiency: evidence from Korea. *Asian Business & Management*, *19*(4), 438-479.

Simpson, E. H. (1949). Measurement of diversity. *nature*, *163*(4148), 688-688.

Stirling, A. (1998). On the economics and analysis of diversity. *Science Policy Research Unit (SPRU), Electronic Working Papers Series, Paper*, *28*, 1-156.

Stuart, S. (2019). The US board index. *New York: Spencer Stuart*.

Wahid, A. S. (2019). The effects and the mechanisms of board gender diversity: Evidence from financial manipulation. *Journal of Business Ethics*, *159*(3), 705-725.

Warner, J., & Corley, D. (2017). The women's leadership gap. *Center for American Progress*, *21*.

Zhang, L. (2020). An institutional approach to gender diversity and firm performance. *Organization Science*, *31*(2), 439-457.