

Stock Market Reaction to Female CEO Nominations: Is the Market Gendered?

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Abstract

Stock markets react negatively to the nomination of female CEOs. Recent research has argued that this may reflect the investors' negative perception about female leadership and media reporting that is biased against women. In this paper, we propose a new explanation based on the hypothesis that the market is 'gendered'. As female and male market participants may exhibit differences in preferences and in biases towards gender, gender diversity in the financial sector potentially impacts the market outcomes. To test this hypothesis, we run a simulation-based lab experiment in which female and male participants trade stocks of a company in response to the nomination of its future CEO, who could be either a man or a woman. We find that when a female CEO is appointed, the female participants' perception is positive (they buy stocks), while the male participants' perception is negative (they sell stocks). The opposite result holds when a male CEO is appointed. We interpret our findings drawing from homophily, entitativity and expectation theories. The policy implication of our study is that the gender issue is not only an issue reflected at the corporate level in the need to nominate more female CEOs but also an issue at the financial industry level related to the need to increase gender diversity by attracting more women in investment occupations; finally it is an issue at the societal level related to the need to change individual and collective stereotypes about female leadership.

Keywords: CEO nomination, gender diversity, gender stereotypes, entitativity, homophily.

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INTRODUCTION

Stock markets react more negatively following the appointment of a female CEO than following that of a male CEO (Lee and James, 2007). This phenomenon is important for both corporations and society at large. At the corporate level, if they anticipate a negative market reaction, firms may be reluctant to appoint otherwise talented women. At the societal level, barriers to females at the top of the corporate ladder may result in higher overall gender inequality, inefficient talent allocation and lower economic growth (Elborgh-Woytek *et al.*, 2013; Ferrant and Kolev, 2016).

Why do stock markets react negatively to the appointment of a female CEO? Regarding the characteristics of female top executives and the performance of female-led firms, the market reaction may reflect negative perceptions based on gender differences in cognitive and noncognitive skills. Regarding cognitive skills, women have recently reversed the gender gap in educational attainment and have significantly narrowed the gender gap in years of professional experience (Blau and Khan, 2017), suggesting that cognitive differences are not a plausible explanation. Regarding noncognitive skills, recent research has documented gender differences in risk-aversion (Crozon and Gneezy, 2009), overconfidence and optimism (Huang and Kisgen, 2013), taste for competition (Niederle and Vesterlund, 2011) and bargaining styles (Card, Cardoso and Kline, 2016).

The negative market reaction may also reflect gender biases in the way the media reports CEO nominations. These biases can contribute to create or reinforce negative stereotypes about female leadership. Lee and James (2007) investigate how press articles may influence the investors' reaction by shaping their perception and by contributing to reinforce existing gender stereotypes. Dixon-Fowler, Ellstrand and Johnson (2013) also show that media reporting of a newly appointed CEO depends on the CEO's gender.

A reason that has been overlooked by existing research is that the negative stock market

reaction to a female CEO appointment may be due to a lack of gender diversity among stock market participants. The degree of gender diversity may influence the stock market reaction to gender-related news because female and male participants may exhibit differences in preferences and in biases towards gender. With respect to the gender diversity of market participants, occupations in the financial sector attract few women. For example, women represent only 16% of Chartered Financial Analysts (CFAs) in the US, and female leadership across major US banks is low (Mattia, 2018). With respect to gender differences, existing research documents differences in the behavior and performance of female and male traders, fund managers and fundraisers (Eckel and Fullburn, 2015). Following the appointment of a female CEO, markets may react negatively because of the trading behavior of investors that hold stereotypes against female CEOs. The extent to which this is the case may depend on the gender of investors. However, so far, in explaining the negative stock market reaction to female CEO appointments, research has not studied the role of the market participants' biases according to their own gender. We study the role played by gender diversity in explaining the stock market reaction to the appointment of a female or male CEO. Our contribution is to propose a new explanation based on the hypothesis that the market is 'gendered'. Importantly, diversity plays a role because female and male participants may exhibit differences in preferences and in biases towards gender.

To test our hypothesis that the market is 'gendered', we design a simulation-based lab experiment in which in response to news, female and male participants buy and sell stocks of a company. We focus on a particular event: the nomination of the new CEO, who could be either a man or a woman. We adopt a **two-dimensional approach to gender**: we study both the gender of the CEO *and* the gender of market participants. Using experimental simulations in a controlled environment, following the CEO appointment, we analyze the market reaction according to the gender of the CEO and, crucially, according to the gender of the market participants. On the market participants' side, an experimental approach allows us to have a gender-balanced

composition of participants and to precisely map the participant's gender to his or her trading activity during the simulation. On the CEO side, the design of our experiment allows us to balance the proportion of male/female CEOs. Thanks to this experimental approach, we can address the previous empirical studies' statistical problems due to the scarcity of female CEOs in existing firms (less than five percent of Fortune 500 firms are led by female CEOs). We also remedy the absence of information problem regarding the gender composition on the investors' side, therefore enabling us to explore the impact of the gender diversity (or the lack of) of the market.

More specifically, we build a simulation-based lab experiment where participants trade their portfolio (cash and stocks) on a company and react to the news flow, which is a series of events about the company that may unfold during the day. Among these events, the focus of this research is on the following gender-related event: the announcement of the next CEO, who in the simulations, may be either a man or a woman. By randomizing the CEO gender at the launch of the simulation, following the CEO announcement, we can identify the participants' trading reactions according to the CEO gender. The participants' trading decision to buy or sell stocks signals their beliefs or expectations regarding the new CEO's impact on future firm performance. If a participant buys the stocks of the company, then we conclude that he or she perceives the event as good news. Conversely, if a participant sells stocks, then we conclude that the participant perceives the event as bad news.³

Our design enables us to explore the role of the investors' gender to explain why stock markets react negatively to the appointment of a female CEO. Based on the existing literature, we test a set of statistical hypotheses related to whether the participants' reaction to a male or female

³ Note that a participant may think that it is good news or bad news or may think that the market (other participants) thinks that it is good news or bad news. We discuss the role of beliefs and expectations—a key element for the valuation of stocks in the financial markets—when we interpret our results.

CEO appointment is similar and crucially whether for male and female market participants, the reaction to a male or female CEO appointment is similar.

To study the reaction of participants to the CEO gender, the data from our experiments is exploited both at the aggregated level, our baseline, and at the disaggregated level by distinguishing the market participants' gender, our main focus. At the aggregated level, we find that in reaction to the CEO's gender, there is no significant difference in the reaction of the participants pooled together. Interestingly, when we disaggregate the participants by gender, we find that when a female CEO is nominated, the female participants perceive this event as good news, as they tend to buy the stocks of the company, while the male participants perceive it as bad news, as they tend to sell the company's stocks. The opposite behavior is observed when a male CEO is nominated: female participants perceive this event as bad news, as they tend to sell stocks, while male participants perceive it as good news, as they tend to buy stocks.

In short, our findings support the hypothesis that the gender diversity of market participants plays an important role in explaining the market reaction to a newly nominated CEO. The reason why gender diversity matters is that female and male participants may exhibit differences in preferences and in biases towards gender. This is consistent with the observation that occupations in the financial sector (traders, investors, fund managers, financial advisors, etc.) tend to attract mostly men, possibly explaining the negative stock market reaction to female CEO appointments. In this sense, we argue that the market is 'gendered', meaning that the gender composition of the market participants is not neutral to market outcomes. To assess the quantitative importance of our findings, we build a *market gender bias* indicator based on the proportion of female market participants that would be needed to have a gender-neutral market reaction.

Drawing from homophily, entitativity and expectation theories, we then interpret our

findings. Homophily refers to a sociological concept asserting that individuals prefer to interact with individuals of their own type and that share similar traits, such as gender, race, ethnicity, and social class (McPherson, Smith-Lovin and Cook, 2001). In our case, gender homophily refers to the tendency of market participants to prefer a CEO of their own gender. Entitativity refers to the degree to which individuals belonging to minority groups are defined based on stereotyped group characteristics rather than on the individuals' singularities (Dixon-Fowler *et al.*, 2013). In our case, the entitativity theory can be applied to female CEOs, as they represent a minority among CEOs. Another interpretation of our findings refers to the role of expectations, which posits that rather than reflecting their own beliefs, the market participants' trading reflects the participants' expectation about the market's reaction to gender.

Finally, we provide policy implications at the individual, corporate, and financial industry levels. The policy implication of our study is that the gender issue is not only an issue reflected at the corporate level in the need to nominate more female CEOs but also an issue reflected at the financial industry level in the need to increase gender diversity by attracting more women in investment occupations and reflected at the societal level in the need to change individual and collective stereotypes about female leadership.

LITERATURE REVIEW

Our literature review starts by discussing research regarding CEO successions and then focuses on the two dimensions that we study: the gender of the CEO and the gender of financial market participants.

CEO successions

CEO successions matter and have received the attention of research in strategic management since CEO successions are often seen as a signal of the firm's future path (Zajac, 1990). Using the event studies approach, Lubatkin *et al.* (1989) found that following changes in firm leadership, investors

revise downward their earnings expectations, driving down the stock price of the firm by 1% around the time of the announcement of the new CEO nomination and by approximately 3% in a post-announcement period of three months. Note however that subsequent empirical studies have provided mixed results about the market reaction following the nomination of a new CEO. Indeed, research works have found stronger results when controlling for the conditions surrounding the CEO nomination, such as the relative past performance of the firm (overperformance/underperformance), the departure type (forced /voluntary) and the succession type (outsider/insider). Conditional on each of these impacting conditions, the market reaction after the announcement of the CEO nomination is either strongly negative or strongly positive.

Gender and CEOs

By comparing firms appointing male or female CEOs, recent work has particularly studied how gender plays a role in understanding nomination events. Lee and James (2007) study the stock market price fluctuations for a set of firms in 1990-2000 by using a dataset of 529 CEO appointments. They find that the investors' reaction to the announcement of a female appointment is significantly more negative than their reaction to the announcement of a male appointment.

An important factor considered so far has been how the media influences the reaction of market participants by differently portraying female and male CEOs. Lee and James (2007) investigate how press articles may influence the investors' reaction by shaping their perception. Indeed, the investors' perceptions of the leadership ability of women may be negative because the investors draw extensively on female stereotypes that are at odds with leadership roles and because following the appointments of women, the media may focus on the gender dimension. These two factors may be a consequence of the scant representation of females at the top of the hierarchy and contribute to reinforcing the existing gender stereotypes. Dixon-Fowler *et al.* (2013) have also shown that the media tends to portray female CEOs as part of a homogeneous group where gender is a salient characteristic, while the media describes male CEOs as unique

individuals. The authors use the concept of *entitativity*, which describes a situation where the members of a group are perceived as homogeneous. This describes particularly well the beliefs held by outsiders and by individuals with little or no interaction with the members of the group. Entitativity theory could also explain why Zhang and Qu (2016) find that the negative effect of a female succession to a departing male CEO is weaker when the female is an insider to the company.

The negative stock market reaction may also reflect the differences in the *perceived* performance of female-led firms compared to that of male-led firms. For instance, if investors perceive the productivity of the average female CEO to be lower than the productivity of the average male CEO, they may engage in statistical discrimination (Phelps, 1972). This perception may be based on existing research that suggests that women have lower attachment to the labor force and that they are more likely to demand flexibility in their schedule. For instance, women may be less willing to work long hours and at specific times of the day, which is often expected and highly rewarded in top hierarchical roles (Goldin, 2014). This may explain why the gender wage gap has been reduced the lowest for wages at the top of the wage distribution scale (Blau and Kahn, 2017) and why stock markets put a discount on investments of firms with female CEOs in anticipation of these differences in time investments. In line with these arguments, Bertrand, Goldin and Katz (2010) show that female MBA holders see their earnings diverge from male MBA holders as time after graduation passes because they are more likely to interrupt their participation in the labor market due to an uneven division of labor within the household (child-care). Last but not least, it is also possible that stock market participants exhibit taste-based discrimination preferences against women (Becker, 1957). Following an experimental approach that is similar to ours but in a different sector—the secondary art market—Adams *et al.* (2017) are able to uncover evidence of discrimination. They show that art buyers place a discount on female art. Importantly, they also show that buyers are unable to say whether a man or a woman

makes an art piece unless they know the name of the artist. This implies that the discount on female art is not due to objective differences between the art made by men and women artists but reflects a dislike of female art *because* it is made by women. In our research design based on simulations, we provide no information about the qualifications of the female and male CEO candidates and therefore there is objectively no difference between them. The only information disclosed is the name of the candidate from which the gender can be inferred. In parallel to Adams *et al.* (2017), therefore, if participants sell following the nomination of a female CEO, this should reflect a dislike of a female CEO precisely *because* of her gender.

Regarding stereotypes and leadership traits, Powell, Butterfield and Parent (2002) study gender and managerial stereotypes by surveying undergraduate and graduate students receiving business education. They test the hypothesis that performing managers are described as having masculine traits of character and leadership style. As they point out, the formation and use of stereotypes reveal both a cognitive shortcut (to minimize information processing costs) and a social aspect that is shaped by interactions with others in school, at home and at the workplace. By surveying student populations in three different decades (1979, 1989 and 1999), they study the persistence or change of those stereotypes. Although revealing an increase in female presence in managerial positions throughout the period and finding some evidence of change in stereotypes, they also find that the masculine view of managers persists.

The negative stock market reaction may also reflect differences in the *actual* performance of female-led firms compared to that of male-led firms. Faccio, Machica and Mura (2016) study the performance of female-led firms and find that when firms transition from a male to a female CEO, risk-taking and capital allocation efficiency decrease, and the survival rate of the firms increases. The differences in actual performance between firms led by either men or women may also be attributed to differences across gender in preferences and leadership traits: risk-aversion (Crozon and Gneezy, 2009), overconfidence and optimism (Huang and Kisgen, 2013), taste for

competition (Niederle and Vesterlund, 2011) and bargaining styles (Card, Cardoso and Kline, 2016).⁴

To summarize, the existing literature has shown that the market reaction to CEO nominations differs by CEO gender and tends to be unfavorable to newly appointed female CEOs. This phenomenon may reflect either imperfect information about an individual CEO (statistical discrimination) or preferences for a particular type of CEO (taste-based discrimination).

Gender and financial market participants

We now discuss research that points at potential gender differences in the financial market participants' behavior. Such differences may result from differences in the preferences of female and male investors. For example, Olsen and Cox (2001) study the effect of the investment managers' gender on their response to risk. They do so by analyzing financial practitioners and find significant gender differences in portfolio management. By surveying a group of chartered financial analysts (CFA) and a group of certified financial planners (CFP), they show that, unlike men, women focus on minimizing risk. Interestingly, they also find that both female and male professionally trained investors hold gendered stereotypes about other investors' risk taking. In particular, they perceive other female investors as more risk-averse in portfolio management. One of the implications of this study, as discussed by Olsen and Cox (2001), is that "women clients are also more likely to be focused on security...might feel more comfortable dealing with women advisors". Barber and Odean (2001) also study stock trading as a function of gender and find that in their trading behavior, men and women exhibit differences that can be attributed to men being overconfident and more optimistic. Other studies in the behavior of financial professionals, such

⁴ The interpretation of these findings may suffer from a potential selection issue as put forward by Adams and Rajunhatan (2017). This issue is addressed in the hypothesis development section.

as traders, fund managers and fundraisers, have also documented gender differences. Eckel and Fullbrun (2015) show that female traders are less prone to generate speculative bubbles, Beckmann and Menkhoff (2008) show that female mutual fund managers are more likely to shy away from competition, and Niessen and Ruenzi (2008) show that female fund managers perform less well than male fund managers.

In this section, the existing research discussed has documented gender differences among finance professionals, in investment behavior in several realms. However, no explanation has so far tried to link the lack of the gender diversity of financial market participants with the negative stock market reaction to female CEO appointments.

HYPOTHESES

Building on the literature previously reviewed, we now elaborate on how the gender of market participants may influence their reaction to the CEO appointment. We connect the two strands of literature (on the gender of the CEOs and the gender of financial market participants) to establish statistical hypotheses that we will test with the data of our lab experiment.

In our paper, we posit that following the CEO's nomination, the market reaction based on the CEO's gender depends on the gender diversity of the market participants.

Hypotheses development

Part of the literature shows that, on the one hand, unlike male CEOs, female CEOs are negatively perceived because the description of leadership involves mostly masculine traits (Powell *et al.*, 2002) and lower capital allocation efficiency (Faccio *et al.* 2016). On the other hand, part of the literature suggests that female CEOs could be positively perceived based on some other dimensions, such as, in the role of CEO, having a lower level of overconfidence (Huang and Kisgen, 2013) and a higher survival rate than men have (Faccio *et al.*, 2016). Therefore, on the CEO side, following the CEO appointment, it is not clear how market participants would react

based on the gender of the CEO. Faccio *et al.* (2016) also show that in firms led by female CEOs, risk taking is lower. Indeed, differences in the degree of risk aversion between men and women have been pointed at as a source of difference in managerial styles and performance. Crozon and Gneezy (2009) survey the experimental literature on the topic and conclude that women are more risk-averse than men. This would lead investors that are more risk-averse to buy stocks when a female CEO is nominated and could lead us to predict that female investors would be more likely to react positively to a female nomination, while the opposite could hold for male investors. Risk-aversion preferences could be a source of gender homophily (tendency to interact with your own gender) where female investors tend to buy stocks of firms led by female CEOs and similarly where male investors tend to buy stocks of firms led by male CEOs. However, there are at least two caveats to the argument of differences in risk aversion and implied trading behavior. First, while risk-taking is important, Faccio *et al.* (2016) also show that female-led firms have lower capital allocation efficiency but higher survival rates. Therefore, it is not clear whether we should expect male and/or female investors to react differently to the nomination of female CEOs. Second, because of selection effects, female professionals in the financial industry and female individuals investing in the stock market, on the one hand, and female CEOs, on the other hand, may be less risk-averse than the general female population. Adams and Raganathan (2017) discuss that the self-selection bias is due to the fact that women in certain industries or leadership roles may be selected and exhibit differences with women in the overall population. Therefore, conditional on the selection of women for certain industries, stereotypes regarding female and male leadership attributes may not hold true, or females in leadership roles may be *less* risk-averse than men. Depending on whether participants in our experiment are cognizant of this selection effect or not, they may hold favorable or unfavorable stereotypes regarding female leadership as opposed to male leadership.

Overall, the existing literature does not allow us to assess unambiguously how following

the appointment of the CEO, the gender of the market participants may influence their reaction according to the gender of the CEO. This leads us to posit the following statistical hypotheses.

Statistical hypotheses

In our experiments, the participants' attitude towards gender is captured from their trading activity after the nomination of the CEO. The participants' trading decision to buy or sell stocks signals their beliefs or expectations regarding the new CEO's impact on future firm performance. Using experimental simulations in a controlled environment, following the CEO appointment, we decompose the market reaction according to the gender of the CEO and to the gender of participants.

Regarding the gender of the CEO, we posit the following set of statistical null hypotheses.

Hypothesis 1: The proportion of buy/sell orders sent by *all* participants when a female CEO is nominated equals the proportion of buy/sell orders sent by *all* participants when a male CEO is nominated.

Since we know the gender of each participant in our experiment, we can also test the following two corollary hypotheses:

Hypothesis 1a: The proportion of buy/sell orders sent by *female* participants when a female CEO is nominated equals the proportion of buy/sell orders sent by *female* participants when a male CEO is nominated.

Hypothesis 1b: The proportion of buy/sell orders sent by *male* participants when a female CEO is nominated equals the proportion of buy/sell orders sent by *male* participants when a male CEO is nominated.

Regarding the gender of market participants, we posit the following hypothesis:

Hypothesis 2: After the nomination of a CEO of *any gender*, the proportion of buy/sell orders sent by female participants equals the proportion of buy/sell orders sent by male participants.

Since we know the gender of the CEO in our experimental design, we can also test the following two corollary hypotheses:

Hypothesis 2a: After the nomination of a *female* CEO, the proportion of buy/sell orders sent by female participants equals the proportion of buy/sell orders sent by male participants.

Hypothesis 2b: After the nomination of a *male* CEO, the proportion of buy/sell orders sent by female participants equals the proportion of buy/sell orders sent by male participants.

METHODOLOGY

We build a simulation-based lab experiment to have a two-dimensional approach to the gender issue in corporate leadership: we study both the gender of the newly appointed CEO and the gender of the market participants. On the CEO side, an experimental approach allows us to balance the proportion of male/female CEOs, which solves the statistical problems of previous empirical studies (due to the scarcity of female CEOs in reality). On the market participants' side, it allows us to identify the gender of the participants, as we are in a controlled environment.

Experimental design

Experimental economics uses laboratory methods to study phenomena that are difficult to observe directly in the real world. Experiments classically contain factors (process variables) used to observe changes on outcomes (response variables). In our experiment, to keep it as simple and clear as possible, we use only one factor of interest: a gender-related event—the nomination of

the CEO who can be either a man or a woman. The change in the factor (the independent variable) is hypothesized to result in a change in the outcome (the dependent variable). In our experiment, the outcome of interest is the trading activity of the participant just after the announcement of the nomination of the future CEO. In particular, we are interested in the participants' buying or selling decisions reflecting after the event their attitude towards the CEO's gender.

The experiments are also designed to work out the optimal practice conditions for the participants. Is the design of our experiment optimal for the issue that we study? Does the experiment reflect a realistic environment to make decisions? Does the choice of the participants validate our study? Do the participants understand what is requested from them in the experiment setting? The answers to these questions are detailed below.

Choice of experimental design

There are two different methods to design an experiment: the *between-subject* and the *within-subject* design (Charness, Gneezy and Kuhn, 2012). In a within-subject designed experiment, each participant must repeat the experiment several times with different treatments. Applied to our research, in a within-subject design, each participant would launch the simulation twice; in the first launch, the firm would announce a female CEO, and in the second launch, the firm would announce a male CEO (or vice-versa). In a between-subject designed experiment, each participant participates in the experiment only once, and participants are randomly assigned to experiments with different treatments. Applied to our research, in a between-subject design, each participant would launch the simulation once; in a random manner, either the firm would announce a female CEO, or the firm would announce a male CEO.

As explained by Charness *et al.* (2012), both design methods have their advantages and drawbacks. The main point to consider when choosing the design method is the importance of the "demand effect", which is a spurious effect reflecting the attempt of participants to behave to

satisfy their perception of the experimenter's expectations. By changing the value of a parameter from one experiment to another, the participant understands what the experiment is about. In our case, by changing the gender of the CEO between the two consecutive simulations, the participant would understand that the experiment is about gender stereotypes in leadership. For our design experiment, we followed Greenwald (1976) who studied the conditions under which within-subjects and between-subjects are preferable. He pointed out that when exposure to multiple experiments makes the individual sensitive to the variations between experiments, a between-subjects approach should be chosen. To avoid a "demand effect", we then decided to adopt a between-subject design.

Realistic simulation tool

To carry out our research, we use an on-line trading simulation platform called SimTrade. In terms of experimental design, compared to traditional out-of-context experiments (such as lotteries used to measure preferences), the added value of SimTrade is contextualization: similar to traders in an investment bank, participants in the simulation can buy and sell stocks of a company in reaction to stock market price fluctuations and economic news. The experiment conducted by using the SimTrade simulation platform then provides a realistic environment to study the decisions taken by the participants of the experiment.

At the launch of the simulation, participants are introduced to the scenario, which includes the presentation of a company (SunCar) and a series of related events that will unfold during the trading day. The event related to the new CEO announcement is presented to participants as shown in Box 1. No information is given to the participants about the impact of the nomination of a man or a woman on firm performance.

Box 1. Extract of the simulation scenario

SunCar designs, produces and sells low-speed electric vehicles for city use. The batteries of

these solar-powered cars can be refilled at public charging points. Due to a severe illness, Jack Dallara, founder and CEO, will be relinquishing his operational duties soon. At midday, SunCar is expected to announce the name of his successor. The two candidates for the CEO position are Anna Farrell and Henri Villa.

Choice of participants for the experiment

The participants in the experiment were recruited from the core finance course at ESSEC Business School. The experiment attracted 126 students, including 71 female and 55 male students (the ESSEC student population is rather gender balanced). Female and male participants in the experiment have followed the same course track, share the same background in finance, and exhibit similar average course grades. This rules out confounding factors such as education, experience and selection effects that may otherwise influence investment decisions. Finally, students from a business school such as ESSEC represent a relevant population because they are likely to take on leadership positions, such as that of CEO, in their future professional careers.

Experimental setting

The experiment was carried out in the ESSEC experimental research lab designed for conducting experiments in a controlled environment. The experiment was presented to students as an opportunity to contribute to a research project studying how economic agents make their financial decisions.⁵ Following common practice, the gender aspect of the research project was not revealed to participants to avoid disclosing our research subject.

In the experiment, we randomize the gender of the nominated CEO by building two simulation variants: in the first variant, Anna Farrell is nominated as CEO; in the second variant, Henri Villa is nominated as CEO. The probability that a participant faces either of the two variants

⁵ At the beginning of the experiment, we asked students to read and sign a form explaining the context of the experiment and the use of personal data, as required by the French authority (Cnil) in charge of digital issues. The experiment was also approved by the Research Ethics Committee at ESSEC.

is set equal to 50%.

At the beginning of the experiment, the participants are required to read the description of the scenario, which includes a description of the firm, a brief history of the stock price, the events expected to occur during the trading session (the nomination of the next CEO is one of the events presented) and the market consensus by financial analysts. The participants are presented the sequence of events that may unfold during the simulation. This sequence includes two major events: a gendered event—the CEO nomination—and a nongendered event—the result of a tender offer. The nongendered event takes place after the CEO nomination and serves as a placebo check to study the robustness of our results. Prior to the announcements of these events, the participants are uninformed about their final outcome. Regarding the gendered event, while they know that the company is going to announce the next CEO, they do not know *who* will be nominated. Regarding the nongendered event, while they know that the result of the tender offer will be announced during the day, they do not know whether SunCar will win it or not. Participants are asked to act as investors whose objective is to maximize their gains out of the trading day, something of which they are clearly reminded at the start of the simulation. As an incentive, participants receive compensation in the form of a course grade bonus derived as a function of their realized gains during the simulation. The participants, who have followed the core finance course, are familiar with the functioning of financial markets, but this is the first time that they launch the simulation used for our experiment.

Our research design also deals with the informational issue concerning the exact date of the public announcement of the CEO nomination. In empirical studies, researchers face the challenge of determining *exactly when* investors learn about the CEO succession (Malatesta and Thompson, 1985). In actual markets, due to information leaking, some market participants may have access to this information before the date of the official public announcement by the firm. A related but distinct informational issue is that due to the market participants' limited attention,

traders may not immediately react to the news (Hirshleifer and Teoh, 2003).

Our research design, based on controlled experiments, allows us to minimize these two problems. In particular, before launching the simulation, all participants are informed of the news flow that will unfold during the trading day. With respect to the CEO nomination, it is clearly stated that at midday, SunCar will announce the newly appointed CEO. However, before the official announcement by the firm (no information leakage), the participants cannot possibly anticipate the result of the announcement, i.e., whether the CEO nominee will be a man or a woman. Additionally, during the simulation, the news of the CEO nomination is presented on the simulation trading platform as an important piece of information (reduced limited attention).

RESULTS

For the presentation of the results, we distinguish the participants' gender and the CEO's gender. We also include the results for the pooled sample with all participants (both female and male participants), and the pooled sample with all simulations (simulation variants in which either a female or a male CEO was nominated). First, we focus on the participants' trading reaction to the CEO nomination announcement in terms of their buying and selling decision. Second, we analyze the participants' reaction strength following the CEO nomination announcement by measuring how fast, how large, and how aggressive the reaction of the market participants is. Third, we present our robustness checks including the trading reaction after a nongendered event that we use as a placebo.

Participants' trading reaction

Table 1 presents the results regarding the participants' buying or selling reaction to the CEO nomination announcement. In each cell, we indicate the percentage of participants who buy or sell stocks after the CEO nomination announcement.

{Insert Table 1 about here}

Baseline results

At the aggregated level, pooled participants and simulations are reported in the top left cell of Table 1 and constitute our baseline results. We find that following the announcement of the CEO nomination, 56% of the participants sell stocks, while 44% of the participants buy stocks. This suggests that they perceive the nomination of a new CEO as a negative event. This is consistent with previous empirical research looking at the short-term reaction of the market after the nomination of a new CEO, as discussed in the literature review. However, the interpretation needs some caution since the probability of sellers and buyers is not significantly different from 50% at conventional levels (two-sided binomial test of 0.65 with a p-value of 0.26).

We next discuss the results regarding our main hypothesis: following the CEO nomination, the reaction according to the gender of the CEO depends on the gender composition of the market participants. To do so, we follow a two-dimensional approach to the gender dimension at a disaggregated level: we study both participants' gender (row) and the CEO gender (column).

Results conditional on the gender of the CEO

We now test if the proportion of buy/sell orders sent by all participants when a female CEO is nominated equals the proportion of buy/sell orders sent by all participants when a male CEO is nominated (Hypothesis 1). We find that when a female CEO is nominated, the participants perceive this event negatively because they tend to sell more stocks: among the participants, 57% are sellers, while 43% are buyers. When a male CEO is nominated, the participants also perceive this event negatively because they tend to sell more stocks: among the participants, 56% are sellers, while 44% are buyers. We find that participants react in the same manner when a male or a female CEO is nominated (the difference between participants' trading is not statistically significant), which fails to reject Hypothesis 1.

This paper argues that the female and male participants' reaction to the CEO nomination may depend on their gender, as men and women may exhibit differences in preferences and in biases towards gender. If this is indeed the case, the gender diversity of market participants may play an important role in explaining the negative stock market reaction to a female CEO nomination. Using the information of the gender of the participants, we test the two corollary hypotheses H1a and H1b.

As a reminder, Hypothesis H1a states that the female participants' reaction to a female CEO announcement would be the same as that to a male CEO announcement. We find that when a female CEO is nominated, female participants perceive this event positively because they tend to buy more stocks: among the participants who are women, 55% are buyers, and 45% are sellers. When a male CEO is nominated, female participants perceive this event negatively, as they tend to sell more stocks: among the participants who are women, 73% are sellers, and 27% are buyers. We find that female participants react significantly differently when a male or a female CEO is nominated but that the difference is not statistically significant at conventional levels (chi-square test of 3.51 with a p-value of 0.17).

As a reminder, Hypothesis H1b states that the male participants' reaction to a female CEO announcement would be equal to that of a male CEO announcement. We find that when a female CEO is nominated, male participants perceive this event negatively because they tend to sell more stocks: among participants who are men, 73% are sellers, and 27% are buyers. When a male CEO is nominated, male participants perceive this event positively, as they tend to buy more stocks: among participants who are men, 63% are buyers, and 37% are sellers. We find that male participants react differently when a male or a female CEO is nominated and that the difference is statistically significant at conventional levels (chi-square test of 5.66 with a p-value of 0.06).

Results conditional on the gender of market participants

We now test if after the nomination of a CEO, the proportion of buy/sell orders by female participants equals the proportion of buy/sell orders by male participants (Hypothesis 2). We find that when a CEO is nominated, female participants perceive this event negatively because they tend to sell more stocks: among female participants, 58% are sellers, and 42% are buyers. When a CEO is nominated, male participants also perceive this event negatively because they tend to sell more stocks: among male participants, 53% are sellers, and 47% are buyers. We find that male and female participants react in the same manner when a CEO is nominated (the difference between female and male participants' trading is not statistically significant), which fails to reject Hypothesis 2.

Using information of the gender of the CEO, we test two corollary hypotheses H2a and H2b.

As a reminder, Hypothesis H2a states that after the nomination of a female CEO, the proportion of buy/sell orders by female participants equals the proportion of buy/sell orders by male participants. We find that when a female CEO is nominated, female participants perceive this event positively because they tend to buy more stocks: among female participants, 55% are buyers, and 45% are sellers. Male participants perceive the event negatively because they tend to sell stocks: among male participants, 73% are sellers, and 27% are buyers. From a statistical point of view, we find that when a female CEO is nominated, the difference between female and male participants' trading is not statistically significant at conventional levels (chi-square test of 3.18 with p-value of 0.20).

As a reminder, Hypothesis H2b states that after the nomination of a male CEO, the proportion of buy/sell orders by female participants equals the proportion of buy/sell orders by male participants. We find that when a male CEO is nominated, the results are the opposite: female participants perceive this event negatively because they tend to sell more stocks: among female

participants, 67% are sellers, and 33% are buyers. Male participants perceive the event positively because they tend to buy more stocks: among male participants, 63% are buyers, and 37% are sellers. From a statistical point of view, we find that when a male CEO is nominated, the difference between female and male participants' trading is statistically significant at conventional levels (chi-square test of 6.12 with p-value of 0.09).

Participants' trading reaction strength

Table 2 presents the results regarding the *strength* of the trading reaction by participants (female/male participants) after the nomination of the new CEO (female/male CEO) in the simulations. We use various measures of trading reaction strength: the time lapse between the CEO nomination announcement and the stock market order sent by the participant (reactivity), the average quantity of assets bought or sold (intensity), and the percentage of market orders (aggressiveness).⁶ These measures capture how fast, how large, and how aggressive, respectively, the reaction of market participants is.

{Insert Table 2 about here}

Regarding reactivity (the time lapse between the nomination announcement and the stock market order), when a female CEO is appointed, for female participants, it takes on average 25 minutes to buy stocks and 23 minutes to sell stocks, while for male participants, it takes on average 30 minutes to buy stocks and 31 minutes to sell stocks. Regarding intensity (quantity of assets bought or sold), for female participants, the average order size is 50 assets for buy orders and 53

⁶ The market environment proposed by the trading simulation platform SimTrade is based on the limit order book. This type of market microstructure is currently mostly used by exchanges around the world, as electronic markets are progressively taking over physical markets. In a market with a limit order book, investors can send orders of different types, mainly market orders and limit orders. With market orders, investors want to buy/sell as soon as possible at the market price. With limit orders, investors want to buy at a maximum price and to sell at a minimum price (the price limit). With market orders, investors favor quantity over price, as they control the quantity executed; inversely, with limit orders, investors favor price over quantity, as they control the execution price. The use of market orders (compared to limit orders) reflects the aggressiveness of investors in trading.

assets for sell orders, while for male participants, the average size is 40 assets for buy orders and 71 assets for sell orders. Regarding aggressiveness (percentage of market orders), female participants mainly use market orders for their trading: market orders comprise 91% for their buy orders and 56% of their sell orders, while male participants always use market orders for their trading: market orders comprise 100% of their buy and sell orders. However, the differences in the three dimensions of the strength of the reaction between male and female participants are not highly statistically significant. These results show that the nature of the participants' trading, other than the buy/sell decision, is not influenced by the participants' gender.

Robustness checks

Placebo event

We now present the results regarding the participants' trading reaction after a nongendered event: a tender offer. This nongendered event, which takes place in the simulation after the CEO nomination, serves as a placebo to study the robustness of our results; for a nongendered event, we should not observe any difference between female and male participants. Before launching the simulation, the participants had the opportunity to read about the news flow that would unfold during the day. The results are reported in Table 3, which gives the statistics of the trading reaction by the participants (female/male participants) after the announcement of the result of the tender offer (tender offer was won/lost by SunCar) in the simulations.

{Insert Table 3 about here}

When SunCar wins the tender offer, which is a positive event for the company, the participants also perceive this event positively because they tend to buy more stocks: among the participants, 80% are buyers, and 20% are sellers. When SunCar loses the tender offer, which is a negative event for the company, the participants also perceive this event negatively because they tend to sell more stocks: among the participants, 64% are sellers, and 36% are buyers. These

results are statistically significant at conventional levels (chi-square test of 10.18 with p-value lower than 0.01).

Our interest is to check if this behavior depends on the gender of market participants or not. We now test if after the announcement of the result of the tender offer, the proportion of buy/sell orders by female participants equals the proportion of buy/sell orders by male participants. When SunCar wins the tender offer, the female participants perceive this event positively because they tend to buy more stocks: among the female participants, 74% are buyers, and 26% are sellers. Similarly, male participants perceive this event positively because they also tend to buy more stocks: 85% are buyers and 15% are sellers. From a statistical point of view, we find that when SunCar wins the tender offer, the difference between the female and male participants' trading is not statistically significant at conventional levels (chi-square test of 1.08 with p-value of 0.58). When SunCar loses the tender offer, female participants perceive this event negatively because they tend to sell more stocks: among the female participants, 66% are sellers and 34% are buyers. Similarly, male participants perceive this event negatively because they also tend to sell more stocks: among male participants, 63% are sellers and 37% are buyers. From a statistical point of view, we find that when SunCar loses the tender offer, the difference between the female and male participants' trading is not statistically significant at conventional levels (chi-square test of 2.33 with p-value of 0.31).

The reaction of female and male participants to the nongendered event (the announcement of the result of the tender offer), our placebo check, contrasts with the reaction to the gendered event (the announcement of the CEO nomination). This strengthens our confidence in our main result, as the difference between female and male participants only appears when there is gender dimension.

Other robustness checks

We also tested if the event—the CEO announcement—had a significant impact on the market participants' behavior by comparing the trading statistics before and after the event, and we found a significant change. We also checked whether our findings depend on the trading window used and find that our results are robust to alternative trading windows (1, 2 and 3 hours after the CEO announcement). These checks are available upon request.

QUANTITATIVE SIGNIFICANCE OF THE RESULTS

In the previous section, after the announcement of the newly appointed CEO, we have studied the market participants' reaction as demonstrated in their behavior in terms of buying and selling stocks, reflecting what is called a “bullish” market or a “bearish” market. Our main result shows that following the CEO's appointment, the market reaction according to the CEO gender depends on the gender composition of the market participants. According to our findings, the female and male participants reaction to a male or female CEO appointment is significantly different. The participants buy stocks of the company when a CEO of their own gender is nominated and sell stocks when a CEO of a different gender is nominated. However, are these findings quantitatively meaningful? To answer this question, we now turn to measure the quantitative significance of our results.

Figure 1 plots as a function of the proportion of female market participants, the difference between the percentage of buyers and the percentage of sellers after the announcement of the nomination of a female CEO (Figure 1A) and of a male CEO (Figure 1B). This allows us to quantitatively estimate the critical threshold of female market participants *needed* to reverse the sign of the stock market reaction from negative to positive when a female CEO is nominated (Figure 1A) and symmetrically, from positive to negative when a male CEO is nominated (Figure 1B). This critical threshold corresponds to a gender-neutral market composition, that is, a market where the proportion of buyers equals the proportion of sellers after a female CEO nomination

and symmetrically, following a male CEO nomination. A departure of the critical threshold from the reference value of 50% indicates a *market gender bias*. The market gender bias reflects both the attitude of female and male participants towards the gender of the CEO (revealed by their trading activity) and the composition of market participants (the number of men and women participating to the market).

{Insert Figure 1 about here}

When a female CEO is nominated, the critical threshold of female market participants that makes the market reaction gender-neutral is equal to 82% (Figure 1A). When a male CEO is nominated, the critical threshold of female market participants that makes the market reaction gender-neutral is equal to 43% (Figure 1B). This means that the market gender bias is larger in magnitude (further away from the reference value of 50%) when the nomination concerns a female CEO (a positive value equal to +32%) than when the nomination concerns a male CEO (a negative value equal to -7%).

In the case of the nomination of a female CEO, the market gender bias (+32%), measured by the difference between the critical threshold of the proportion of female participants of 82% and the reference value of 50%, is explained by the selling trading activity of male market participants (73%), which outweighs the buying trading activity of female market participants (55%). When the proportion of female market participants is equal to this critical threshold of 82%, the market reaction to the nomination of a female CEO is neutral (neither negative nor positive bias). With a proportion of female participants higher than this critical threshold, the market reaction to the nomination of a female CEO would exhibit a positive gender bias towards female CEOs, and inversely, with a proportion of female participants lower than this critical threshold, the market reaction to the nomination of a female CEO would exhibit a negative gender bias towards female CEOs.

In the case of the nomination of a male CEO, the market gender bias (-7%), measured by the difference between the critical threshold of the proportion of female participants of 43% and the reference value of 50%, is explained by the buying trading activity of male market participants (67%), which outweighs the selling trading activity of female market participants (33%). When the proportion of female market participants is equal to this critical threshold, the market reaction to the nomination of a male CEO is neutral (neither negative nor positive bias). With a proportion of female participants lower than this critical threshold of 43%, the market reaction to the nomination of a male CEO would exhibit a positive gender bias in favor of male CEOs, and inversely, with a proportion of female participants higher than this critical threshold of 43%, the market reaction to the nomination of a male CEO would exhibit a negative gender bias in favor of male CEOs.

This analysis shows that our results are quantitatively meaningful since the critical threshold of female market participants that makes the market reaction gender-neutral to the nomination of a female CEO (82%) is substantially above the current level of female participation in the financial sector (for example, only 16% of CFA holders are female, according to Mattia (2018)). In financial sector occupations, given the low gender diversity due to the current underrepresentation of women, based on our results, undoing the negative stock market reaction to female CEO appointments would require a complete transformation of the financial industry by diversifying its workforce.

INTERPRETATIONS, CONTRIBUTIONS AND FURTHER WORK

In this section, we summarize our results and for the female and male market participants' buying/selling behavior, propose different interpretations: homophily, entitativity and expectations. We also discuss the contributions of our research regarding the role of the media, the conditions surrounding a succession and the methodology. We conclude this section by

discussing further work.

Summary of our results

Our main finding is that following the CEO appointment, the market reaction according to the CEO gender depends on the gender composition of market participants. In particular, we find that participants tend to buy stocks of the company when a CEO of their own gender is nominated: when a female CEO is nominated, 55% of female participants buy; when a male CEO is nominated, 63% of male participants buy. In contrast, the participants exhibit selling behavior when a CEO of a different gender is nominated: when a male CEO is nominated, 73% of female participants sell; when a female CEO is nominated 67% of male participants sell. Using these results, we also calculated the female market participants' critical threshold that makes the market reaction neutral: 82% when a female CEO is nominated and 43% when a male CEO is nominated. We built a market gender bias measure to assess the quantitative significance of our results and showed that the bias is larger in magnitude when the nomination concerns a female CEO (+32%) than when the nomination concerns a male CEO (-7%).

Result interpretations

Homophily

Our results are consistent with preferences that exhibit homophily, that is, the tendency to form ties with individuals who share traits similar to one's own (McPherson, Smith-Lovin and Cook, 2001). In our case, gender is the underlying trait behind homophily. As discussed in the hypotheses development, a factor explaining gender homophily is related to risk-aversion. Indeed, female participants may buy stocks when a female CEO is nominated because they expect the female CEO to lead the firm with a level of risk-aversion that is close to their own risk preference. This depends on the extent to which female CEOs exhibit risk-aversion levels similar to those of the female market participants (that is, to the extent that selection issues are not a concern with

regards to this dimension). By contrast, male participants may buy stocks when a male CEO is nominated because they expect the male CEO to exhibit a level of risk-seeking behavior in the firm leadership style and management that is close to their own risk preference. While plausible, it is important to note that this interpretation of the results through the lens of homophily relates to the preferences of participants and is based on a revealed preference argument (that is, we do not directly measure the participants risk-aversion).

Entitativity

We can also interpret our results by using the entitativity theory. This theory describes a situation where the members of a group are perceived as homogeneous, which is more likely when the members of the group are perceived from the outside. We argue that entitativity may be particularly present when male market participants evaluate female CEOs since female CEOs are more likely to be perceived as outsiders by male investors. Indeed, one interpretation of the finding that female CEOs are perceived negatively by the stock market in real situations may be that they are perceived as outsiders by market participants who are predominantly male (ingroup vs outgroup).

Expectations

Do market participants trade stocks based on their personal beliefs and preferences or based on their market expectations? An interpretation based on expectations could posit that market participants trade according to their expectations about the market reaction to gender, which may differ from their inner beliefs and own preferences. The market participants' trading may reflect the market convention rather their own conviction.

Contributions

Main contribution

The main contribution of our paper is to propose a new explanation for the negative stock market reaction to the appointment of female CEOs. It is based on the hypothesis that the market is ‘gendered’. The stock market is an institution that is not gender-neutral. Indeed, female and male market participants may exhibit differences in preferences and in biases towards gender. These differences imply that gender diversity in the financial sector (proportion of male and female participants) impacts the market outcomes. Indeed, we posit that the observed negative market reaction to the female CEOs’ appointment reflects the negative stereotypes held by market participants who are mostly men. To test this hypothesis, we develop a simulation-based experiment that allows us to overcome the empirical research’s challenges concerning the scarcity of female CEO appointments and the lack of information regarding the market participants’ gender and trading behavior. In this experiment, we explore the role that the investors’ gender plays in their buying and selling decisions in response to the news of a CEO appointment. We find that female and male participants react differently to the announcement of male and female CEOs, confirming our hypothesis that understanding the role of gender in trading behavior can shed new light on the interpretation of stock market fluctuations to gender-related news. This also implies that specific policies related to the feminization of the profession and to the handling of negative leadership stereotypes about female CEOs need to be devised in the financial sector.

Role of the media

A major challenge for understanding the market reaction to the nomination of a male or female CEO is to capture the role played by the media in communicating information on CEO nominations. The reaction of market participants may be indeed driven by the media portraying a female in a stereotypical fashion (Lee and James, 2007) and only as a member of a group (Dixon Fowler, Ellestrand and Johnson, 2013). In our analysis, we can control for the salience and the nature of information that participants receive at the time of the CEO nomination. Therefore, our approach “neutralizes” potential media driven biases by providing information without relying on

stereotypes. It would be interesting to create alternative simulations where we try to replicate media biases to observe whether our results change accordingly.

Conditions surrounding a succession

The existing literature has shown that the conditions surrounding a succession, such as the relative past performance of the firm (overperformance/underperformance), the departure type (forced/voluntary) and the succession type (outsider/insider), are important determinants of the market reaction after the announcement of the future CEO and that the choice of the CEO may be endogenous to firm characteristics. For example, a succession could signal a poorly performing outgoing CEO that may have made bad decisions for the company. This could drive stock prices down regardless of the potential skills of the new CEO. Our design “neutralizes” the role of these factors, as in the simulations, the CEO succession is attributed to the illness of the former CEO, a reasonably exogenous factor to the future performance of the company. More generally, one of the advantages of our simulation-based approach is to control the entire scenario. While in actual situations, there may be little transparency regarding the reasons why a CEO is replaced in the real world, in our experimental approach, we are able to precisely inform market participants about this reason. One potential extension for future work could be to consider alternative scenarios where the outgoing CEO is leaving the firm for other reasons emphasized in the literature. For example, we could take into account the gender of the departing CEO as gender change in the CEO transition may be an important dimension as shown by Zhang and Qu (2016).

Methodological contribution

As discussed in the literature review, the possibility that CEO choices are a function of the firm characteristics and therefore endogenous limits the scope for a causal interpretation of the empirical results (Faccio *et al.*, 2016). Even when controlling for the determinants of female CEO nomination, it is hard to fully rule out the possibility that the transition to a female CEO takes

place precisely because of firm specific circumstances and/or characteristics. In contrast to such difficulties, in our paper, we are able to overcome this type of endogeneity issues. In our study, we develop an experiment where the nomination of a female or male CEO is exogenous to the firm characteristics.

Our simulation-based lab experiment allows us to measure the behavior of participants at the disaggregated level: their trading activity during the simulation and their profile (gender, age, educational attainment, and other personal information). Such an approach increases the internal validity of our results obtained in a controlled environment by controlling the proportion of CEO, the timing of the events, and the disclosure of information and detailed data about market participants (crucially their gender). This high internal validity comes at the cost of potentially lower external validity. Typically, in experimental research, a single study on its own cannot improve on this trade-off. However, the experiment that we developed on the SimTrade application is available for the research community upon request. As part of future work, our experiment could be implemented in different environments. This would be particularly useful to increase the external validity of our results. In our case, this seems even more needed and potentially interesting because countries vary greatly in terms of gender inequality both at the societal level and in the financial sector (World Bank Group, 2018). These differences may be the consequence of economic and institutional factors but could also be due to cultural norms (Fernández, 2013) and linguistic variations (Santacreu-Vasut, Shenkar and Shoham, 2014). Our experiment could be run in different countries, taking into account different cultural and linguistic origins.

Further work

In the future, we plan to enrich the description of CEO candidates to include personal and professional characteristics that may influence perceptions regarding their potential performance as a CEO. These include personal information about their age, marital status, and work availability

as well as professional information about educational background, work experience, and insider/outsider status. These extensions would allow us to go beyond simulations in which gender is related to the sex of CEO candidates to conducting simulations in which gender is a social construct (de Beauvoir, 1949).

CONCLUSION

Our study contributes to the strategic management research on CEO nomination and gender leadership stereotypes. We focus on the negative stock market reaction following female CEO appointments and that is documented in the existing literature and propose an explanation based on the gender diversity of the market participants. We document differences based on the CEO's gender, in the trading behavior between male and female participants after the CEO's nomination. This supports our main hypothesis that following the CEO nomination, the market reaction according to the CEO gender depends on the gender diversity of the market participants.

To test this hypothesis, we run a simulation-based lab experiment. We design a two-dimensional approach to the gender dimension: we study both the gender of the CEO and the gender of the market participants. In the experiment, the participants trade stocks in reaction to the nomination of a new CEO. Due to the experimental nature of our methodology, we can balance the proportion of female and male participants and the proportion of female and male CEOs. We find that participants are more likely to buy stocks for a newly nominated CEO of their own gender and to sell stocks for a newly nominated CEO of the opposite gender. Beyond the simulation-based lab experiment used in our study, to extend our results in different contexts, we also provide the academic community access to our on-line research design and tool.

We make a quantitative assessment of the gender bias of financial markets by calculating the critical threshold of female market participants that makes the market reaction neutral when either a female CEO or a male CEO is appointed. We find quantitatively meaningful results: the

critical threshold of female market participants that makes the market reaction gender-neutral to the nomination of a female CEO (82%), which is substantially above the current level of female participation in the financial sector. To interpret our results, we rely on homophily, entitativity and expectation theories, which capture the gender differences in preferences and biases towards gender leadership. Last but not least, one of the advantages of our approach is that by designing the simulation scenario, we can control for the nature and salience of the information that participants receive. This allows us to neutralize the potential media biases documented in the real world, to avoid information leakage and reduce the participants' limited attention.

Based on our analysis, we conclude that stock markets react negatively to the nomination of female CEOs because the stock markets are composed mainly of male investors that may hold negative leadership stereotypes regarding female CEOs. The policy implication of our study is that gender is not only an issue at the corporate level reflected in the need to nominate more female CEOs but also an issue at the financial industry level reflected in the need to increase its gender diversity by attracting more women in investment occupations; finally it is an issue at the societal level reflected in the need to change individual and collective gender stereotypes about leadership.

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TABLES AND FIGURES

Table 1. Participants' trading reaction following CEO nomination announcement

	Pooled simulations	Female CEO simulations	Male CEO simulations
Pooled participants	Buy: 44% Sell: 56%	Buy: 43% Sell: 57%	Buy: 44% Sell: 56%
Female participants	Buy: 42% Sell: 58%	Buy: 55% Sell: 45%	Buy: 33% Sell: 67%
Male participants	Buy: 47% Sell: 53%	Buy: 27% Sell: 73%	Buy: 63% Sell: 37%

Note: This table gives the statistics of trading reaction by participants (female/male participants) following the nomination of the new CEO (female/male CEO) in the simulations. In each cell, we indicate the percentage of participants who bought or sold SunCar stocks just after the announcement of the nomination of SunCar new CEO (within a one-hour time-window after the announcement). The participants were recruited among ESSEC Business School students. The experiments were done in the ESSEC experimental research lab designed for conducting experiments in a controlled environment. The first row of the table considers the pooled sample with all participants (both female and male participants); the first column considers the pooled sample with all simulations (simulation variants in which either a female or a male CEO was nominated).

Table 2. Participants' trading reaction strength following the CEO nomination announcement

	Pooled simulations	Female CEO simulations	Male CEO simulations
Pooled participants	<p>Buy orders: Time lapse: 25 min. Quantity: 51 assets Market orders: 93%</p> <p>Sell orders: Time lapse: 28 min. Quantity: 56 assets Market orders: 95%</p>	<p>Buy orders: Time lapse: 27 min. Quantity: 47 assets Market orders: 93%</p> <p>Sell orders: Time lapse: 28 min. Quantity: 63 assets Market orders: 80%</p>	<p>Buy orders: Time lapse: 23 min. Quantity: 73 assets Market orders: 92%</p> <p>Sell orders: Time lapse: 28 min. Quantity: 50 assets Market orders: 97%</p>
Female participants	<p>Buy orders: Time lapse: 27 min. Quantity: 40 assets Market orders: 100%</p> <p>Sell orders: Time lapse: 25 min. Quantity: 45 assets Market orders: 100%</p>	<p>Buy orders: Time lapse: 25 min. Quantity: 50 assets Market orders: 91%</p> <p>Sell orders: Time lapse: 23 min. Quantity: 53 assets Market orders: 56%</p>	<p>Buy orders: Time lapse: 27 min. Quantity: 30 assets Market orders: 100%</p> <p>Sell orders: Time lapse: 26 min. Quantity: 42 assets Market orders: 100%</p>
Male participants	<p>Buy orders: Time lapse: 25 min. Quantity: 53 assets Market orders: 94%</p> <p>Sell orders: Time lapse: 34 min. Quantity: 67 assets Market orders: 95%</p>	<p>Buy orders: Time lapse: 30 min. Quantity: 40 assets Market orders: 100%</p> <p>Sell orders: Time lapse: 31 min. Quantity: 71 assets Market orders: 100%</p>	<p>Buy orders: Time lapse: 23 min. Quantity: 73 assets Market orders: 92%</p> <p>Sell orders: Time lapse: 37 min. Quantity: 40 assets Market orders: 86%</p>

Note: This table gives the statistics of the strength of the trading reaction by participants (female/male participants) following the nomination of the new CEO (female/male CEO) in the simulations. In each cell, we indicate the measures of the trading reaction strength: the time lapse between the CEO nomination announcement and the stock market order sent by the participant (reactivity), the average quantity of assets bought or sold (intensity), and the percentage of market orders (aggressiveness). The participants were recruited among ESSEC Business School students. The experiments were done in the ESSEC experimental research lab designed for conducting experiments in a controlled environment. The first row of the table considers the pooled sample with all participants (both female and male participants); the first column considers the pooled sample with all simulations (simulation variants in which either a female or a male CEO was nominated).

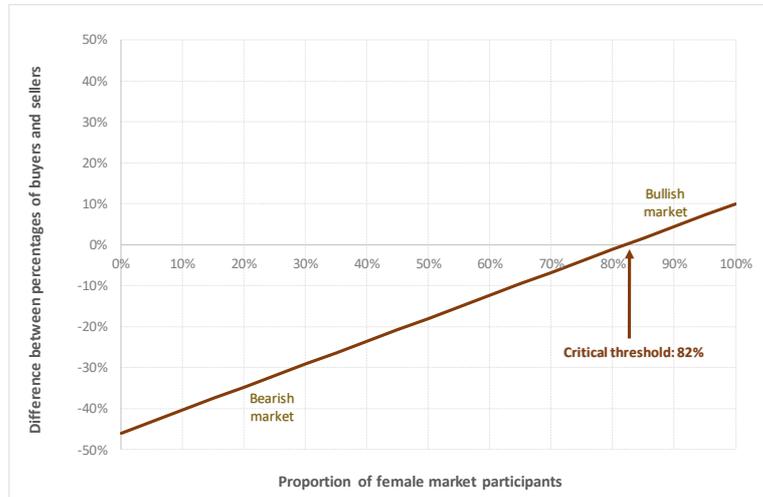
Table 3. Participants' trading reaction following the announcement of the result of the tender offer

	Pooled simulations	Tender offer won simulations	Tender offer lost simulations
Pooled participants	Buy: 53% Sell: 47%	Buy: 80% Sell: 20%	Buy: 36% Sell: 64%
Female participants	Buy: 50% Sell: 50%	Buy: 74% Sell: 26%	Buy: 34% Sell: 66%
Male participants	Buy: 56% Sell: 44%	Buy: 85% Sell: 15%	Buy: 37% Sell: 63%

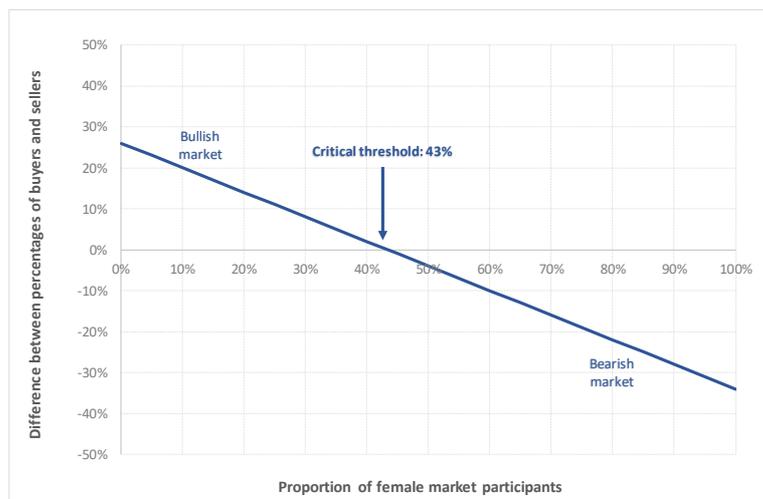
Note: This table gives the statistics of the trading reaction by participants (female/male participants) following the announcement of the result of the tender offer (tender offer won/lost by SunCar) in the simulations. In each cell, we indicate the percentage of the participants who bought or sold SunCar stocks just after the announcement of the result of the tender offer (within a one-hour time window after the announcement). The participants were recruited among ESSEC Business School students. The experiments were done in the ESSEC experimental research lab designed for conducting experiments in a controlled environment. The first row of the table considers the pooled sample with all participants (both female and male participants); the first column considers the pooled sample with all simulations (simulation variants in which SunCar either won or lost the tender offer).

Figure 1. Difference between the percentage of buyers and sellers as a function of the proportion of female market participants

A. Following the nomination of a female CEO



B. Following the nomination of a male CEO



Note: This figure plots the difference between the percentage of buyers and the percentage of sellers following the announcement of the nomination of a female CEO (Figure 1A) and a male CEO (Figure 1B) as a function of the proportion of female market participants. When the difference between the percentage of buyers and sellers is positive (negative), the market is bullish (bearish). The critical threshold corresponds to the proportion of female market participants *needed* to have a gender-neutral market reaction to the CEO nomination: a difference between the percentage of buyers and sellers equal to 0%. A departure of the critical threshold from the reference value of 50% indicates a *market gender bias*. The two figures are built with the estimated proportions of female and male buyers and sellers in the case of the nomination of a female and male CEO (using the proportions obtained from our experiment reported in Table 1).