Is Gender in the Pocket of Investors?

Identifying Gender Bias Towards CEOs with a Lab Experiment

by François Longin[1] and Estefania Santacreu-Vasut[2]

14/01/2022

Abstract

Do investors react negatively to the appointment of female CEOs because of their gender bias? To answer this question, we build a trading experiment to causally identify gender bias towards newly appointed CEOs. We distinguish among gender stereotypes, double standard and group biases (in-group favoritism and out-group discrimination) as theoretical sources of gender bias. When a female CEO is appointed, we find that female participants buy stocks while male participants sell stocks. The opposite holds when a male CEO is appointed. For male traders, our results are consistent with both stereotypes and group biases. For female traders, our results are consistent with both double standard and group biases. These sources of gender bias, combined with the lack of gender diversity in the stock market, can explain the negative stock market reaction to female CEO appointments documented in archival work, and contribute to the pervasive underrepresentation of female CEOs around the world.

Keywords: agentic and communal traits, CEO, double standard, female leadership advantage, gender bias, gender diversity, gender stereotypes, glass ceiling, glass cliff, group biases, in-group favoritism, out-group discrimination, stock market.

JEL: J16, M14.

[1] ESSEC Business School, Professor of Finance, 3 Avenue Bernard Hirsch, 95021, Cergy-Pontoise, France. E-mail: longin@essec.edu. Tel: +33 (0)1 34 34 30 40.

[2] ESSEC Business School and THEMA. Associate professor of Economics. 3 Avenue Bernard Hirsch, 95021, Cergy-Pontoise, France. E-mail: santacreuvasut@essec.edu. Tel: +33 (0)1 34 34 30 00.

INTRODUCTION

It is well known that women are a numerical minority in chief executive officer (CEO) positions in the world's major economies. For example, women represent only 7.5 percent of the largest publicly listed companies' CEOs in the European Union (EIGE, 2021); 6.9 percent in China (CSMAR, 2020) and 7.4 percent in the US (Fortune 500 list, 2020). It is understood that smaller numbers of female CEOs are, *ex ante*, the result of firms not hiring women for CEO positions and, *ex post*, of female CEOs having shorter tenures due to higher probabilities of being fired, quitting, or not being reappointed in such positions. However, what is the cause of the rarity of women at the top?

Objective differences in qualifications and competencies between men and women are becoming less relevant, as women have recently reversed the gender gap in educational attainment and have significantly narrowed the gap in years of professional experience (Blau and Kahn, 2017). Furthermore, female CEOs are a selected pool that may not be representative of the average population (Adams and Ragunathan, 2017). Despite the diminishing role of these supply-side factors in the job market for CEOs, women still face barriers to advancement and longevity at the top of corporate hierarchies. *Ex ante*, the barriers faced by women prior to appointment constitute a phenomenon known as "the glass ceiling". *Ex post*, barriers take the form of harsher conditions for women in CEO positions and constitute a phenomenon known as "the glass cliff". Overall, these barriers are not related to female candidates' qualifications or competence and are costly to corporations and society at large and therefore important to understand.

The glass ceiling has been prominently documented within organizations. Studies have shown evidence of a gender bias among board members involved in the CEO selection process (Matsa and Miller, 2011). Gender stereotypes involving nonconscious heuristics have been proposed as a root for managerial sex typing such as the construct of "think manager, think male" (Schein, 1973). Contextual factors also play a role in reinforcing or mitigating such biases. For instance,

biases against female CEOs are more prevalent in stereotypically male industries (Glass and Cook, 2016). In contrast, female CEOs are perceived to be more suitable in industries with a larger share of female workers. The glass cliff effect has been shown to result from factors that make it more difficult for female CEOs to survive once they are appointed than it is for male CEOs, for example, because poorly performing firms are more likely to appoint women (Ryan and Haslam, 2005).

In this paper, we study the trading reactions of stock market investors to the appointment of CEOs as a phenomenon that speaks to both the glass ceiling and the glass cliff conditions faced by female CEOs. Investors are an important external audience whose reaction may constitute a demand-side barrier that indirectly poses a constraint on a firm's choices. Because investors can sell their stocks, they can vote with their feet to express discontent with the appointed CEO influencing the firm's environment and, as a consequence, its choices. *Ex ante*, the negative market reaction to female CEO appointments can cause firms to be more reluctant to appoint female CEOs to avoid future downward pressure on their market valuation, which can, at a minimum, attract negative press. *Ex post*, a negative market reaction may influence the conditions faced by CEOs in office and thereby increase board scrutiny, which has been shown to increase the monitoring of CEOs by boards when firm performance is poor (Tuggle et al., 2010). Such concerns are not merely hypothetical, as evidence shows that stock markets react more negatively to the appointment of female CEOs than to the appointment of male CEOs (Lee and James, 2007, in the US, Schmid and Dauth, 2014, in Europe, and Zhang and Qu, 2016, in China).

As Krause, Whitler and Semadeni (2014) argue, in the context of CEO compensation, boards take into account the feedback from shareholders' voting behavior to adapt their communication and CEO compensation strategies. We argue that boards thus also aim at predicting investors' frame of reference when stocks are traded in response to board decisions about CEO appointments. Furthermore, while a bearish market is not binding in the sense of forcing a board to change its CEO choice, it can still have negative consequences that the board may want to avoid including

negative press and increased investor scrutiny.

The fact that stock prices fall significantly when a company announces the appointment of a female CEO contrasts with evidence showing that in the long term, companies led by female CEOs do not underperform those led by male CEOs (Wolfers, 2006). In fact, they may even overperform, as shown by the meta-analysis of Jeong and Harrison (2017), and have a higher survival rate (Faccio, Marchica and Mura, 2016). Therefore, negative stock market short-term reactions to female CEO appointments may inefficiently influence corporate staffing choices at the top and, as a consequence, hurt a firm's long-term performance, orientation and survival.

Despite this potential significance, the stock market response to female CEO appointments as a process that underlies discrimination has been understudied in the gender and leadership scholarship. A possible reason for this is that this process takes place outside organizations. Furthermore, interpreting why stock prices fall significantly when a company announces the appointment of a female CEO is not an easy task. On the corporate side, the pure effect of gender is difficult to disentangle from the other characteristics of the appointed CEO and the conditions of appointment. Identifying the causal effect of gender involves controlling for appointment conditions (such as the existence of a nomination committee and the involvement of the departing CEO) and contextual factors (such as the past performance of the firm). On the stock market side, evidence is often based on aggregate stock market data, which cannot tell us how any particular investor assesses any particular CEO, making it harder to reveal and explain the presence and sources of a gender bias among investors. Understanding the sources of a gender bias may be particularly relevant considering the fact that gender diversity in the financial sector is rather low. Only 16 percent of holders of the chartered financial analyst (CFA) certification, one of the professional qualifications required to work in the financial industry, are women (Mattia, 2018); only 10 percent of US equity funds are managed by women (Niessen-Ruenzi and Ruenzi, 2019); and, at the institutional level, only 14 percent of those with the highest decision-making powers

in European financial institutions are women (EIGE, 2021).

Could gender bias among investors play a role in explaining the negative stock market reaction to female CEO announcements, and, if so, what is the source of such a bias? This paper seeks to answer this question by studying the presence of a gender bias in investors' reactions to CEO appointments. On the theoretical level, our work goes beyond the existing paradigm of gender stereotypes. We do so by arguing that, in addition to gender stereotypes, investors' decision-making may exhibit double standard and group biases (in-group favoritism and out-group discrimination). Heilman (2012) defines gender stereotypes as generalizations about men and women that are applied to individuals based solely on their gender. Foschi (1996) defines a standard as a norm that specifies the level of an outcome from which to infer a particular ability. When a stricter standard is used to infer ability for individuals considered as having lower status, such as women, a double standard operates. Because of this stricter standard, successful women tend to be perceived as better than comparable male competitors. Tajfel (1970 and 1982) defines group biases as a tendency to favorably treat individuals of one's own group (in-group favoritism) and to unfavorably treat individuals from the outer group (out-group discrimination), leading to homosocial reproduction (Kanter, 1977).

We argue that gender biases can explain the reaction of stock market investors to the appointment of female CEOs. We hypothesize 1) the role of negative gender stereotypes regarding female leadership abilities, 2) the emergence of a female leadership advantage because of a double standard of competence applied to infer the abilities of female and male CEOs, and 3) the role of group biases such as favoritism towards in-group members and discrimination against out-group members. Distinguishing among the different sources of gender bias is important for the development of the extant theory. By observing the trading choices of participants according to their gender, we are able to tease out these different sources of bias. We contribute to the existing theory by bringing together three distinct theoretical explanations and shedding light on how

investment context is an important factor for understanding such bias. We identify the conditions that allow us to distinguish among these theories, which will also be useful for future empirical and theoretical work, to understand investors' decision-making. While the reactions of investors have already been studied from a gender stereotype perspective, to our knowledge, no one has yet studied investor reactions from both double standard and group biases perspectives, which we do in this paper.

We test our hypotheses by conducting a lab experiment. Our experiment is based on a trading simulation platform that mimics the environment of practitioners in financial markets, which enables us to contextualize participants' trading decisions. Critically, the experiment is designed to study market reactions to the appointment of a new CEO at the level of individual participants. Our experimental approach allows us to identify the pure effect of CEO gender on individual trading activity, which provides causal evidence of gender bias. Furthermore, this approach allows us to precisely map a participant's gender to his or her trading activity, which is key to empirically distinguishing among gender stereotypes, double standard and group biases as sources of gender bias in trading reactions.

We find evidence of the presence of a gender bias consistent with double standard and in-group favoritism among female investors. We also find evidence of the presence of a gender bias that is consistent with gender stereotypes and out-group discrimination among male investors. That is, the preference shown towards a CEO's gender is moderated by the participant's gender. Therefore, the gender of investors is relevant. Given the lack of gender diversity among stock market participants, our hypotheses provide an explanation for the negative stock market reaction to female CEO appointments documented in archival work, and potentially for the rarity of women in corporate leadership positions.

Our work contributes to the gender and leadership literature by considering alternative theories for which these different types of biases can be concurrent. We articulate how to disentangle the

theoretical effects of three sources of bias (gender stereotypes, double standard and group biases) and the conditions under which the effects of these different sources of bias can either reinforce each other or counter each other. Crucially, we show that the interplay among these effects depends on the participants' group affiliation, in this case based on gender. In particular, we show that omitting information regarding investors' gender may lead researchers to misinterpret the evidence behind the negative stock market reaction to female CEO appointments as supporting gender stereotypes as the sole theoretical explanation and misguiding the choice of possible remedies. Finally, we also contribute to the glass ceiling literature by shedding new light regarding the ongoing debate between supply-side and demand-side explanations of female rarity at the top. In particular, in our context, we identify the role of demand-side factors (negative gender biases towards female CEOs) among external audiences (stock market). We are able to do so because we use data from a lab experiment which, contrary to archival data, allows us to empirically identify the pure role of demand factors, as the traders in the experiment have no information regarding the qualifications of the female and male CEOs. That is, we show that demand-side factors play an important role in explaining the negative bias towards female CEOs. This does not imply that supply factors are not important but rather that demand factors should be considered on their own.

THEORY

In this section, we present our theoretical development, our hypotheses and their operationalization. We actively engage with the existing literature about leadership and gender stereotypes, double standard and group biases.

Leadership and gender stereotypes

The rarity of females in corporate leadership positions has been attributed to both supply-side (CEO candidates) and demand-side (firms searching for CEOs) factors in the job market for

CEOs. On the supply side, objective differences have been found in CEOs' career trajectories (Singh and Vinnicombe, 2003), demographic factors such as age and family status (Harlan and Weiss, 1982) and differences in leadership abilities and style (Eagly, Karau and Makhijani, 1995). Behavioral traits also correlate with gender (Frear et al., 2019); for instance, gender differences have been documented in the degree of risk aversion (Crozon and Gneezy, 2009), even among CEOs (Faccio et al., 2016), although such differences have recently been called into question by Fillipin and Crosetto (2016). The research also finds gender differences in overconfidence and optimism (Huang and Kisgen, 2013), taste for competition (Niederle and Vesterlund, 2011) and bargaining styles (Card, Cardoso and Kline, 2016). These gender differences could explain the rarity of qualified female candidates, also known as the "pipeline problem". These differences could also constitute the basis for statistical discrimination (Phelps, 1972) in a context of asymmetric information between recruiters and job market candidates, where recruiters may infer individual productivity based on statistical information about the group (in this case, gender) to which an individual belongs.

On the demand side, women face invisible barriers in accessing leadership positions independently of their objective qualifications. Some of these barriers are internal to the firm and relate to its corporate governance, which has been shown to influence CEO appointment decisions. For example, the result of such decisions may directly depend on whether the board of directors is independent vis-à-vis the current CEO and whether a hiring board is put in place (Shivdasani and Yermack, 1999). Other internal factors are related to firm performance and sector. Regarding firm performance, Ryan and Haslam (2005) show that negative company performance in the months leading to the CEO transition is predictive of the appointment of female CEOs. Regarding the firm sector, Harrigan (1981) shows that female executives are more likely to be appointed by labor-intensive, service-oriented firms catering to female consumers, whereas female executives are less likely to be appointed in capital-intensive sectors, such as

manufacturing, or in sectors with a male-dominated workforce, such as mining (Davidson and Cooper, 1992; Goodman et al., 2003).

These internal barriers to women's advancement may be rooted in gender stereotypes, which are generalizations about men or women that are applied to individuals based on their gender. Stereotypes have been documented in a variety of settings. Becker (1957) theoretically studies discrimination in the labor market based on the assumption that decision makers exhibit taste-based discrimination as a result of a preference against interacting with members of certain groups, such as women. Stereotypes are often applied to individuals belonging to minority groups and are defined based on stereotyped group characteristics rather than individual singularities, a concept known as entitativity (Campbell, 1958). The pervasiveness of gender stereotypes and their application to a variety of settings is grounded on the fact that gender is a diffuse status characteristic that is socially significant. This means that the female state is valued less than the male state in a generalized ("diffuse") way, influencing the capacities and performance generally attributed and expected from women and men (Berger, Cohen and Zelditch, 1972).

Less studied are the glass ceiling barriers that are external to the firm. These barriers include the role of the media and the behavior of stock market investors for publicly traded companies. Considering the role of the media, Lee and James (2007) show that the media tends to portray men and women CEOs differently, reinforcing existing gender stereotypes and prejudice against female CEOs. Prejudice in this context means that female CEOs are unfairly evaluated based on stereotypical judgments because of their gender rather than based on their behavior or qualifications as individuals. Similarly, Dixon-Fowler et al. (2013) show that female CEOs are subject to entitativity biases resulting from female CEOs being considered a coherent group to which stereotypes are applied (whereas male CEOs are treated as individuals).

Considering the behavior of stock market investors is important because their reactions can influence corporate decision making and exert a "feedback loop" on the firm (Dow, Goldstein,

Guembel, 2017; Soros, 1988). In the case of CEOs, investors can influence firms' CEO appointments by voting with their feet and selling stocks when a CEO they do not like is appointed. Indeed, empirical work by Lee and James (2007), Schmid and Dauth (2014) and Zhang and Qu (2016) documents, in the US, European and Chinese contexts, respectively, that stock markets tend to react more negatively to the appointment of a female CEO than to that of a male CEO. Because the expected financial benefits and costs from changes in leadership are borne by investors, their trading decisions can exert a subtle and invisible influence on firms' CEO choices. Fluctuations in stock price following the appointment of male and female CEOs may be anticipated by the board and affect the decision to appoint a female or a male CEO. This negative feedback effect may constitute an external barrier to women's advancement. It is therefore important to understand the causes behind the negative stock market reaction to female CEO appointments, an issue that remains poorly understood due to methodological challenges.

We argue that stock market activity sets in motion an evaluative process in the form of buying or selling stocks. The existing research that is based on archival data uses changes in stock prices as a "barometer for how investors assess the decision's potential effect on a corporation's short- and long-term economic viability" (Cook and Glass, 2011, page 503). We argue that this assessment is potentially gender-biased and rooted in descriptive gender stereotypes according to which women are not fit to occupy traditionally male positions such as that of a CEO. In particular, evaluators who have stereotypes about a group tend to make prejudiced inferences against individuals whose group attributes are incongruent with attributes associated with success, paving the way to a discriminatory process (Eagly and Carli, 2003).

A participant who buys a company's stocks reveals that he or she perceives the appointment of a female CEO as good news, while a participant who sells stocks under the same circumstance reveals that he or she perceives the event as bad news. These decisions can be the result of rationally updated beliefs about the impact of the appointed CEO on the firm's future cash flows

(Fama, 1970) and, more generally, on the firm's performance. However, trading activity may also reflect behavioral factors including psychological processes that result in the use of decision-making heuristics rather than rational and deliberate decision-making. Decision-making heuristics are often based on a combination of expertise and stereotypes, automatically triggered in a nonconscious manner and in situations of uncertainty (Kahneman and Tversky, 2000). In our case, this may lead investors to unconsciously replace the answer to the rational question "Does the appointed CEO create value?" with the answer to a simpler question "Do I like the appointed CEO?".

Schein (1973) proposes the existence of an automatic "think manager, think male" stereotype that may explain the lack of female promotion to CEO roles. Gender stereotypes are, according to the "lack of fit" model (Heilman, 1983), prone to create negative expectations about the performance of women because CEO positions and leadership roles are more broadly seen as male (Koenig et al., 2011). These negative expectations, or prejudices, place women at a disadvantage that is undeserved (Allport, 1954). Powell, Butterfield and Parent (2002) test the hypothesis that performing managers are described as having masculine traits of character and leadership style. As they point out, both the formation and use of stereotypes result from a cognitive shortcut (to minimize information processing costs). They study the persistence or change of those stereotypes by surveying student populations in three different decades (1979, 1989 and 1999). Although they find some evidence of change in stereotypes due to the increase in female presence in managerial positions throughout the period, the masculine view of managers persists.

Building on the "lack of fit" model, Eagly and Karau (2002) propose the "role congruity" theory of prejudice according to which negative stereotypes towards women are context dependent. This theory predicts that in organizational settings where gender roles (consensual beliefs about men and women) and leadership roles (consensual beliefs about leadership) are both consequential and in competition with one another, women will be perceived less favorably as potential and actual

leaders. Contextual factors include the masculinity of the leader role, the business function, and the role in the hierarchy. Role congruity theory predicts that there is incongruity between gender roles and leadership roles for women (but not for men) in CEO positions. Consensual beliefs about gender refer to the traits of agency and communion as stereotypically related to gender. Agentic traits refer to achievement-oriented behavior that combines competence and independent decision-making to reach objectives, while communal traits refer to relationship-oriented behavior that combines empathic personality and openness to others to facilitate interaction. Women tend to be perceived as more communal than men, and men tend to be perceived as more agentic than women (Abele, 2003). Consensual beliefs about leadership are ascribed to leaders' agentic characteristics. This explains why for women, the leadership role is perceived at being at odds with the gender role.

According to the "lack of fit" model and to role congruity theory, we predict that stock market participants hold gender stereotypes towards CEOs characterized by negative performance expectations towards female CEOs and positive performance expectations towards male CEOs. This leads us to posit the following hypothesis:

Hypothesis 1a. Stock market participants buy stocks when a male CEO is appointed and sell stocks when a female CEO is appointed.

Regarding CEO gender, the traditional stereotype model proposed by role congruity theory predicts that a female CEO is at a disadvantage because of the perceived incongruence between gender stereotypes and top leadership stereotypes. This incongruence results from the fact that agentic stereotypes for the CEO position (top leadership role) are perceived as incompatible with the communal stereotypes usually attributed to females (gender roles). Alongside the traditional model, an alternative stereotype model is emerging. It predicts that female leaders are perceived as having a leadership advantage grounded in the double standard of competence for female CEOs and the evolution of leadership roles.

A double standard refers to the use of different requirements for the inference of acquisition of an attribute, depending on the social status of the individuals being evaluated. More specifically, stricter requirements are used for low-status individuals while lenient requirements are used for high-status individuals. According to the theory of a gender-based double standard of competence (Foschi, 1992), women are considered to have low social status and are subject to stricter requirements than men for the inference of competence. This means that at similar levels of performance between men and women, women are evaluated less favorably and perceived as less competent than men. This also implies that successful women must exhibit higher levels of competence than successful men (Foschi, 1996).

Rosette and Tost (2010) argue that leadership roles at different levels of the hierarchy display variance in the level of agency with the highest level of agency expected at the top, concluding that "women who succeed at the top may be evaluated favorably relative to men because they have demonstrated that they have overcome a double standard both to arrive in their top position and further to excel in that top position that is dominated by men and perceived to be particularly masculine" (page 223). Applied to appointed CEOs, women reaching top leadership roles must therefore be exceptionally competent and have a better track record than men because they are subject to the double standard of competence. Female CEOs are therefore positively selected and perceived as highly agentic precisely because they have survived discrimination in the selection process, which implies that they must be more skilled than their male counterparts (Eagly and Carli, 2003). The recent research by Dwivedi, Joshi and Misangyi (2018) confirms the double standard theory as they show that, for female CEO successions in the largest firms in the US, once appointed, female CEOs are successful and meet expectations in terms of performance.

In addition to the agentic characteristics required for their CEO position and recognized as such (double standard theory), female CEOs are nevertheless considered to still exhibit the communal characteristics attributed to the female gender. While the communal characteristics that have been

considered to be stereotypically female have traditionally not been perceived as valuable for the CEO role, the research on gender and leadership increasingly views communal traits as an advantage resulting in a transformational leadership style that is effective under contemporary conditions (Eagly and Carli, 2003). The combination of both agentic and communal characteristics implies that female leaders may be even more favorably perceived than their male counterparts, which gives them a female leadership advantage.

According to this alternative stereotype model, there may be congruity between the female gender role and the leadership role, leading to a female leadership advantage. This advantage for female CEOs results from the combination of their agentic characteristics (validated by a double standard of competence) and of their communal characteristics (increasingly viewed as beneficial for effective leadership). This leads us to posit a "think CEO, think female" heuristic based on the premise that female CEOs may be more likely to be evaluated as more agentic and more communal than male CEOs (Rosette and Tost, 2010). A "think CEO, think female" model could develop as an alternative model to the prevalent "think manager, think male" heuristic. This new model would confer female CEOs a leadership advantage in the form of positive performance expectations, leading us to formulate the following alternative hypothesis about CEO gender:

Hypothesis 1b. Stock market participants buy stocks when a female CEO is appointed and sell stocks when a male CEO is appointed.

Hypotheses 1a and 1b make no distinction according to the gender of investors. This is based on extant research arguing that both female and male evaluators hold the same gender stereotypes. For example, in the financial sector, Olsen and Cox (2001) find that both female and male professionally trained investors hold gendered stereotypes about other investors' risk taking. One reason explaining this phenomenon is that women evaluate women (including themselves) according to the same gender stereotypes used by men (Hentschel, Heilman and Peus, 2013). Women and men have also been shown to exhibit similar double standard criteria for inferring the

abilities of female and male candidates (Foschi, 1996). Another explanation is that women evaluating other women compete for such positions (Parks-Stamm, Heilman and Hearns, 2008).

The fact that the evaluators' gender does not matter is puzzling, as stressed by Heilman (2012). This is puzzling because, as Tajfel (1970) argues, stereotypes develop with deeply rooted notions of "we" versus "they" and form the basis for how individuals are expected to judge and behave vis-à-vis other members of society. Interestingly, experimental evidence shows that social learning and conformity trigger a generic norm of group bias (both in-group favoritism and out-group discrimination) that is independent of the context and "extraordinarily easy to trigger off" (Tajfel, 1970, page 102). Because gender is a key organizing pillar in the social construction of reality, gender biases may therefore reflect not only the gender of the evaluees but also the gender of the evaluator. In other words, gender biases may result from intergroup categorization and reflect favoritism towards members of the in-group and discrimination against members of the out-group. To the extent that investors' decision-making is influenced by one's psychology and sociocultural milieu, gender biases may be cut across gender lines. We develop the implications of this possibility in the next section.

Group biases

The research studying the role of gender biases in preventing the career progression of female managers and their appointment to top leadership positions has also emphasized the role of group biases. For example, decision makers in hiring committees and boards have been shown to exhibit in-group favoritism and to reserve leadership positions for in-group members (Powell, Butterfield and Parent, 2002, Matsa and Miller, 2011). In-group bias has also been documented among financial analysts that recommend stocks (Jannati et al., 2020), venture capitalists that fund entrepreneurs in the primary market in various forms (Greenberg and Mollick, 2017, Hebert, 2019), and firms that make deals in mergers and acquisitions (Levi, Li and Zhang, 2014).

Group biases are closely related to homophily (McPherson, Smith-Lovin and Cook, 2001), a

sociological concept according to which "like is attracted to like" (Greenberg and Mollick, 2017). At the structural level, its manifestation is known as "induced homophily" as networks are more likely to be composed of individuals of similar type or social category. Such networks and affiliations influence the patterns of individual interactions, which then impact opportunities of in-group and out-group members (Currarini and Mengel, 2016). Interestingly, gender is a prominent basis for homophily (Ibarra, 1992; Kleinbaum, Stuart and Jushman 2013). A consequence of gender homophily is that the prevalence of men in decision-making and leadership positions can constitute a structural hurdle for women aiming to access top leadership roles (Pfeffer and Davis-Blake, 1987). Similarly, the research on the impact of gender diversity within corporate boards appears to suggest that adding women to the board eases the hurdles posed by men who tend to favor their peers and reproduce social structures (Matsa and Miller, 2011). While in-group favoritism implies that male-dominated boards are more likely to appoint male CEOs, more diverse boards can tilt their favor towards female board members and consequently female CEOs (Ely, 1995). At the interpersonal level, homophily may manifest itself in the form of individuals being attracted by individuals who resemble them, a phenomenon defined as "choice homophily". Greenberg and Mollick (2017) further distinguish between interpersonal choice homophily, which is based on similarity, and activist choice homophily, which is based on the perception of shared barriers.

To date, group biases have been used as a lens to describe the preferences of decision makers internal to the firm, leading to homosocial reproduction at the top. However, stock market investors external to the firm may also be prone to group biases that are likely to operate at both the structural level (shaping the networks of investors) and at the interpersonal level (influencing investors' choices). In our context, female traders may support women CEOs not only because of shared values and similarities but also because of a conscience of shared structural barriers to accessing such positions, particularly in industries where they are underrepresented (Greenberg

and Mollick, 2017). Consistent with these different sources of group biases related to gender homophily, we argue that traders will exhibit in-group favoritism towards CEOs of their own gender and out-group discrimination against CEOs of the opposite gender. This leads us to posit our next hypothesis as follows:

> **Hypothesis 2: Stock market participants buy stocks when a CEO of their own gender is appointed and sell stocks when a CEO of the opposite gender is appointed.**

Hypothesis 2 argues that stock market participants' assessment of CEOs depends on their own gender in a way that is consistent with in-group favoritism and out-group discrimination. While in-group favoritism has been extensively used to describe the behavior of decision-makers in the corporate realm, to the best of our knowledge, no research has studied the role of group biases to explain the behavior of investors evaluating female and male CEOs in the stock market.

Operationalization

Based on our theoretical construct (participants' preference towards the appointed CEO's gender), our hypotheses argue that gender biases towards CEOs can originate from gender stereotypes, from a double standard of competence held by female and male evaluators and from group biases that may depend on the evaluator's own gender. Testing our hypotheses requires the identification of two gender dimensions: the gender of the CEO and the gender of the market participants. Regarding the CEO, identifying a pure gender effect requires the separation of gender from other CEO characteristics that are known to be supply-side factors in the CEO job market. Regarding market participants, the identification of group biases requires knowledge of the gender of each individual participant to analyze individual trading reactions to the announcement of a female or male CEO as a function of the participant's gender. Formally, in our theoretical framework, the participants' gender is a moderating variable that can change the relationship between the participants' trading reaction to the CEO appointment (the dependent variable) and the gender of

the appointed CEO (the manipulated variable).

Hypothesis 1a and Hypothesis 2 predict the same trading behavior for male stock market participants. In particular, they predict that male traders buy stocks when a male CEO is appointed and sell stocks when a female CEO is appointed. Therefore, observing male traders' behavior allows us to rule out the role of a double standard. Hypothesis 1b and Hypothesis 2 predict the same trading behavior for female stock market participants. In particular, they predict that female traders buy stocks when a female CEO is appointed and sell stocks when a male CEO is appointed. Therefore, observing female traders' behavior allows us to rule out the role of gender stereotypes. Indeed, while Hypothesis 1a predicts that female participants hold gender stereotypes against female CEOs and therefore that they sell stocks when a female CEO is appointed, Hypothesis 1b and Hypothesis 2 predict that female participants buy stocks when a female CEO is appointed because they hold a double standard and/or exhibit in-group favoritism.

METHODS

In this section, we begin by motivating our choice of methodology—a lab experiment—in relation to our theoretical development.[3] We then discuss our experimental design and explain certain key choices. Next, we describe our selection of participants and the experimental setting in detail. We conclude by discussing internal and external validity issues.

Motivation

The main benefit of using a lab experiment is the ability to observe trading decisions at the individual level. Individual-level data allow us to precisely map information about the participants' gender and their trading activity to the gender of the appointed CEO. Doing so is

[3] Experiments have previously been used to study gender-related topics such as the glass cliff phenomenon (Haslam and Ryan, 2008), the role of psychological mechanisms in explaining risk-taking decisions in financial markets (Eckel and Füllbrunn, 2015) and flows into investment funds (Niessen and Ruenzi, 2019).

particularly relevant for testing the existence of group biases (in-group favoritism and out-group discrimination). Furthermore, as explained above, observing the behavior of female and male participants allows us to distinguish between different sources of gender bias in a way that aggregate data would not.

The choice of a lab experiment also overcomes two main challenges of empirical studies: the paucity of real data and, more critically, the difficulty of making causal inferences. The paucity of data is due to the limited number of female CEOs, which makes it difficult to use archival data to reliably estimate investors' reactions to the appointment of female CEOs. In contrast, lab experiments can be designed to balance the proportion of male and female CEOs. In terms of causal inference, archival data make it difficult to study the pure effect of CEOs' gender because no two CEOs in the real world are identical except for their gender, and differences in objective and behavioral factors can blur identification. In contrast, with an experimental approach, we can expose participants to CEOs whose gender is the only manipulated variable. In the trading simulation, we follow the Goldberg paradigm of experiments on the evaluation of leaders (Goldberg, 1968). In this paradigm, the main motivation is to identify reactions to female and male evaluees using experiments that establish equivalence between men and women, holding the characteristics other than gender constant, because doing so guarantees excellent internal validity. We therefore make the deliberate choice of providing only limited information about the candidate CEOs by means of their names, from which gender can be inferred, and by not introducing objective differences in qualifications. Common to experiments following the Goldberg paradigm, this comes at the cost of presenting hypothetical CEOs about which limited information is given.

In addition, empirical analysis cannot separate the relative roles of investors' biases from those of their endowments and available information in accounting for their trading reaction to the appointed CEO's gender. To address this issue, our lab experiment relies on a trading simulation

in which each participant is endowed with the same initial portfolio (composed of stocks and cash) and faces the same news flow regarding the company. This setting allows us to isolate the role of potential confounding factors other than those related to individual preferences.

Empirical analysis of market reactions to CEO appointments suffers from two additional problems related to the fact that CEO replacements are not exogenous. First, the researcher may not observe all the relevant variables, which can be problematic because an omitted variable may affect both the stock market activity and the likelihood of appointing a female or male CEO. For example, according to the glass cliff hypothesis, firms that are performing poorly are more likely to appoint female CEOs. Because of their negative performance, the assets of such firms are also more likely, regardless of their CEO, to be sold or even shorted by traders. This may cause observers to conclude that there is a negative causal link between the two factors—the appointment of a female CEO and the stock market reaction—while none actually exists. Second, firms may choose their CEO strategically, taking into account the expected market reaction using backward induction. Firms may also choose the timing of news releases in strategic ways to either maximize or minimize investors' and media attention on the news. A related but distinct informational issue includes the fact that some market participants may hold private information regarding the CEO appointment, which makes it difficult to determine exactly when investors learn and therefore react to the CEO appointment (Malatesta and Thompson, 1985). Finally, market participants' limited attention means that traders may not immediately react to the news (Hirshleifer and Teoh, 2003). In short, using archival data to study managerial changes is likely to suffer from omitted variable bias and reverse causality concerns. Therefore, randomized experiments are best suited to investigate the causal mechanisms behind many of the theories in the field of gender leadership and, more concretely, to test our hypotheses about the evaluation of female and male leaders.

Experimental design

While we describe the experiment in detail in the next section, here we discuss four key

experimental design choices and their rationales: first, we adopt a between-subject design; second, we define our control and treatment groups; third, we conduct an experiment with mixed-gender participants; and fourth, we use a consequential experiment.

Applied to our setting, a *between-subject* design means that each participant in the experiment launches the simulation once and faces random assignment to the variant of the simulation where the firm appoints a male CEO or the variant where the firm appoints a female CEO. While both between-subject and within-subject design methods have their advantages and disadvantages (Charness, Gneezy and Kuhn, 2012), we made the choice to follow Greenwald (1976), who noted that when exposure to multiple experiments makes the individual sensitive to the variations between experiments, a between-subject approach should be chosen. Indeed, in a within-subject experiment, participants would have been confronted with the two variants, and therefore, by changing the gender of the CEO between the two consecutive variants, they would have been made aware (implicitly) of our variable of interest. This could potentially lead to a "demand effect", which is a spurious effect reflecting participants' attempts to behave in a way that satisfies their perception of the experimenter's expectations.

The second choice involved the definition of the *control* and *treatment* groups in the experiment. A question that we asked ourselves when developing the experiment was how to define what constitutes the control group relative to CEO gender. For the control group, we decided to use the simulation variant with an appointed male CEO because it corresponds to the baseline case that investors have in mind. This choice of benchmark is consistent with the fact that men represent the overwhelming majority of CEOs observed in real firms. It is also in line with prevailing gender stereotypes about CEOs reflected in the "think manager, think male" heuristic.[4] Furthermore,

[4] In a preliminary study to our experiment, the students also spontaneously identified the CEO as a man justifying the "think manager, think male" effect, as also found in other studies across the globe including among male and female students in Asia and Europe and among male students in the US (see Schein, Mueller, Lituchy and Liu, 1996).

since the departing CEO is chosen to be male, the appointment of a male CEO does not lead to a gender change in the management of the firm. The control group faces the standard scenario in the business world that fits the gender stereotype of males occupying top management positions. In contrast, the appointment of a female CEO leads to a CEO transition involving a gender change and therefore constitutes our treatment. This is also representative of CEO transitions often involving male-to-male CEO changes and rarely male-to-female ones.[5] The participants in our experiment are, therefore, randomly exposed either to the appointment of a male CEO (our control group) or to the appointment of a female CEO (our treatment group).[6] CEO gender is the only dimension of the intervention in our experiment. In line with the Goldberg paradigm discussed above, there are no confounding factors as the two variants of the simulation have been equated and differ only in the gender of the CEO.

The third choice we made was to run a *mixed-gender* experiment (with female and male participants together). The reason for using a mixed-gender approach is that by mixing both female and male participants, we avoid a signaling effect about the relationship of our research project to the gender of participants. Had we chosen to separate male and female participants in our experiment, this could have created a demand effect by signaling to the participants that their gender was important for their participation in our experiment and ultimately for our research question.

Our fourth design choice was to run *consequential* experiments. As Lonati et al. (2018) explain,

[5] Indeed, newly appointed female CEOs tend to replace male outgoing CEOs and very rarely do they replace outgoing female CEOs. For example, in the US, Dwivedi et al. (2017) found only one case out of 98 of a female CEO replacing an outgoing female CEO for S&P 1500 and Fortune 500 firms over the period 1992-2009. A similar finding is obtained for China by Zhang and Qu (2016).

[6] For the control group, we did not choose a simulation in which no information was given about the gender of the CEO–a "neutral" simulation–because such a case does not correspond to a possible value for our manipulated variable (the CEO gender) and, more importantly, because it would not address our research question, which is to explain investors' reaction to the appointment of a female CEO in a world where they replace a male CEO.

it is important to build experiments where participants' behavior has real consequences in the form of incentives. This approach increases both motivation and attention from participants and decreases behavior that aims to conform to the expectations of the experimenter or to what is socially acceptable. Therefore, in our experiment, we incentivize the participants by granting them a grade bonus for their finance course as a function of their trading performance in the experiment. We decided to grant a grade bonus rather than monetary compensation because students' GPA (grade point average) in their first year is key for selection into prestigious university exchange programs or highly demanded internships, representing real stakes for students.

Sample of participants

The participants come from the population of students of the Master in Management (MiM) at a leading business school in France (a program currently ranked in the Top 3 by the Financial Times). We recruited the participants on a voluntary basis among students enrolled in the core finance course. The sample of participants in our experiment represents 33 percent of the population of the first-year student cohort. The sample and the population present similar characteristics in terms of demographics (age and gender). In particular, the average age is the same (20 years old), and the female representation in the sample (56 percent) is slightly above that in the population (52 percent). Regarding academic performance, the average grade in the finance course in the sample (11.21) is slightly above that in the population (10.34).

Relying on a sample of students has both advantages and disadvantages. As Thébaud (2015) points out, students tend to be more open-minded than older generations, implying that tests using students tend to provide lower bound estimates of general social processes such as gender biases. Another advantage of using students is that the underlying population of students is gender balanced. This is not the case for the population of actual investors, which suffers from selection issues. That is, selection into investment occupations may itself be prone to gender biases that affect both the selection into such occupations and their actual investment behavior (Adams and

Ragunathan, 2017; Eckel and Füllbrunn, 2015). Furthermore, because all students follow the same course track and have the same background in finance, confounding factors, such as field of study (or education) and experience, are eliminated. A disadvantage of using students compared to actual investors is that because of their smaller experience, students may be more likely to use cognitive shortcuts such as gender stereotypes than rational decision-making. However, contrary to undergraduates, the students in our sample have been exposed to experiences in professional settings (internships and mentoring by former alumni occupying top managerial positions).

Experimental setting

The experiment was conducted in the school experimental lab, which was specifically 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 financial decisions. Following common practice, the gender aspect of the research project was not revealed to the participants to avoid disclosing our research subject.

The experiment is based on a trading simulation platform called SimTrade. In contrast to out-of-context experiments (such as lotteries used to measure preferences), this platform enables us to contextualize our variable of interest: CEO gender. The platform also increases the psychological realism of the experiment as it mimics the environment of practitioners in financial markets. At the launch of the simulation, participants are introduced to a simulation scenario that contextualizes the CEO appointment within a company named SunCar, a fictitious company described as designing, producing and selling electric vehicles. We chose an automotive company because it belongs to an industry that is perceived as a male industry according to gender stereotypes (Thébaud, 2015). The downside of contextualization is that our results may not generalize to other industries, which could be addressed in future research with alternative scenarios that manipulate the industry.

The reason for the departure of the incumbent CEO is health related. This choice was made to

provide an exogenous reason for the appointment of a new CEO. We named the departing CEO Jacques Dallara and chose the male gender for the departing CEO, in line with prevailing stereotypes about CEOs and with our definition of the control group as previously motivated.

The following extract from the scenario shows how information is presented to participants: "Due to a severe illness, Jacques 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 Henry Villa." We manipulate the gender of the CEO and set a 50 percent *ex ante* probability that a participant faces either of the two variants of the simulation. Regarding firm performance, the company is said to be experiencing an upward trajectory in the months prior to the CEO change. This choice was made to avoid the appointment occurring during a company in crisis ("glass cliff" context), which has been shown to lead to the automatic "think crisis, think female" heuristic (Ryan and Haslam, 2005).

We next present the experiment instructions given to the participants and their initial endowment, choice set, incentives and information set. The general instructions were read aloud before the start of the experiment. The participants were asked to act as investors whose objective was to maximize their gains during the trading day. The participants started the simulation with an identical portfolio composed of a combination of cash and stocks.[7]

Similar to traders in an investment bank, the choice set of participants includes decisions about trading (to trade or not to trade), the direction of trading activity (buy or sell stocks), the quantity of stocks bought or sold, the type of order sent (market order or limit order), and the timing of

[7] The initial portfolio of every participant is worth approximately €60,000. It is composed of €30,000 in cash and 300 shares of SunCar (the only company in the trading environment), each share being valued at approximately €100 in the market.

their trading reaction.[8] This set of choices is available to participants throughout the duration of the experiment, which replicates a trading day. The whole experiment lasted approximately 90 minutes with a preliminary trial simulation to familiarize participants with the trading platform and the simulation used for our research.

We next discuss the information set available to participants throughout the duration of the simulation. Our research design, which is based on a controlled experiment, enables us to minimize the series of informational problems discussed above that are present in archival research.

At the launch of the simulation, the participants read that the company is going to announce the appointment of a new CEO. However, they do not know *who* will be appointed; that is, we separate the information regarding the appointment of a new CEO and the gender of the newly appointed CEO. This is important because it means that the participants are already aware that a new CEO will be appointed when the actual appointment is made public. At the time of the announcement, the only news concerns the name of the appointed CEO, from which participants can unambiguously infer gender (this point was discussed with a student group prior to the experiment). Furthermore, in the French context, the names chosen for the CEOs do not have minority connotations related to social class, ethnic group and religious affiliation, which is important since there are minorities other than women among CEOs.

[8] The market environment proposed by the trading simulation platform is based on the limit order book. This type of market microstructure is currently the most common structure 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 at the market price. With limit orders, investors want to buy at a maximum price and sell at a minimum price (the price limit).

Importantly, no information is given to the participants about the candidates' qualifications: we mute the supply-side factors related to female CEOs' formal and informal qualifications and experience (Goldberg paradigm). Therefore, the participants' reactions to the CEO appointment can be attributed to *a pure gender effect* in their evaluation of female and male CEOs. If the participants buy or sell stocks following the appointment of a CEO of a given gender, this action reflects a like or a dislike of the CEO precisely because of the CEO's gender.

The participants also know *when* the appointment of the new CEO will be made. The information about the appointment is presented as important news on the ticker displayed on the trading platform. This component is included to maximize market participants' attention.[9] In other words, we minimize the problem of limited attention among traders who may not immediately react to the news (Hirshleifer and Teoh, 2003). Our experimental design also enables us to neutralize the influence of information providers in financial markets such as financial analysts and the media. Indeed, male financial analysts have been shown to give stock recommendations that are biased against female-led firms (Jannati et al., 2020). On the media side, female CEO appointments have been shown to attract higher media attention and different media treatment (Lee and James, 2007 and Dixon-Fowler et al., 2013).

Before launching the simulation, all participants are informed of the news flow that will unfold during the trading day. With respect to the CEO appointment, it is clearly stated that at midday, SunCar will announce the newly appointed CEO. However, before the official announcement by the firm, the participants cannot possibly anticipate the result of the announcement, i.e., whether

[9] This was confirmed in a pilot study using an eye tracking tool. The heat map obtained from the data showed that the ticker attracted the attention of the participants.

the appointed CEO will be a man or a woman (no information leakage). Our approach also enables us to disentangle the effect of the CEO appointment from other confounding news items that may affect the reaction of market participants as the CEO appointment is the only news released at that point in time. Because the timing of the announcement is fixed *ex ante* (it is the same regardless of the CEO being appointed, and it is announced to participants before the trading day starts), it is therefore independent of the gender of the CEO being appointed, eliminating potential biases linked to a strategic timing choice by the firm.

In summary, in developing the simulation scenario, we follow a unity of time (precise date of the event), unity of action (unique event) and unity of place (the experimental setting). As in theater, this makes the CEO appointment a *salient* event, allowing us to measure a pure gender effect.

DATA AND STATISTICAL MODEL

Data collection and measures

We collected individual-level data for all participants. Before launching the simulation, we asked the participants to fill in their profile on the SimTrade platform.[10] Their entire trading activity (orders sent to the market) and the evolution of their portfolio and trading performance during the simulation were collected via the platform. We also collected information regarding the simulation variant faced by each participant (defined by the gender of the CEO appointed during the simulation). From the data collected, we measure the participants' trading reactions following the news about the CEO appointment to construct our dependent variable, the gender of the CEO to define the independent variable manipulated in our experiment, and the gender of the participant to define our moderating variable. Figure 1 illustrates the links among these variables and the

[10] At the beginning of the experiment, we also asked the 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 school's Research Ethics Committee.

theoretical hypotheses.

{Insert Figure 1 about here}

The gender of the CEO and the gender of the participants are coded with dummy variables as follows: *CEO gender* (0 for male and 1 for female) and *Participant gender* (0 for male and 1 for female).

We capture the trading reaction of each participant along two dimensions: qualitative and quantitative. Qualitatively, we consider the trading activity following the appointment of the CEO: buying, selling or not trading stocks. This qualitative measure reveals the positive, negative or neutral evaluation of the appointed CEO. Quantitatively, we consider the intensity of the trading reaction, which provides information regarding *how much* the trader likes or dislikes the appointed CEO.

The trading activity and the trading intensity constitute the two components of our dependent variable. Formally, we define the trading activity as the participant's qualitative decision to buy or sell after the news of the appointment of the CEO or to do nothing. This factor is measured using two variables: *Market participation*, which is a dummy variable equal to 1 if the participant traded after the news and 0 otherwise, and *Order direction*, which is a dummy variable equal to -1 if the participant sold stocks and equal to +1 if the participant bought stocks. We combine these two measures to build the *Trading activity* variable given by Equation (1):

$$\textbf{Trading activity} = \textbf{Market participation} \times \textbf{Order direction}$$

We define trading intensity as a multifactorial construct to capture the amount, the aggressiveness, and the reaction speed of each participant. Our construct includes three factors: 1) the quantity of stocks traded, which reveals the *amount* by which a participant increased or decreased his or her investment in the firm after the CEO announcement; 2) the type of order (market order or limit

order), which reveals how *aggressive* the participant's reaction was after the announcement[11]; and 3) the time lapse between the CEO appointment announcement and the order sent by the participant, which reveals the *speed* of the participant's reaction. Each of these factors is measured with the following variables. *Quantity of stocks* is the number of stocks indicated in the buy or sell order sent by the participant. *Probability of execution* is estimated from the type of order (market order or limit order) specified by the participant; it is equal to one for a market order and less than one for a limit order. *Time lapse* is the (inverse) time lapse between the CEO appointment announcement and the order sent by the participant and captures the promptness of the order. A time window is defined to observe the participants' reaction time; *Time lapse* is equal to 1 for an order sent at the beginning of the window immediately after the announcement of the new CEO and 0 for an order sent at the end of the window (a linear function is applied between the beginning and the end of the window). We combine these multiple dimensions to define the *Trading intensity* variable as a signed adjusted-quantity measure given by Equation (2):

Trading intensity = Trading activity × Quantity of stocks × Probability of execution × Time lapse

Here, we present our control variables. Our first control variable is *Participant gender*, which, in addition to its role as a moderator, may have its own direct effect. Indeed, the extant research shows gender differences in trading behavior. For example, Barber and Odean (2001) study stock trading as a function of gender and find that men and women exhibit differences in their trading behavior that can be attributed to men being overconfident and more optimistic than women. Other studies have also documented gender differences in the behavior of financial professionals such as traders, fund managers and fundraisers. Eckel and Füllbrunn (2015) show that female traders are less prone to generate speculative bubbles, Beckmann and Menkhoff (2008) show that

[11] With market orders, investors favor quantity over price as the quantity of their order is fully executed (in a liquid market); conversely, with limit orders, investors favor price over quantity as they control the execution price. The use of market orders compared to limit orders reflects investors' aggressiveness in trading.

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 addition to gender, we control for the participants' academic knowledge and trading skills for the following reasons. The participants' academic knowledge may correlate with their ability to process information and, therefore, their reaction to the appointment news. To control for this possibility, we use the participants' grade in the finance course (*Course grade*) as a measure of academic knowledge and a control in our regressions. Similarly, the participants' trading performance (their practical trading skills) may also vary by gender, leading to incorrect inference. Therefore, we add the participants' trading performance in the simulation (*Trading performance*) as another control variable.

Statistical models and hypotheses

Our theoretical development identified three explanations, potentially concurrent, for the relationship between CEO gender and trading reaction. The first explanation is based on gender stereotypes and is formulated in Hypothesis 1a as follows: "Stock market participants buy stocks when a male CEO is appointed and sell stocks when a female CEO is appointed." The second explanation is based on the presence of a double standard and is formulated in Hypothesis 1b as follows: "Stock market participants buy stocks when a CEO of their own gender is appointed and sell stocks when a CEO of the opposite gender is appointed." The third explanation is based on group biases and is formulated in Hypothesis 2 as follows: "Stock market participants buy stocks when a CEO of their own gender is appointed and sell stocks when a CEO of the opposite gender is appointed." While Hypothesis 1a and Hypothesis 1b imply that the impact of CEO gender (our independent variable *X*) on trading reaction (our dependent variable *Y*) is the same for all participants, Hypothesis 2 implies that this impact is moderated by the participants' gender (our moderating variable *Z*).

Statistically, therefore, testing our theoretical hypotheses requires the analysis of both the impact

of our independent variable (*X*) on our dependent variable (*Y*), for Hypothesis 1a and for Hypothesis 1b, and the impact of our moderating variable *Z* on the relationship between the independent variable (*X*) and the dependent variable (*Y*), for Hypothesis 2. To do so, we use an interaction term statistical model that is estimated jointly for male and female participants (see Aiken and West (1991) for a detailed presentation of interaction models). Such a model is the appropriate approach to test our theoretical hypotheses because we wish to statistically test the effect of *X* on *Y* and the joint effect of *XZ* on *Y* beyond the separate effects of *X* and *Z* on *Y*. This is the case because the effect of either gender stereotypes or a double standard may be concurrent with the effect of group biases. Therefore, these effects must be tested in the same model. As a robustness check, we complement our main specification (our interaction model) with a direct comparison between two "simple slope" models estimated separately for the subsamples of male and female participants. Testing the difference in the "simple slopes" in the two subsamples allows us to test whether there is a different relationship between *X* and *Y* for each group *Z*. Such an approach has been shown to provide a more powerful test of the moderation effect due to less severe multicollinearity problems (Robinson, Tomek and Schumacker, 2013).

For each model, we run the estimation for the two components of our dependent variable. For the trading activity, the qualitative component of our dependent variable, we use a multinomial logit model with three categories (-1 for a sell order, 0 for no order, and +1 for a buy order). The odds ratio of the probabilities of two different categories (*j* and *k*) for individual *i* is a linear function of the explanatory variables given by Equation (3):

$$ln\left(\frac{Prob(Trading\ activity_i=j)}{Prob(Trading\ activity_i=k)}\right) = \alpha_0 + \alpha_1 \cdot CEO\ gender_i + \alpha_2 \cdot Participant\ gender_i + \alpha_3 \cdot CEO\ gender_i \times Participant\ gender_i + \beta_1 \cdot Trading\ performance_i + \beta_2 \cdot Course\ grade_i + \varepsilon_i$$

For trading intensity, the quantitative component of our dependent variable, we use the linear regression model given by Equation (4):

$$\textit{Trading intensity}_i = \alpha_0 + \alpha_1 \cdot \textit{CEO Gender}_i + \alpha_2 \cdot \textit{Participant gender}_i + \alpha_3 \cdot \textit{CEO gender}_i \times \textit{Participant gender}_i + \beta_1 \cdot \textit{Trading performance}_i + \beta_2 \cdot \textit{Course grade}_i + \varepsilon_i$$

Mirroring our theoretical hypotheses (Hypothesis 1a about gender stereotypes, Hypothesis 1b about double standard, and Hypothesis 2 about group biases), we test the following statistical hypotheses: Hypothesis 1a predicts that the coefficient for *CEO gender* is negative ($\alpha_1 < 0$). Hypothesis 1b predicts that the coefficient for *CEO gender* is positive ($\alpha_1 > 0$). Hypothesis 2 predicts that the coefficient for the interaction term *CEO gender* × *Participant gender* is positive ($\alpha_3 > 0$).

RESULTS

Descriptive statistics

{Insert Table 1 about here}

Table 1 presents descriptive statistics for the main variables of interest and for the control variables in our sample. Forty-four percent of the simulations have a female CEO being appointed, and 56 percent of the participants are women. A total of 83 percent of the participants reacted to the news of the CEO appointment by either buying or selling stocks. Regarding the participants' trading activity, on average, the participants tend to sell stocks (the mean of *Order direction* is slightly negative). The average quantity of stocks traded is 42.14, which is approximately 15 percent of their initial cash for a buy order or of their stocks for a sell order. The participants overwhelmingly use market orders rather than limit orders (average use of 95 percent). The average standardized time lapse is 0.57, indicating that the participants reacted halfway through the time window defined to study the event. The participants' average course grade is 11.21 out of 20, and while the average trading performance is negative, the standard deviation is high.

{Insert Table 2 about here} {Insert Figure 2 about here}

Table 2 provides descriptive statistics separately for the control group (simulation variant with a male CEO) and the treatment group (simulation variant with a female CEO). Figure 2 plots the percentage of buyers and sellers following the announcement of the appointment of a male CEO (Figure 2A) and a female CEO (Figure 2B).

When a CEO, either male or female, is appointed, the participants tend to sell shares of the company (56 percent). As shown in Figure 2A, when the appointed CEO is male (control group), the participants tend to sell (56 percent). When disaggregating the results by participant gender, 63 percent of male participants choose to buy stocks, while 67 percent of female participants choose to sell stocks. As shown in Figure 2B, when the appointed CEO is female (treatment group), the participants tend to sell (57 percent). When disaggregating the results by participant gender, 73 percent of male participants choose to sell stocks, while 55 percent of female participants choose to buy stocks. Next, we formally test our hypotheses using individual-level data in our regression analysis.

Regression analysis

{Insert Table 3 about here}

Table 3 presents our results. The dependent variable is the participant's trading reaction with its two components: trading activity (Column (1) and Column (2)) and trading intensity (Column (3) and Column (4)). The coefficients in columns (1) and (2) are presented in terms of multinomial log-odds (logits). When relevant, we discuss their interpretation in terms of relative risk ratios. All specifications include *CEO gender* as our manipulated variable, *Participant gender* as our moderating variable, and *CEO gender* × *Participant gender* as our interaction term. Columns (1) and (3) are replicated in columns (2) and (4), our main specifications, by adding control variables: *Trading performance* and *Course grade*.

Before discussing the empirical test of our hypotheses, we discuss the results concerning the

control variables. Across the columns, none of the control variables are statistically significant. In particular, the estimated coefficient for *Participant gender*, $\widehat{\alpha_2}$, is negative in all specifications but not statistically significant. The estimated coefficient for *Trading performance*, $\widehat{\beta_1}$, is positive in all specifications but not statistically significant. Finally, the estimated coefficient for *Course grade*, $\widehat{\beta_2}$, is negative for the specification in columns (1) and (2) and positive for the specification in columns (3) and (4), but not statistically significant.

Hypothesis 1a, which is based on gender stereotypes, predicts that the estimated coefficient for *CEO gender*, $\widehat{\alpha_1}$, is negative. While throughout all the specifications the sign of the estimated coefficient is negative, it is not statistically significant as it fails to provide direct support for the hypothesis of negative gender stereotypes about female CEO performance as a cause for the gender bias against female CEOs.[12]

Hypothesis 1b, which is based on a female leadership advantage that originates in a double standard and in the increasing value of communal traits as part of a transformational leadership style, predicts that the estimated coefficient for CEO gender is positive. Contrary to this prediction, the sign of the estimated coefficient is negative although not statistically significant as it fails to provide direct rejection for the hypothesis of a female leadership advantage.

Hypothesis 2, which is based on group biases, predicts that the estimated coefficient for the interaction term *CEO gender* × *Participant gender*, $\widehat{\alpha_3}$, is positive. Throughout all the specifications, the sign of the interaction term is positive and statistically significant at the 5 percent level. When a female CEO is newly appointed, the female participants are more likely to buy stocks. In terms of trading activity, the interaction term is positive and equal to +1.712 and is

[12] This lack of significance may be due to low statistical power rather than a lack of relationship between the two variables. We perform a power analysis and find that the lack of significance does not result from low statistical power (see the Appendix).

statistically significant at the 5 percent level (the logit of the "buy-order" outcome relative to the "sell-order" outcome is expected to change by 1.712 log-odds units). In terms of relative risk ratio, the relative risk for a buy order compared to a sell order is expected to increase by a factor of 5.67 given that all other variables are held constant. In terms of trading intensity, the interaction term is positive and equal to +40.236 and is statistically significant at the 5 percent level. This represents the additional adjusted quantity bought by the female participants when a female CEO is appointed (approximately 13 percent of their initial stock endowment, which is economically significant). Therefore, our statistical results for the trading reaction of the female participants are consistent with group bias (both in-group favoritism and out-group discrimination): the female participants tend to buy stocks when a female CEO is appointed and to sell stocks when a male CEO is appointed. Such a result is also consistent with the presence of a double standard and is at odds with negative gender stereotypes about female CEOs. Regarding the male participants, the sign of the interaction term implies that they are more likely to buy stocks when a male CEO is appointed and to sell stocks when a female CEO is appointed, which is consistent with both gender stereotypes and group biases (in-group favoritism and out-group discrimination) and at odds with the double standard about female CEOs. That is, our result lends direct support in favor of the presence of a female leadership advantage and group biases among female traders. In contrast, the sources of gender bias among male traders are consistent with both gender stereotypes and group biases.

We also carry out a test based on a direct comparison of "simple slopes" from two regression models estimated separately for the subsamples of male and female participants to complement our test based on the interaction term. For the subsample of male participants, the "simple slope" coefficient for *CEO gender* (equivalent to $\widehat{\alpha_1}$ in the model with the interaction term) is negative and equal to -0.851 for trading activity and to -47.367 for trading intensity. For the subsample of female participants, the "simple slope" coefficient for *CEO gender* (equivalent to $\widehat{\alpha_1} + \widehat{\alpha_3}$) is

positive and equal to +0.844 for trading activity and +30.682 for trading intensity. The test based on the difference between the two "simple slope" coefficients is equal to +2.886 for trading activity and statistically significant at the 1 percent level (p-value = 0.002) and +2.897 for trading intensity and statistically significant at the 1 percent level (p-value = 0.002). This more powerful test corroborates our previous result regarding the significance of our moderating variable (participants' gender) in support of the presence of group biases (Hypothesis 2).

FURTHER ANALYSIS

Our empirical results show that investors react differently to the appointment of female and male CEOs as a function of their own gender. Beyond the study of individual decision-making, here, we consider the role of aggregate market reaction by asking the following question: Could the lack of gender diversity among investors play a role in explaining the negative stock market reaction to female CEO announcements and, as a consequence, firms' reluctance to appoint female CEOs? To study the role of gender diversity, we analyze the impact of the proportion of female and male investors in the aggregate stock market reaction to a CEO appointment as a function of its gender. To do so, we calibrate the probabilities of buying and selling using the proportions of buyers and sellers among female and male participants estimated from the data of our experiment (as plotted in Figure 2). In doing so, we assume that buying/selling behavior does not depend on the gender diversity among stock market participants (an assumption supported by Eckel and Füllbrunn, 2015).

Figure 3 plots the difference between the percentage of buyers and the percentage of sellers after the announcement of the appointment of a male CEO (Figure 3A) or a female CEO (Figure 3B) as a function of the proportion of female market participants. This enables 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 appointed and from positive to

negative when a male CEO is appointed). 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 male CEO appointment or a female CEO appointment. A departure of the critical threshold away from the reference value of 50 percent (corresponding to gender neutrality) indicates a market gender bias. Market gender bias reflects both male and female participants' gender biases, as revealed by their trading activity and the hypothetical composition of market participants (the proportion of women participating in the market).

{Insert Figure 3 about here}

When a male CEO is appointed, the critical threshold of female market participants that makes the market reaction gender neutral is 43 percent (Figure 3A). When a female CEO is appointed, the critical threshold of female market participants that makes the market reaction gender neutral is 82 percent (Figure 3B). This means that the market gender bias is larger in magnitude (further away from the reference value of 50 percent) when the appointment concerns a female CEO (a positive gap of +32 percent) than when the appointment concerns a male CEO (a negative gap of -7 percent).

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

bias in favor of male CEOs.

More importantly, in the case of the appointment of a female CEO, the market gender bias (+32 percent), measured by the difference between the critical threshold of the proportion of female participants of 82 percent and the reference value of 50 percent, is explained by the selling activity of male market participants (73 percent), which outweighs the buying activity of female market participants (55 percent). When the proportion of female market participants is equal to this critical threshold of 82 percent, the market reaction to the appointment 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 appointment of a female CEO exhibits 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 appointment of a female CEO exhibits a negative gender bias towards female CEOs.

This thought experiment suggests that our results can explain the negative stock market reaction to female CEO appointments. Indeed, the threshold of female market participants that makes the market reaction gender neutral to the appointment of a female CEO is 82 percent, well above the current female representation in decision-making positions in the financial sector (less than 15 percent) as mentioned above. In this context, undoing the negative stock market reaction to female CEO appointments would require a complete transformation of the financial industry by diversifying its workforce. Doing so may require changes in how these occupations are designed to enhance temporal flexibility, one of the key factors explaining the gender pay gap in the corporate, financial and legal worlds, as argued by Goldin (2014). In conclusion, our thought experiment implies that the market is "gendered", meaning that the gender composition of the market participants is not neutral to market outcomes.

DISCUSSION

Our study contributes to the management research on glass ceiling barriers to the appointment of female CEOs. While most of the research focuses on barriers that are internal to the firm, we study external constraints on a firm's management originating in the financial market. Our contribution is to identify a glass ceiling barrier related to the presence of gender biases among stock market investors. Investors can influence a firm's appointment decisions through their selling or buying of stocks. Because investors' trading choices may be influenced by gender biases, their trading activity may indirectly impact female access to CEO positions. If the stock market reacts negatively to the appointment of female CEOs, this could discourage firms from appointing female CEOs. Indeed, because stock markets tend to react more negatively to the appointment of a female CEO than to the appointment of a male CEO, the decisions made in the stock market may effectively act as a demand-side barrier to female advancement in corporate leadership.

We focus on inquiring on the presence and sources of gender biases (gender stereotypes, double standard and group biases) in stock market individual trading activity; that is, we study investors' reaction to CEO appointment at the individual level, which is essential to interpreting aggregate stock market fluctuations in reaction to the appointment of a CEO. We rely on an experimental methodology to causally identify the pure effect of gender. Therefore, our experimental design ensures that participant selling following the appointment of a female CEO reflects a negative evaluation of a female CEO precisely because of her gender.

In our experiment, we observe trading decisions at the individual level in a controlled environment. We build a trading simulation around the appointment of a new CEO that mimics the investment environment. By randomizing CEO gender, we can study the effect of CEO gender on the trading activity of the participants as a function of participant gender. We show that the gender of the market participants—a moderating variable—fundamentally changes the relationship between the trading reaction of the participants and the gender of the appointed CEO.

Including the participants' gender in our analysis allows us to distinguish several sources of gender bias among both female and male participants, thereby contributing to the research on gender biases in the evaluation of female and male CEOs.

Our theoretical development employs a "lack of fit" model to engage with the existing paradigm of gender stereotypes regarding the negative expected performance of females in leadership roles. It also engages with the research on double standards, and on the presence of group biases. We find that the male participants' trading activity is consistent with both gender stereotypes and group biases, while the female participants' trading activity is consistent with both double standard and group biases. Specifically, we find that male participants tend to buy shares of a company when a male CEO is appointed and tend to sell shares when a female CEO is appointed. The opposite result holds for female participants. Using these results, we quantify the implications of increasing gender diversity among stock market participants and the negative stock market reaction to female CEO appointments.

We contribute to the existing theory by employing three distinct theories of leadership evaluation and gender (gender stereotypes, double standard and group biases) and shed light on how considering investment context helps to the testing of those theories. We identify some of the conditions that allow us to distinguish among gender stereotypes, double standard and group biases, which will also be useful for future work on shareholders' decision making. The reaction of investors has already been studied from a gender stereotype perspective, but to our knowledge, no one has yet studied it from both double standard and group biases perspectives, which we do in this paper. Furthermore, no one has theoretically developed how to distinguish between them.

Empirically, gender biases including gender stereotypes, double standard, and group biases, can help reconcile three stylized facts: 1) the underrepresentation of women in CEO positions, 2) the negative stock market reaction to female CEO appointments, and 3) the underrepresentation of women in investment positions. The evidence of group biases among traders implies that

alleviating the underrepresentation of women in investment occupations could undo the negative stock market reaction that currently constitutes a barrier to the advancement of women at the top of the corporate world. Indeed, decisions made by investors in financial markets can spillover firm decisions on CEO appointments. Breaking the glass ceiling for women reaching CEO positions is not only an issue for the corporate world but also for the financial industry because, as we show, gender is "in the pocket" of investors.

Our work has three main policy implications. First, efforts to deal with the underrepresentation of women in leadership positions should also consider interventions in the financial industry and among stock market participants. Such efforts can involve early interventions including unblinding gender in finance curricula as well as on-the-job interventions to reveal the role of such biases to decision-makers in the financial industry. These two measures are important not only for dealing with barriers to females accessing top positions but also for the development of social skills among investors at a moment when nonfinancial performance is becoming increasingly relevant with the rise of socially motivated investment demands from consumers and regulators. The second policy implication is derived from the fact that women face barriers climbing the corporate ladder for reasons outside of their control. Therefore, the use of measures such as quotas may be appropriate to break the glass ceiling barriers that originate from investors' gender biases (demand-side barriers). The third policy implication of our findings is that training programs that aim at dealing with gender stereotypes and double standards may benefit from taking into account their interaction with group biases. By reinforcing the notion that men and women's judgments are prone to gender-related biases, interventions may trigger an increase in the salience of gender as an organizing principle of group affiliation. It is therefore important to address gender biases considering both stereotypes and the role of generic group affiliation and their consequences on decision-making. Relatedly, if group consciousness is unaffected by existing diversity or its lack, then diversifying the financial sector workforce may also contribute to the undoing of the negative

reaction of stock markets to female CEO appointments.

LIMITATIONS AND FUTURE WORK

Our study has both advantages and limitations regarding validity issues. While our choices of using a consequential experiment with a between-subject design and mixed-gender participants contribute to the minimizing of internal validity concerns our results may not generalize to firms in crisis circumstances. This is the case because our scenario depicts a company that is experiencing an upward trajectory in the months prior to the CEO change. Similarly, because our experiment considers a setting where the departing CEO is male, our results may not apply to the less frequent case of female-to-female transitions and female-to-male transitions.

Another important aspect related to generalizability concerns the choice of participants and whether they constitute a relevant sample to study our hypothesis. Are business school students an appropriate sample for studying gender and leadership? Beyond the obvious fact that students can be easily mobilized for experiments and incentivized with relatively small stakes, the choice of business school students is particularly relevant for three substantive reasons: work experience, career choices, and acquisition of stereotypes. As discussed above, contrary to university students, who tend to have limited work experience, students in French business schools have significant exposure to the corporate world during their compulsory internship period in their first academic year. Corporate immersion for the students in our sample starts in the first term with on-site presence and mentoring from top manager alumni. Therefore, we believe that participants in our experiment have relevant work experience and educational background to analyze corporate news. They also have the knowledge and skills (acquired in the finance course) to implement their analysis in their decision to buy and sell stocks in the market on the simulation platform. Regarding career choices, as the students in our sample come from a leading French business school, they represent a relevant population because they are likely to take on leadership positions,

such as those of CEOs, in their professional careers. Furthermore, an analysis of the specialization choices of our students (finance, marketing, communication, etc.) in their second and third years reveals a choice that is consistent with stereotypes (e.g., most students who chose the finance track are male). As the academic research shows, gender stereotypes and roles are acquired during childhood and persist over time (see, for example, Hicks, Santacreu-Vasut and Shoham, 2015). Therefore, our sample is suitable for studying the effect of preferences towards CEO gender. In that sense, we expect that the qualitative aspect of our results (the direction of the trading reaction revealing the preferences of market participants) is generalizable. For most experimental research, generalizability for the quantitative aspects, which in this case involve the amount of stocks bought or sold, is difficult to claim (Kessler and Versterlund, 2015).

To sum up, we do not claim to have designed the perfect experiment, but our choices follow best practices (see Lonati et al., 2018). We develop a rigorous approach to optimize the internal validity of our experiment (consequential experiment, no deception, minimized unwanted demand effects). We also rely on a relevant approach to optimize the external validity using a realistic trading platform and by choosing a relevant sample of participants.

In future work, research could focus on digging deeper into the mechanisms underpinning group biases among stock market traders. Following Greenberg and Mollick (2017), experiments could manipulate the sector and the industry composition to distinguish between interpersonal choice homophily and activist choice homophily as distinct sources of group biases manifested in trading activity. Regarding other avenues for future work, our experiment could be implemented in different environments, which could help to increase the external validity of our results. In our case, such an approach appears to be highly 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 a 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 implemented in different countries and consider the different cultural and linguistic origins of participants (Thébaud, 2015). To that end, the experiment we developed on the SimTrade platform is available for the research community upon request. Regarding CEO gender, further research could explore the role of other individual identity dimensions such as age group, handicap status, religion or social class as well as their combined effects (or intersection) with gender. Indeed, intersectionality could be explored in our experimental setting by building CEO candidate profiles that vary in these other dimensions. Finally, another line of future work could involve the study of gender as a nonbinary biological and social construct. While in this paper we used a binary representation (male/female) corresponding to the way in which the current business world portrays gender, scientific research and political activism are increasingly conceiving gender as a continuous spectrum (Ainsworth, 2015). Our experimental setting is also applicable to the study of investors' reactions to CEOs who belong or self-identify as neither of the two traditional gender categories.

ACKNOWLEDGMENTS

This research benefited from the support of the Centre d'Innovation et de Recherche en Pédagogie de Paris (CIRPP) of the Chamber of Commerce and Industry of Paris Ile-de-France and fruitful exchanges with Professor Virginie Descoutures, sociologist at the Université Picardie-Jules Verne. We received valuable feedback from participants at the 3rd Society of Economics of the Household Meetings (Lisbon, May 2019), the 34th Annual Congress of the European Economic Association (Manchester, August 2019), the 9th Paris Financial Management Conference (Paris, December 2019) and our discussant Felix Meyerinck, ESSEC Gender Research Day (March 2020), EM Strasbourg seminar (March 2020), SFI/EPFL/HEC Lausanne seminar (December 2020) and from fruitful discussions with Sandrine Brissot, Lucie Paquy and Malini Sumputh from the CIRPP, Renée Adams, Craig Crossland, Delphine Dubart, Geneviève Helleringer, Ivona Hideg, Sacha Nauta, Anne-Claire Pache, Raymond Thietart, Laszlo Tihanyi and Radu Vranceanu. This research also benefited from the financial support of Ceressec and the ESSEC-Amundi Chair.

REFERENCES

Abele A. 2003. The dynamics of masculine-agentic and feminine-communal traits: Findings from a prospective study. *Journal of Personality and Social Psychology* **85**(4): 768–776.

Adams RB, Ragunathan V. 2017. Lehman sisters. Working paper. University of South Wales.

Aiken LS, West SG. 1991. *Multiple regression: Testing and interpreting interactions*. Sage Publications: Thousand Oaks, CA.

Ainsworth C. 2015. Sex redefined. *Nature* **518**: 288-91.

Allport G.W. 1954. *The nature of prejudice*. Reading, MA: Addison- Wesley.

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

Becker G. 1957. *The Economics of Discrimination*, Second Edition, The University of Chicago Press Economics.

Beckmann D, Menkhoff L. 2008. Will women be women? Analyzing the gender difference among financial experts. *Kyklos* **61**(3): 364-384.

Berger J, Cohen BP, Zelditch M. 1972. Status characteristics and social interaction. *American Sociological Review* **37**(3): 241–255.

Blau F, Kahn L. 2017. The gender wage gap: Extent, trends, and explanations. *Journal of Economic Literature* **55**(3): 789-865.

Campbell D T. 1958. Common fate, similarity, and other indices of the status of aggregates of persons as social entities. *Behavioural Science* **3**(1): 14–25.

Card D, Cardoso AR, Kline P. 2016. Bargaining, sorting, and the gender wage gap: Quantifying the impact of firms on the relative pay of women. *The Quarterly Journal of Economics* **131**(2): 633-686.

Charness G, Gneezy U, Kuhn MA. 2012. Experimental design methods: Between-subject and within-subject design. *Journal of Economic Behavior & Organization* **81**(1): 1-8.

Cook A, Glass C. 2011. Leadership change and shareholder value: How markets react to the appointments of women. *Human Resource Management* **50**(4): 501-519.

Croson R, Gneezy U. 2009. Gender differences in preferences. *Journal of Economic Literature* **47**(2): 1-27.

China Stock Market & Accounting Research (CSMAR). 2020. https://cn.gtadata.com/, accessed on May 12th, 2021.

Currarini S, Mengel F. 2016. Identity, homophily and in-group bias. *European Economic Review* **90**(C): 40-55.

Davidson MJ, Cooper CL. 1992. *Shattering the Glass Ceiling: The Woman Manager*. Paul Chapman Publishing.

Dixon-Fowler HR, Ellstrand AE, Johnson JL. 2013. Strength in numbers or guilt by association? Intragroup effects of female chief executive announcements. *Strategic Management Journal* **34**(12): 1488-1501.

Dow J, Goldstein I, Guembel A. 2017. Incentives for information production in markets where prices affect real investment. *Journal of the European Economic Association* **15**(4): 877-909.

Dwivedi P, Joshi A, and Misangyi V F. 2018. Gender-inclusive gatekeeping: How (mostly male) predecessors influence the success of female CEOs. *Academy of Management Journal*, **61**(2): 379-404.

Eagly AH, Carli LL. 2003. The female leadership advantage: An evaluation of the evidence. *The Leadership Quarterly* **14**(6): 807–834.

Eagly AH, Karau SJ. 2002. Role congruity theory of prejudice toward female leaders. *Psychological Review* **109**(3): 573–598.

Eagly AH, Karau SJ, Makhijani MG. 1995. Gender and effectiveness of leaders: A meta-analysis. *Psychological Bulletin* **117**(1): 125-145.

Eckel CC, Füllbrunn SC. 2015. Thar "SHE" blows? Gender, competition, and bubbles in experimental asset markets. *American Economic Review* **105**(2): 906-920.

EIGE (European Institute for Gender Equality). 2021. Gender statistics database. https://eige.europa.eu/gender-statistics, accessed on May 12th, 2021.

Ely R. 1995. The power in demography: Women's social constructions of gender identity at work. *The Academy of Management Journal* **38**(3): 589-634.

Faccio M, Marchica MT, Mura R. 2016. CEO gender, corporate risk-taking, and the efficiency of capital allocation. *Journal of Corporate Finance* **39**(C): 193-209.

Fama E. 1970. Efficient Capital Markets: A review of theory and empirical work. *The Journal of Finance* **25**(2): 383-417.

Fernández R. 2013. Cultural change as learning: The evolution of female labor force participation over a century. *American Economic Review* **103**(1): 472-500.

Filippin A, Crosetto P. 2016. A reconsideration of gender differences in risk attitudes. *Management Science* **62**(11): 3138-3160.

Fortune 500 list. 2020. https://fortune.com/fortune500/, accessed on May 12th, 2021.

Foschi M. 1992. Gender and double standards for competence. in *Gender, Interaction, and Inequality*, edited by C.L. Ridgeway. New York, NY: Springer-Verlag.

Foschi M. 1996. Double standards in the evaluation of men and women. *Social Psychology Quarterly* **59**(3), 237–254.

Frear KA, Paustian-Underdahl S C, Heggestad ED, Walker LS. 2019. Gender and career success: A typology and analysis of dual paradigms. *Journal of Organizational Behavior* **40**(4), 400–416.

Glass C, Cook A. 2016. Leading at the top: Understanding women's challenges above the glass ceiling. *The Leadership Quarterly* **27**(1): 51-63.

Goldberg P. 1968. Are women prejudiced against women? *Transaction* **5**(5): 316–322.

Goldin C. 2014. A grand gender convergence: Its last chapter. *American Economic Review* **104**(4): 1091-1119.

Goodman JS, Fields DL, Blum TC. 2003. Cracks in the glass ceiling: In what kind of organizations do women make it to the top? *Group & Organization Management* **28**(4): 475–501.

Greenberg J, Mollick E. 2017. Activist choice homophily and the crowdfunding of female founders. *Administrative Science Quarterly* **62**(2): 341-374.

Greenwald A. 1976. Within-subjects designs: to use and not to use. *Psychological Bulletin* **83**(2): 314-320.

Harlan A, Weiss C. 1982. Sex differences in factors affecting managerial career advancement. In P. Wallace (Ed.), *Women in the workplace* (pp. 59-100). Auburn House: Boston.

Harrigan K. 1981. Numbers and positions of women elected to corporate boards. *Academy of Management Journal* **24**(3): 619-625.

Haslam SA, Ryan MK. 2008. The road to the glass cliff: Differences in the perceived suitability of men and women for leadership positions in succeeding and failing organizations. *The Leadership Quarterly* **19**(5): 530-546.

Hebert C. 2019. Mind the gap: Gender stereotypes and entrepreneur financing. Working paper.

Heilman M.E. 1983. Sex bias in work settings: The lack of fit model. In Staw, B., & Cummings, L. Eds. Research in organizational behavior (Vol.5). Greenwich, CT: JAI.

Heilman M.E. 2012. Gender stereotypes and workplace bias. *Research in Organizational Behavior* **32**(1): 113–135.

Hentschel T, Heilman ME, Peus C. 2013. Have perceptions of women and men changed? Gender stereotypes and self-ratings of men and women. Presentation at the Society of Personality and Social Psychology Annual Conference.

Hicks DL, Santacreu-Vasut E, Shoham A. 2015. Does mother tongue make for women's work? Linguistics, household labor, and gender identity. *Journal of Economic Behavior & Organization* **110**(C): 19-44.

Hirshleifer D, Teoh SH. 2003. Limited attention, information disclosure, and financial reporting. *Journal of Accounting and Economics* **36**(3): 337-386.

Huang J, Kisgen DJ. 2013. Gender and corporate finance: Are male executives overconfident relative to female executives? *Journal of Financial Economics* **108**(3): 822-839.

Ibarra H. 1992. Homophily and differential returns: Sex differences in network structure and access in an advertising firm. *Administrative Science Quarterly* **37**(3): 422–447.

Jannati S, Kumar A, Niessen-Ruenzi A, Wolfers J. 2020. In-group bias in financial markets. Working paper.

Jeong SH, Harrison DA. 2017. Glass breaking, strategy making, and value creating: Meta-analytic outcomes of women as CEOs and TMT members. *Academy of Management Journal* **60**(4): 1219-1252.

Kahneman D, Tversky A. 2000. *Choices, values, and frames*. Cambridge University Press.

Kanter RM. 1977. *Men and Women of the Corporation*. Basic Books: New York.

Kessler JB, Vesterlund L. 2015. The external validity of laboratory experiments: qualitative rather than quantitative effects. *Handbook of Experimental Economic Methodology*, Edited by Fréchette GR. and A. Schotter, Oxford Scholarship Online.

Kleinbaum AM, Stuart TE, Tushman ML. 2013. Discretion within constraint: Homophily and structure in a formal organization. *Organization Science* **24**(5): 1316–1336.

Koenig AM, Eagly AH, Mitchell AA, Ristikari T. 2011. Are leader stereotypes masculine? A meta-analysis of three research paradigms. *Psychological Bulletin* **137**(4): 616–642.

Krause R, Whitler KA, Semadeni M. 2014. Power to the principals! An experimental look at shareholder say-on-pay voting**.** *Academy of Management Journal* **57**(1): 94–115.

Lee PM, James EH. 2007. She-E-Os: Gender effects and investor reactions to the announcements of top executive appointments. *Strategic Management Journal* **28**(3): 227-241.

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

Lonati S, Quiroga BF, Zehnder C, Antonakis J. 2018. On doing relevant and rigorous experiments: Review and recommendations. *Journal of Operations Management* **64**(1): 19-40.

Malatesta PH, Thompson R. 1985. Partially anticipated events: A model of stock price reactions with an application to corporate acquisitions. *Journal of Financial Economics* **14**(2): 237-250.

Matsa DA, Miller AR. 2011. Chipping away at the glass ceiling: Gender spillovers in corporate leadership. *American Economic Review* **101**(3): 635–39.

Mattia L. 2018. Gender on Wall Street. Uncovering opportunities for women in financial services. Palgrave-Macmillan.

McPherson M, Smith-Lovin L, Cook JM. 2001. Birds of a feather: homophily in social networks. *Annual Review of Sociology* **27**(1): 415-44.

Niederle M, Vesterlund L. 2011. Gender and competition. *Annual Review of Economics* **3**(1): 601-630.

Niessen-Ruenzi A, Ruenzi S. 2019. Sex matters: Gender bias in the mutual fund industry. *Management Science* **65**(7): 3001-3025.

Olsen RA, Cox CM. 2001. The influence of gender on the perception and response to investment risk: The case of professional investors. *The Journal of Psychology and Financial Markets* **2**(1): 29–36.

Parks-Stamm EJ, Heilman ME, Hearns KA. 2008. Motivated to penalize: Women's strategic rejection of other women. *Personality and Social Psychology Bulletin* **34**(2): 237–247.

Pfeffer J, Davis-Blake A. 1987. The effect of the proportion of women on salaries: The case of college administrators. *Administrative Science Quarterly* **32**(1):1-24.

Phelps E. 1972. The statistical theory of racism and sexism. *American Economic Review* **62**(4): 659-661.

Powell GN, Butterfield DA, Parent JD. 2002. Gender and managerial stereotypes: Have the times changed. *Journal of Management* **28**(2): 177-193.

Robinson C, Tomek S, Schumacker R. 2013. Tests of moderation effects: Difference in simple slopes versus the interaction term. *Multiple Linear Regression Viewpoints* **39**(1): 16-24.

Rosette AS, Tost LP. 2010. Agentic women and communal leadership: How role prescriptions confer advantage to top women leaders. *Journal of Applied Psychology* **95**(2): 221–235.

Ryan MK, Haslam SA. 2005. The glass cliff: Evidence that women are over-represented in precarious leadership positions. *British Journal of Management* **16**(2): 81–90.

Santacreu-Vasut E, Shenkar O, Shoham A. 2014. Linguistic gender marking and its international business ramifications. *Journal of International Business Studies* **45**(9): 1170-1178.

Schein VE. 1973. The relationship between sex stereotypes and requisite management characteristics. *Journal of Applied Psychology* **57**(2): 95-100.

Schein VE, Mueller R, Lituchy T, Liu J. 1996. Think manager-think male: A global phenomenon? *Journal of Organizational Behavior* **17**(1): 33–41.

Schmid S, Dauth T. 2014. Does internationalization make a difference? Stock market reaction to announcements of international top executive appointments. *Journal of World Business*, **49**(1): 63-77.

Shivdasani A, Yermack D. 1999. CEO Involvement in the selection of new board members: An empirical analysis. *Journal of Finance* **54**(5): 1829-1853.

Singh V, Vinnicombe S. 2003. The 2002 female FTSE index and women directors. *Women in Management Review* **18**(7): 349–358.

Soros G. 1988. *The Alchemy of Finance*, John Wiley & Sons.

Tajfel H. 1970. Experiments in intergroup discrimination. *Scientific American* **223**(5): 96-102.

Tajfel H. 1982. Social psychology of intergroup relations. *Annual Review of Psychology* **33**(1) 1-39.

Thébaud S. 2015. Status beliefs and the spirit of capitalism: Accounting for gender bias in entrepreneurship and innovation. *Social Forces* **94**(1): 61-86.

Tuggle CS, Sirmon DG, Reutzel CR, Bierman L. 2010. Commanding board of director attention: Investigating how organizational performance and CEO duality affect board members' attention to monitoring. *Strategic Management Journal* **31**(9): 946- 968.

Wolfers J. 2006. Diagnosing discrimination: Stock returns and CEO gender. *Journal of the European Economic Association* **4**(2-3): 531-41.

World Bank Group. 2018. Women, business and the law 2018. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO.

Zhang YA, Qu H. 2016. The impact of CEO succession with gender change on firm performance and successor early departure: Evidence from China's publicly listed companies in 1997-2010. *Academy of Management Journal* **59**(5): 1845-1868.

TABLES AND FIGURES

Table 1. Descriptive statistics

	Mean	Standard deviation	Min	Max	Observations
CEO gender	0.436	0.490	0	1	126
Participant gender	0.563	0.502	0	1	126
Market participation	0.833	0.374	0	1	126
Order direction	-0.039	0.915	-1	1	126
Quantity of stocks	42.14	66.97	0	400	126
Order type	0.896	0.305	0	1	126
Time lapse	1.140	0.670	0.000	1.483	126
Trading performance	-6,376	9,818	-47,626	4,761	126
Course grade	11.21	3.31	1.00	18.95	126

Note: This table gives the descriptive statistics (mean, standard deviation, minimum and maximum) for the observed variables of the experiment. The participants in the experiment were recruited among students enrolled in the core finance course at a French business school. The *CEO gender* dummy variable is equal to 0 if a male CEO is appointed in the simulation and to 1 if a female CEO is appointed. The *Participant gender* dummy variable is equal to 0 if the participant in the experiment is a male and to 1 if the participant is a female. The *Market participation* dummy variable is equal to 0 if the participant did not trade after the announcement of the new CEO and to 1 otherwise. The *Order direction* dummy variable is equal to -1 for a sell order and to +1 for a buy order. The *Quantity of stocks* is the number of shares in the buy or sell order. The *Order type* dummy variable is equal to 0 for a limit order and to 1 for a market order. The *Time lapse* is the standardized time-difference between the announcement of the new CEO and the order sent by the participant. The *Trading performance*, measured in euros, is the performance of the participant in the simulation. The *Course grade* is the grade of the participant in the finance course with French grading between 0 and 20.

Table 2. Descriptive statistics for the control and treatment groups

	Pooled simulations and pooled participants	Control group: Male CEO simulations			Treatment group: Female CEO simulations		
		Pooled participants	Male participants	Female participants	Pooled participants	Male participants	Female participants
Market participation	0.833	0.873	0.862	0.881	0.781	0.769	0.793
	(0.374)	(0.335)	(0.350)	(0.327)	(0.416)	(0.429)	(0.412)
Order direction	-0.039	-0.056	0.103	-0.166	-0.018	-0.230	0.172
	(0.915)	(0.939)	(0.939)	(0.934)	(0.374)	(0.262)	(0.889)
Quantity of stocks	42.14	34.23	38.83	31.05	52.36	65.27	40.79
	(66.97)	(42.66)	(40.67)	(44.18)	(88.52)	(106.60)	(68.35)
Order type	0.896	0.971	0.931	1.000	0.800	0.961	0.655
	(0.305)	(0.166)	(0.257)	(0.000)	(0.403)	(0.196)	(0.483)
Time lapse	1.140	1.204	1.097	1.278	1.065	0.974	1.146
	(0.670)	(0.642)	(0.673)	(0.618)	(0.702)	(0.672)	(0.730)
Trading performance	-6,376	-6,654	-7,039	-6,387	-6,018	-4,633	-7,260
	(9,818)	(10,339)	(11,346)	(9,717)	(9,183)	(6,527)	(11,010)
Course grade	11.21	11.15	10.82	11.37	11.31	10.78	11.79
	(3.31)	(2.93)	(2.65)	(3.12)	(3.76)	(3.26)	(4.16)
Observations	126	71	29	42	55	26	29

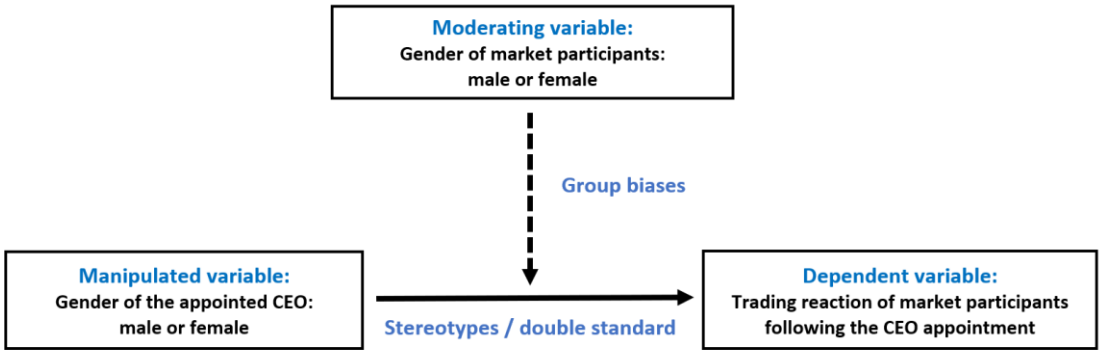
Note: This table gives the descriptive statistics (mean and standard deviation below in parentheses) of the observed variables of the experiment for the control group (when a male CEO is appointed in the simulation) and the treatment group (when a female CEO is appointed). Furthermore, for each group, we disaggregate statistics by participant gender (male and female). The *Market participation* dummy variable is equal to 0 if the participant did not trade after the announcement of the new CEO and to 1 otherwise. The *Order direction* dummy variable is equal to -1 for a sell order and to +1 for a buy order. The *Quantity of stocks* is the number of shares in the buy or sell order. The *Order type* dummy variable is equal to 0 for a limit order and to 1 for a market order. The *Time lapse* is the standardized time-difference between the announcement of the new CEO and the order sent by the participant. The *Trading performance*, measured in euros, is the performance of the participant in the simulation in euros. The *Course grade* is the grade of the participant in the finance course with French grading between 0 and 20.

Table 3. Regression results for the participants' trading reactions following the appointment of the new CEO

	Dependent variable: participants' trading reactions			
	Trading activity		Trading intensity	
	(1)	(2)	(3)	(4)
Intercept	0.241 (0.403)	0.578 (0.817)	2.642 (20.406)	-14.075 (39.240)
CEO gender	-0.860 (0.618)	-0.862 (0.621)	-47.367 (26.679)	-49.737 (29.822)
Participant gender	-0.624 (0.523)	-0.608 (0.527)	-24.957 (26.531)	-26.836 (26.627)
CEO gender × Participant gender	1.685** (0.823)	1.711** (0.828)	78.123* (39.808)	80.472** (40.032)
Trading performance		$5.89 \cdot 10^{-6}$ $(1.96 \cdot 10^{-5})$		$1.02 \cdot 10^{-3}$ $(1.08 \cdot 10^{-3})$
Course grade		-0.027 (0.063)		2.210 (2.996)
Pseudo R^2/R^2	0.14	0.15	0.03	0.05
Observations	126	126	126	126

Note: This table presents the regression results for the trading reactions of participants (female/male participants) following the appointment of the new CEO (male/female CEO) in the trading simulations. The models in columns (1) and (3) present the results without control variables. The models in columns (2) and (4) present the results with control variables (*Trading performance* and *Course grade*). Standard errors are given in parentheses below the coefficient estimates (following convention, ** represents a significant result at the 5% level, and * represents a significant result at the 10% level). Our dependent variable has two components: trading activity, which captures the qualitative aspect of the trading reaction, and trading intensity, which captures the quantitative aspect of the trading reaction. Trading activity is modeled with a multinomial logistic regression (we display the pairwise comparison between the buy order and the sell order—the base case of the model specification). Trading intensity is modeled using a linear regression.

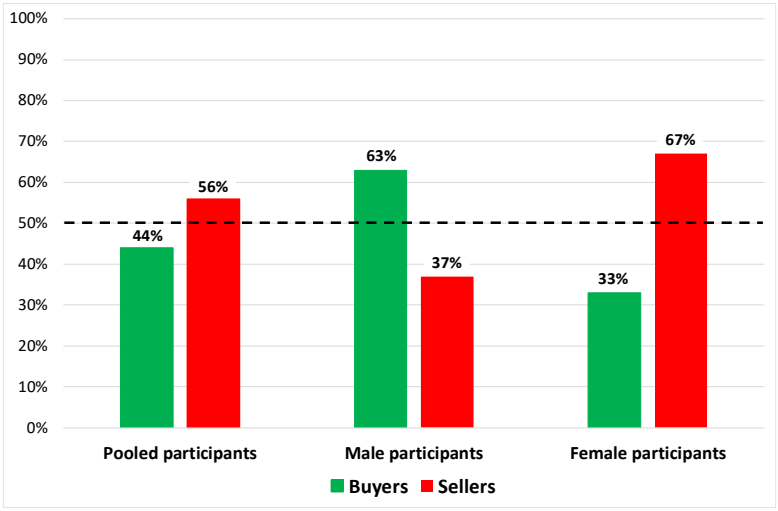
Figure 1. Relationship between variables and theoretical sources of gender bias



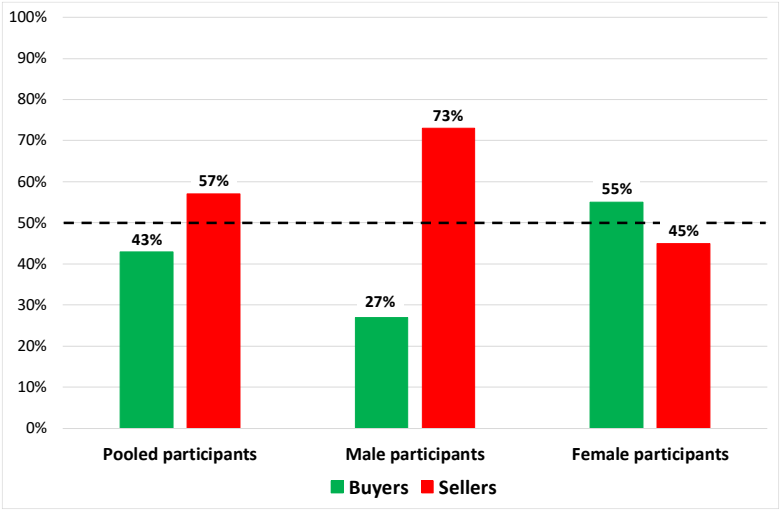
Note: This figure represents the relationship between the dependent, manipulated and moderating variables and the theoretical sources of gender bias (stereotypes, double standard of competence and group biases).

Figure 2. Percentage of buyers and sellers following the appointment of a male CEO or a female CEO

A. Following the appointment of a male CEO



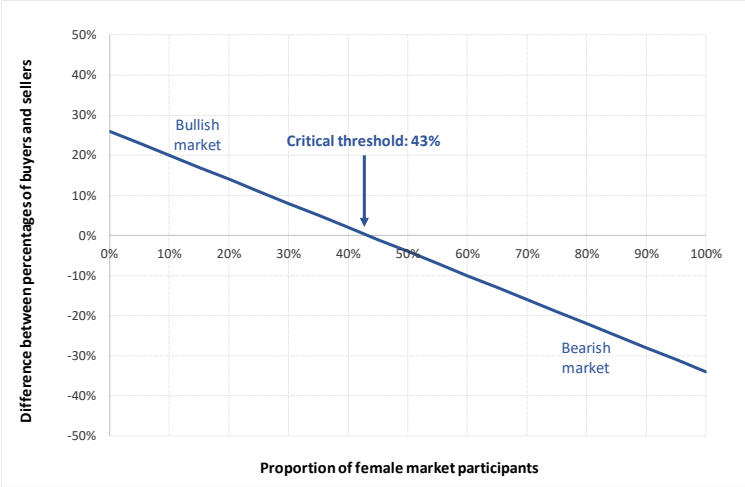
B. Following the appointment of a female CEO



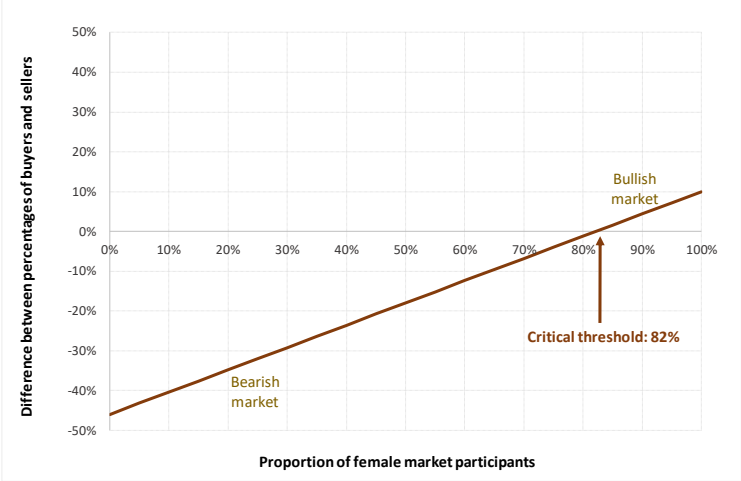
Note: This figure plots the percentage of buyers and sellers following the announcement of the appointment of a male CEO (Figure 2A) or a female CEO (Figure 2B).

Figure 3. Difference between the percentage of buyers and the percentage of sellers as a function of the proportion of female market participants

A. Following the appointment of a male CEO



B. Following the appointment of a female CEO



Note: This figure plots the difference between the percentage of buyers and the percentage of sellers following the announcement of the appointment of a male CEO (Figure 3A) or a female CEO (Figure 3B) 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 appointment: 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. We set the probabilities of buying and selling using the proportions of buyers and sellers among male and female participants estimated from the data of our experiment, as plotted in Figure 2.