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Gender Differences in Executives' Access to Information

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Abstract

We provide novel evidence on gender differences in insider-trading behavior and the profitability of senior corporate executives. On average, both female and male executives make positive profits from insider trading. Males, however, earn significantly more than females in equivalent positions and also trade more than females. These gender differences disappear when we limit the sample to firms in which female trading is relatively high. Collectively, these results suggest that female executives have a disadvantage relative to males in access to inside information, even if they have equal formal status, and informal networks may play an important role in attenuating this disadvantage.

I. Introduction

We provide the first investigation of gender differences in insider-trading behavior by top executives. The increasing presence of females in executive suites has heightened interest in understanding potential gender differences in access to material inside information through formal and informal channels.[1] It is well known that senior executives earn positive abnormal returns on their trades in their own company stock (Seyhun (1986), (1992), (1998)), which is evidence of access to material nonpublic information obtained through formal or informal means.

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[1]Catalyst, an organization that works to expand options for women, reports that the proportion of female corporate officers in Fortune 500 firms increased from 8.7% in 1995 to 14.6% in 2013 (Catalyst (2013a)). The proportion of female chief executive officers (CEOs) in Fortune 500 firms increased from 0.4% in 1998 to 4.8% in 2014 (Catalyst (2014)), and the proportion of females on boards increased from 9.6% in 1995 to 16.9% in 2013 (Catalyst (2013b)).

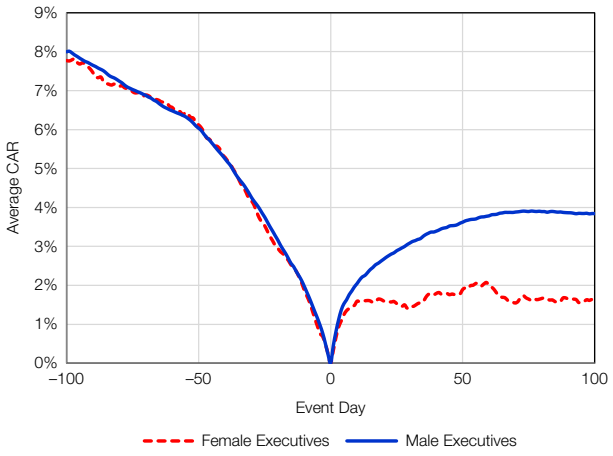
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By investigating the gender differences in the profitability of insider trades, we can assess whether female executives in similar positions have access to the same or similar networks that generate valuable inside information as their male counterparts.[2] Thus, understanding whether female executives can and do trade profitably helps us better understand the environment in which top female executives operate.

We use insider-trading data from 1975 to 2012 to analyze gender differences in trading and profits. We examine both purchases and sales, although we focus on insiders' purchases to a greater extent because purchases tend to be correlated with more valuable insider information. In our database, females make up 4.4% of the purchases in terms of the number of transactions and 3.8% by dollar value. We find that both male and female insiders (top executives, board members, and other senior officers) make significant average positive excess returns from their insider purchases. Figure 1 shows the equal-weighted average market-adjusted returns for 100 trading days before and after the purchase dates for female and male executives. It can be seen that, on average, executives of both genders time their purchases when the stock price is at its lowest, indicating that they are trading on information. The 50-day equal-weighted average market-adjusted return after purchase is positive and economically significant for both genders: approximately 3.2% for male executives and 1.6% for female executives. More importantly, there is a significant gender difference in the profitability, with males earning 1.6

FIGURE 1
Returns from Insider Trades

Figure 1 displays the cross-sectional equal-weighted averages of the market-adjusted cumulative abnormal returns (CAR) of male and female insider purchases in event time, where the event is defined as the date of an insider purchase.



[2]It has been suggested that female executives do not have the same access to information as their male counterparts, especially in organizations where they are underrepresented (see Moore (1988) and Lyness and Thompson (2000) for evidence), because they are excluded from informal networks.

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percentage points more.[3] We also find that, on average, male executives trade more in their firm's shares than females, whether the quantity of trade is measured in the number of shares traded, the dollar value of trades, or the number of trades. It appears that the gender differences in insider-trading activity are similar to those of uninformed investors of an online retail broker documented by Barber and Odean (2001); that is, males trade more frequently than females. The gender difference in the profitability of trading of top executives, however, is opposite that of uninformed investors.

More interestingly, we find that the gender differences in trading activity and profitability are not driven by the well-documented fact that males hold more senior positions (Bertrand and Hallock (2001), Catalyst (2013a), (2014)). When we group insiders into three categories based on their titles (top executives, directors, and officers), we find that within each title category, males trade more than females and also earn greater profits.

There are two potential, although not mutually exclusive, explanations for the finding that there are significant gender differences in the extent and profitability of insider trading. The observed differences between the female and male executives' behavior can be attributed to dispositional factors (e.g., confidence, risk aversion) as well as to situational factors, such as limited access to information arising from the dynamics created by structural issues, particularly the predominance of males in top corporate jobs.[4] The literature on gender differences suggests that there are systematic dispositional differences between males and females: Males are more overconfident and less risk averse than females.[5] Thus, our results could be the outcome of differences in dispositional factors, such as overconfidence or risk aversion and/or differences in access to information.

In order to explore the reasons for gender differences in insider-trading behavior, we use a straightforward extension of the Grossman and Stiglitz (1980) model, introducing insiders who may be overconfident. The model implies that the more overconfident, less risk averse, and better informed insiders are, the more they will trade, and the greater will be their expected profits. Combining the implications of the model with the empirical evidence that males are more confident and less risk averse than females, it follows that males will trade more and hence earn greater expected profits. The question is whether dispositional factors alone can explain why male executives trade more than female executives and earn greater profits from insider information. Or do male executives' greater trading and profits also arise from the additional advantage of possessing better information? We rule out the possibility that gender differences in trading and profitability are driven solely by dispositional factors and provide evidence of male executives' informational advantage. The model implies that, for a given

[3] As a comparison, insiders' abnormal returns are 3.1% after 50 days for all purchases between 1975 and 2012. We report results from more formal tests that confirm the gender difference in profitability, with the male executives earning 100 basis points (bps) more in abnormal returns than female executives over a 50-day window.

[4] See Riger and Galligan (1980) for a review of these factors.

[5] Previous research suggests that males in general are more overconfident than females (Barber and Odean (2001), Niederle and Vesterlund (2007)) and less risk averse (Byrnes, Miller, and Schafer (1999), Eckel and Grossman (2008), Niessen and Ruenzi (2007), and Charness and Gneezy (2012)).

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trade size, traders with superior information ought to earn greater profits regardless of dispositional factors. This is precisely what we find.

The previous conclusion that there are gender differences in access to information can be reconciled with our empirical finding that gender differences exist even within similar title categories only if formal titles are not accurate proxies of access to information. There is a large body of literature that argues that female executives do not have the same access to information, especially in firms where they are underrepresented (see, e.g., Kanter (1977a), (1977b), Lyness and Thompson (2000)), and claims that titles and ranks do not fully capture the informational disadvantage faced by female executives.

If formal titles are not indicative of equal access to information among genders, what are the channels through which male executives obtain more material asymmetric information than female executives with equivalent titles? Gender literature (Davies-Netzley (1988), Moore (1988)) suggests that females are excluded from the informal networks of their male peers. Kanter (1977b) finds that in work environments dominated in numbers by males, the males tend to emphasize their differences from the females, who form a small minority, and the males exclude them from informational networks. As we pointed out earlier, females account for less than 5% of the total trades, regardless of the metric used, confirming that our setting is dominated by males. If informal networks are the channels through which male executives gain an informational advantage, then we should see the advantage reduced in firms in which males are not as dominant in numbers. In our database, the best proxy available for gender dominance is the proportion of trades by a given gender. In order to investigate whether male executives' informational advantage is attenuated in situations where male dominance is lower, we test whether gender differences in trading and profits persist in firms in which the proportion of female trading is relatively higher. When we limit the sample to firms in which the proportion of female trades is at the 90th percentile or above of the distribution of the proportion of female trades in all firms, gender differences in profitability are not significant, controlling for position. This result is consistent with the notion that females suffer an informational disadvantage despite their titles in firms where they form a small minority, but that disadvantage is attenuated when their representation increases.

The rest of the paper is organized as follows: Section II provides a model to develop hypotheses regarding gender differences in insider-trading intensity and profitability. Section III describes the data and provides the summary statistics. Section IV presents the main results regarding gender differences in insider-trading behavior and returns. Section V explores whether the results are due to informational differences between the genders and provides a brief discussion of the paper's implications. Section VI concludes.

II. Theory

In order to understand the factors that may create gender differences in insider-trading behavior, we present a model in which insiders might differ in dispositional factors, such as overconfidence and risk aversion, as well as in access to information. The model uses the Grossman and Stiglitz (1980) framework

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and is a straightforward extension of the model presented by Hirshleifer and Luo (2001). In our model, there are three types of traders: rational, informed or insiders, and noise traders. There are two assets: a risk-free asset (payoff of 1) and a risky asset (payoff of θ); θ has mean of $\overline{\theta}$ and volatility of σ_θ. All distributions are normal. The risk-free rate is 0. The price of the risky asset is determined by rational and noise traders who trade often. Insiders trade occasionally, as price takers (i.e., their trade volume is very small compared with rational investors' trading volume).

Rational traders and insiders know the distribution of θ. Insider i receives a signal $s_i = \theta + \varepsilon_i$, where ε_i has zero mean and volatility of σ_i. Both rational traders and insiders maximize the expected exponential utility of end-of-period wealth based on their information: $U_j(w_j) = -e^{\alpha_j w_j}$, where w_j is the end-of-period wealth, and $\alpha_j > 0$ is the coefficient of the absolute risk aversion of trader j. All rational investors are assumed to have the same risk aversion coefficient of α.

Insiders could be overconfident. As in Gervais and Odean (2001), we assume that overconfident insiders put more than rational weight on their signals. In particular, they update the expected value of θ upon receiving the signal using the following rule:

$$(1) \qquad \mathrm{E}\{\theta|s_i\} = \overline{\theta} + k_i\gamma_i(s_i - \overline{\theta}); \quad \mathrm{var}\{\theta|s_i\} = \varphi_i,$$

where

$$\gamma_i = \frac{\sigma_\theta^2}{\sigma_\theta^2 + \sigma_i^2} \quad \text{and} \quad \varphi_i = \frac{\sigma_\theta^2\sigma_i^2}{\sigma_\theta^2 + \sigma_i^2} = \gamma_i\sigma_i^2.$$

The insider's overconfidence is represented by the factor k_i. If it is greater than 1, the insider is overconfident about the quality of the signal. If $k_i = 1$, the insider is rational.

The total demand by liquidity traders is x, where $\mathrm{E}(x) = 0$ and $\mathrm{var}(x) = \sigma_x^2$. Each rational trader's demand for the risky asset is then given by $(\overline{\theta} - p)/(\alpha\sigma_\theta^2)$, where p is the price of the risky asset. With N rational traders, the price is given by $p = \overline{\theta} + \alpha\sigma_\theta^2 x/N$.

The demand for the risky asset by insider i is given by

$$(2) \qquad X_i = \frac{\overline{\theta} + k_i\gamma_i\left(\theta - \overline{\theta} + \varepsilon_i\right) - p}{\alpha_i\phi_i}.$$

It follows from equation (2) that, conditional on a good signal, the expected trade size increases with the insider's overconfidence level and the signal's precision and decreases with risk aversion.

Let $\widehat{\theta}$ represent the rational investor's posterior expectation of θ given signal s_i. The value of $\widehat{\theta}$ is obtained by setting $k_i = 1$ in equation (1). Then insider i's expected profit from a rational investor's (or researcher's) perspective is given by equation (3), where expectations are taken over the distributions of θ and ε_i:

$$(3) \qquad \pi_i = \mathrm{E}\{X_i(\widehat{\theta} - p)\}.$$

Substituting for X_i from equation (2), it can be shown that

$$\pi_i = \frac{1}{\alpha_i \phi_i}\left[\left(\bar{\theta} - p\right)^2 + k_i \gamma_i \sigma_\theta^2\right]. \tag{4}$$

It follows from equation (4) that

$$\frac{\partial \pi_i}{\partial k_i} > 0, \quad \frac{\partial \pi_i}{\partial \alpha_i} < 0.$$

Because $\partial \phi_i / \partial \sigma_i^2 > 0$ and $\partial \gamma_i / \partial \sigma_i^2 < 0$, it also follows that $\partial \pi_i / \partial \sigma_i^2 < 0$. Because the comparative statics hold for every value of p, and hence every value of x, they hold when expectations are taken over the distribution of x as well. Therefore, expected profits increase with the insider's overconfidence level and the precision of the signal and decrease with risk aversion.[6] Combining these results with the one following equation (2), the model implies that trade sizes and expected profits increase with the insider's overconfidence level and the precision of the signal and decrease with risk aversion.

In order to apply this model to explain gender differences in trading and profits, we rely on the considerable empirical evidence that there are gender differences in dispositional factors, such as overconfidence and risk aversion. Barber and Odean (2001) find that among trades of online broker investors, males trade more frequently than females and earn greater negative gross and net excess returns; they interpret this result as evidence of greater overconfidence in males. Niederle and Vesterlund (2007) provide evidence that male overconfidence plays a major role in explaining gender differences in willingness to compete. Soll and Klayman (2004) find that males exhibit greater overconfidence than females in experiments requiring them to provide interval estimates. Dahlbom, Jakobsson, Jakobsson, and Kotsadam (2011) show that boys are more overconfident than girls regarding their mathematical performance. It must be noted that there is research that does not find gender differences in overconfidence.[7] Regardless, we can safely conclude from the empirical evidence that females are no more overconfident than males.

Eckel and Grossman (2008) and Croson and Gneezy (2009) survey the economics literature on gender differences in risk aversion, comparing the results

[6]These predictions are consistent with predictions of earlier theoretical work. See Benos (1998), Caballé and Sákovics (2003), Daniel, Hirshleifer, and Subrahmanyam (1998), (2001), Gervais and Odean (2001), Kyle and Wang (1997), Odean (1998), and Wang (1998), (2001) for predictions relating to overconfidence. Predictions relating to risk aversion and precision of information are the same as those noted by Grossman and Stiglitz (1980).

[7]Biais, Hilton, Mazurier, and Pouget (2005) measure overconfidence in graduate business/finance students in a laboratory trading game using a confidence-interval task and find no evidence for greater overconfidence in males. They also find that males do not trade more than females. In a similar vein, Deaves, Lüders, and Luo (2009) first calibrate overconfidence using a confidence-interval task with undergraduate students and find no evidence for greater overconfidence in males. They find, however, that overconfident participants trade more but perform less well. Glaser and Weber (2007) employ surveys of online broker investors to measure overconfidence using both miscalibration and better-than-average measures. They find, however, that investors who think that they are above average in terms of investment skills or past performance (but who did not have above-average performance in the past) trade more, but that measures of miscalibration are, contrary to theory, unrelated to measures of trading volume. They find that gender is not significantly related to trading volume.

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across abstract gambles, contextual experiments, and field studies. The evidence provides substantial support for the hypothesis that women are more risk averse.[8] Although most of the empirical work on risk aversion in financial decision making has been focused on individual decision making, there are a few papers that investigate gender differences in risk aversion in a managerial setting. The results are mixed. Johnson and Powell (1994) find no difference in risk taking between genders in a managerial population of potential and actual managers. Atkinson, Baird, and Frye (2003) compare the performance and investment behavior of male and female fixed-income mutual fund managers and find that male- and female-managed funds do not differ significantly in terms of performance, risk, and other fund characteristics. Niessen and Ruenzi (2007) find that female fund managers are more risk averse than male fund managers: Females deviate less from benchmarks and follow less extreme investment styles that are also more temporally stable than those of male fund managers. Furthermore, female fund managers trade less than male fund managers. In summary, most of the evidence points to gender differences in risk aversion, with females being more risk averse than males.

On the basis of the extant literature, if we assume that males are either more overconfident or less risk averse than females, our model implies that in a setting with informed insiders, males are expected to trade more and make more profits than females because of dispositional factors. In addition, if males are better informed than females, they are expected to trade more and earn greater profits.[9]

The model also suggests a way to test whether dispositional factors are the sole reason that male executives earn greater returns or whether they also possess better-quality information (i.e., information with better precision). It can be seen from equation (3) that, holding the trade size of insiders (X_i) constant, expected profits are positively related to γ_i, a measure of the quality of information. If there is no gender difference in access to information, then there ought to be no gender difference in expected profits for a given trade size. If we find that male executives earn greater profits when holding trade size the same, then we can conclude that better access to information plays a role in the male executives' greater profits.

[8] Dwyer, Gilkeson, and List (2002), using survey data from mutual fund investors, find evidence that females take less risk than men in their last, largest, and riskiest mutual fund investments. However, the observed difference in risk-taking behavior is substantially attenuated when investors possess financial investment knowledge, but it is still statistically significant. Jianakoplos and Bernasek (1998) and Sundén and Surette (1998), using data from the Survey of Consumer Finances, find that single women are significantly more risk averse (i.e., hold a smaller percentage of their wealth in the form of risky assets) than single men. Bajtelsmit and VanDerhei (1997), Hinz, McCarthy, and Turner (1997), and Bernasek and Shwiff (2001) use pension fund data and find that women allocate their pensions more conservatively than men. In contrast, Schubert, Gysler, and Brachinger (1999) observe no gender differences in the risk propensity of males and females when subjects face contextual decisions in a laboratory setting.

[9] A dynamic model, unlike the static one developed here, offers a richer setting to derive implications about how changes in overconfidence and risk aversion, due to a combination of external factors and learning, interact with information to affect gender differences in trading behavior. See Choi, Laibson, Madrian, and Metrick (2009) for evidence on how reinforcement learning, for example, affects savings behavior.

III. Data and Sample Selection

The insider-trading data in the study are obtained from a compilation by the U.S. Securities and Exchange Commission (SEC) Ownership Reporting System that is made available for sale. The data set contains all open-market insider trading of shares by officers, directors, and beneficial owners (direct or indirect owners of more than 10% of any equity class of securities) of publicly traded firms between Jan. 1975 and Dec. 2012.[10] For the purposes of this study, only open-market trades by individuals are included. Shares acquired through exercise of options, stock awards, and trades with corporations are excluded. The data on stock market returns are obtained from the Center for Research in Security Prices (CRSP). The sample contains all insider trades between Jan. 1975 and Dec. 2012 in firms for which stock return data are available in the CRSP database. The final sample is limited to firms for which stock return data are available from CRSP and to trades for which the insider relationship (CEO, chief financial officer (CFO), etc.) is reported. In addition, firms with missing market capitalization data in the CRSP database are screened out. Finally, in order to deal with potential misreports and incorrect outliers, three filters are used: On the insider transaction date, i) the insider transaction price will be less than twice the closing price of the stock, ii) the number of shares of the insider transaction will be less than the daily volume of trade of the stock, and iii) the number of shares of the insider transaction will be less than the outstanding number of shares for the stock.[11]

In order to identify the insider's gender, we tried to match the names in our data set[12] to the database of all male and female baby names for every decade from 1900 to 2010, as recorded by the U.S. Census Bureau.[13] The matching process produced three categories: clear male names, clear female names, and gender-neutral/unclassifiable names. For the third category, we searched Factiva for news stories mentioning the specific insider during the time period identified in our data set to identify the gender. As a further check, we also obtained the gender from the ExecuComp database from 1992 to 2012 and cross-checked it with the gender as obtained using the first procedure. They matched almost completely; the few mismatches were again searched in Factiva to obtain a definitive confirmation of the gender.[14]

[10] For most of the sample period analyzed here, Section 16(a) of the Securities and Exchange Act of 1934 requires that insider transactions be disclosed within the first 10 days of the month following the month of the trade. Section 16(b) prohibits insiders from profiting from short-term price movements, defined as profitable offsetting pairs of transactions within 6 months of each other, and Section 16(c) prohibits profiting from short sales. The Sarbanes–Oxley Act of 2002 (effective Aug. 29, 2002) has modified insider-trading regulations in many significant ways. First, the new reporting requirement states that insider transactions must be reported electronically by the end of the second business day following the day on which the transaction is executed both through the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) site and corporate public Web sites. Sarbanes–Oxley also prohibits the purchase and sale of securities during blackout periods.

[11] The qualitative results do not change if these filters are not enforced. Results are available upon request.

[12] Insiders are required to report their full legal names on Forms 3, 4, and 5.

[13] We obtain this information from http://www.ssa.gov/OACT/babynames.

[14] We repeated the name-matching process using Google's database to analyze common patterns related to the first names of the insiders. The popular usage on the Web corroborated whether a name is more commonly used for a male or a female.

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We separate insider trades by purchases and sales. Although we discuss the sales results, we report only the results pertaining to the purchase subsample. The reason is that purchases are most likely motivated by information, whereas sales may be driven by multiple motivations (diversification, information exploitation, personal liquidity shocks, etc.), making the interpretation of the results from the purchase subsample cleaner. Panel A of Table 1 provides the summary statistics of insider purchases by both genders. There are 18,031 firms in the sample, with trading reported by males in 17,946 firms and by females in 5,351 firms. The total value of the transactions during the sample period is $28.64 billion measured in 1984 constant dollars (using the Consumer Price Index (CPI) from the U.S. Department of Labor, Bureau of Labor Statistics), with the females' share being 3.8%. There are 720,871 transactions, with the females' share being 4.4%.

TABLE 1
Insider-Trading Statistics

Table 1 presents the insider-trading statistics of male and female executives (officers, directors, and top executives) for the period 1975–2012. Monetary amounts are measured in 1984 constant dollars. Panel A reports the summary statistics, with the number of unique executives in the database and the number of executives by executive type. The final column of Panel A reports statistics for females as a percentage of the total. Because the same individual could have held multiple titles at different points in time and in different firms, the sum of the subgroups does not add up to the total number of executives. Panel B presents the insider-trading statistics of male and female executives stratified by executive type. The average value of purchases is defined as the total dollar value of purchases divided by the total number of transactions.

Panel A. Summary Statistics

	Total	With Trades by Males	With Trades by Females	With Trades by Females (%)
No. of firms	18,031	17,946	5,351	29.7%
	Total	Males	Females	Females (%)
Value of purchases ($millions)	28,636	27,558	1,078	3.8%
No. of purchases	720,871	689,494	31,377	4.4%
No. of executives	164,839	156,013	8,826	5.4%
Officers	50,677	47,105	3,572	7.0%
Directors	79,046	75,100	3,946	5.0%
Top executives	35,116	33,808	1,308	3.7%

Panel B. Stratified by Executive Type

	Value of Purchase Transactions ($millions)			
Executive Type	Total	Males	Females	Females (%)
Officers	2,268	2,154	114	5.0%
Directors	15,853	15,180	673	4.2%
Top executives	10,514	10,223	291	2.8%
Total	28,636	27,558	1,078	3.8%
	No. of Purchase Transactions			
Executive Type	Total	Males	Females	Females (%)
Officers	148,585	138,674	9,911	6.7%
Directors	342,168	327,869	14,299	4.2%
Top executives	230,118	222,951	7,167	3.1%
Total	720,871	689,494	31,377	4.4%
	Average Value of Purchase Transactions ($thousands)			
Executive Type	Total	Males	Females	
Officers	15.27	15.54	11.51	
Directors	46.33	46.30	47.07	
Top executives	45.69	45.86	40.55	
Total	39.72	39.97	34.35	

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We group the insiders into three categories based on their titles, namely, top executives, directors, and officers, with corresponding variable names of TOP_EXECUTIVE, DIRECTOR, and OFFICER, respectively. We classify as top executives those who are designated as CEO, CFO, chairman of the board, chief operating officer (COO), executive (or senior) vice president, general partner, director, and officer, as well as those who hold more than 10% equity in addition to being a director and an officer. Directors include members of the board of directors other than those included in the top-executive category. All other executives are classified as officers. In our analysis, an executive is defined as an insider holding a specific title in a specific firm.[15] There are 164,839 executives by this definition in our sample, with 31% officers, 48% directors, and 21% top executives. Females constitute 5.4% of all executives in our sample, 7.0% of the officers, 5.0% of the directors, and 3.7% of the top executives.

Panel B of Table 1 provides trading statistics for the three categories of insiders, namely, officers, directors and, top executives. Among the three categories, directors and top executives make up the bulk of the value of male trades (55% and 37%, respectively), whereas officers account for 8%. The figures are not very different for females: Directors account for 62% of the value of the trades, whereas top executives account for 27%. The proportion of female trades of the total, both in value and number of transactions, declines as the seniority increases, probably reflecting the lower female representation in senior ranks. The average value of a male (female) purchase, calculated as total male (female) dollar purchases divided by the total number of male (female) purchase transactions, is $39.97 ($34.35) thousand in constant dollars, indicating that the average value of male purchases is about 16% greater.

IV. Results

In this section, we provide the main results of our paper regarding gender differences in the profitability and intensity of insider trades.

A. Gender Differences in Profitability and Trading: Univariate Results

For univariate results, we measure the profitability of trades by the cumulative market-adjusted abnormal daily stock returns (CAR) starting from the trade date (date 0) for a period of T days:

$$\text{CAR}_{i,T} = \sum_{t=0}^{T} (r_{i,t} - r_{m,t}),$$

where $r_{i,t}$ is the cum-dividend return to stock i for day t, and $r_{m,t}$ is the cum-dividend return to the CRSP equal-weighted portfolio of all New York Stock Exchange, American Stock Exchange, and NASDAQ stocks for day t. We report the CAR for a 50-day period and obtain similar results when we use a 100-day period.[16]

[15] An executive who works for more than one firm during the sample period is counted as more than one observation, as is an executive who holds different titles within the same firm.

[16] We use holding periods of 50 and 100 trading days (2.5–5 calendar months) to measure insiders' abnormal profitability but report the results for the 50-day period. These holding periods capture the

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Figure 1 shows the cross-sectional equal-weighted mean (across trades) of the cumulative market-adjusted returns of male and female executives (officers, directors, and top executives) for 100 trading days before and after a purchase. It appears that both male and female executives, on average, time their purchases; the returns for both genders display a trough on the purchase date. It can be seen that purchases by males result in greater returns subsequent to the trade over practically every duration.

Panel A of Table 2 provides the univariate results regarding gender differences in profitability and trading. The trading profitability of each executive (i.e., an insider holding a specific title in each firm) is computed as the trade-size-weighted average of the CAR of all trades by that insider, with the trade size measured in 1984 dollar values. Thus, all purchases by an executive are collapsed into a single observation. As reported in Panel A, the mean return of male purchases over the following 50-day period is 351 basis points (bps), whereas that of females is 238 bps. Both are significantly different from 0, implying that both male and female insiders profit from insider purchases on average. Males earn excess returns of 113 bps over 50 days from the purchase date, and this difference is statistically significant at the 1% level. The median excess return of males is 151 bps, whereas that of females is 61 bps, and the difference is significant at a p-value of 0.0001 using a Wilcoxon rank-sum test (not reported). The Kolmogorov–Smirnov test for the equality of the distribution of insider-trading returns for males and females is rejected at a p-value of 0.0001. These results collectively indicate that although both males and females profit from their purchases on average, the returns earned by males are economically and statistically greater than those of females. The results also show considerable skewness in insider returns, because the mean is much greater than the median.

A potential explanation (not mutually exclusive) for the gender difference in trading profits in insider purchases is that males possess more information about their firm's prospects purely by virtue of being, on average, in more senior positions. Bertrand and Hallock (2001), for example, report that the fraction of females in top-management positions is an order of magnitude lower than the fraction of females in lower management positions. Catalyst reports that although 14.6% of the top officers in Fortune 500 firms were females in 2014, only 4.8% were CEOs (Catalyst (2013a), (2014)). Our data are consistent with these findings: The proportion of male executives' trading increases with the importance of their titles, as reported in Panel A of Table 1. Furthermore, Panel B of Table 1 reports that whereas approximately 32% of the male purchases are made by top executives, the corresponding figure for females is only 23%.

In order to account for the fact that males are, on average, in more senior positions than females, we report in Panel A of Table 2 the profitability of males

most important part of the window in which insider-trading information is released. Seyhun (1998) finds that most of the reaction occurs within 6 months, and subsequent movements are much smaller. We also examine the extent to which insiders engage in round-trip transactions, in which case we can measure their realized profits from insider trading. We are able to identify only 8,076 round-trip transactions for 2000–2012, or less than 1% of the overall trades. It must be noted that insiders are prohibited from engaging in round-trip trades by Section 16b of the Securities Exchange Act of 1934 and must return these profits to the corporation.

TABLE 2

Gender Differences in Profitability and Intensity of Insider Transactions: Univariate Analysis

Panel A of Table 2 reports, in basis points (bps), the distribution of the cumulative abnormal returns (CAR) (market-adjusted) over the first 50 days after the insider trade, weighted by the real dollar value of the trade for each executive stratified by executive type. Thus, all purchases by an executive holding a specific title in each firm are collapsed into a single observation. Because the identity of the insiders could not be classified for some of the transactions, the aggregate number of observations is different from the totals obtained by adding the subgroups. Panel B reports the distribution of trading intensity stratified by executive type. Three variables are used to capture the intensity of trading: i) value of purchases made per year by each executive in the sample, in thousands of constant 1984 dollars; ii) number of shares purchased per year by each executive in the sample; and iii) number of purchases per year by each executive in the sample. For each executive in each firm in each position held, we generate one observation. We report the averages for each variable in each group.

Panel A. Market-Adjusted Returns by Gender and Executive Type

Sample	*N*	Mean	Std. Dev.
Whole Sample			
Males	156,013	351	2,165
Females	8,826	238	2,269
Officers			
Males	47,105	382	2,156
Females	3,572	308	2,583
Directors			
Males	75,100	250	1,954
Females	3,946	101	1,774
Top Executives			
Males	33,808	508	2,530
Females	1,308	450	2,622

Kolmogorov–Smirnov Test for Equality of Distributions

Sample	*D*-Value	*p*-Value	*t*-Stat.	*p*-Value
Whole sample: Males versus females	0.03282	0.000	4.46	0.000
Officers: Males versus females	0.04030	0.000	2.64	0.008
Directors: Males versus females	0.04936	0.000	4.95	0.000
Top executives: Males versus females	0.05539	0.001	1.99	0.047

Panel B. Intensity of Insider Trading by Gender and Executive Type

	Purchases								
	Value ($thousands)			No. of Shares			No. of Trades		
Executive Type	Total	Males	Females	Total	Males	Females	Total	Males	Females
Officers	24.1	24.4	19.8	3,477	3,499	3,192	1.41	1.41	1.48
Directors	84.0	83.1	101.1	10,008	10,262	5,162	1.71	1.72	1.53
Top executives	106.3	106.2	110.1	19,019	18,918	21,638	2.28	2.28	2.19
Total	70.4	70.4	69.5	9,923	10,099	6,809	1.74	1.74	1.61

and females for each position. It can be seen that, regardless of position, the mean market-adjusted 50-day return of males is economically and statistically significantly positive and greater than that of the females in the same position, indicating that the gender differences in profitability are caused by factors other than the preponderance of males in senior positions.[17] The gender difference in returns for top executives (58 bps) is lower than that for officers (74 bps); this suggests that formal titles are less indicative of access to information at the officer level compared to that at the top-executive level. The gender difference in returns is greatest at the director level (149 bps), suggesting that female directors on the board are more likely to be tokens. It should be noted that top executives earn more than officers and directors, regardless of gender, as expected.

[17]Ravina and Sapienza (2010) also find that independent directors and the firm's officers earn substantial positive returns from their insider purchases.

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Panel B of Table 2 provides the univariate statistics of the differences in the trading intensity between males and females. We use three metrics to measure trading activity: the dollar value of the trade, the number of shares traded, and the number of trades, all on a per-year basis. To measure the frequency of trading, we define the tenure of the insider in our database as the period between the first trade and the last trade (purchase or sale) made by the insider in the same firm's stock. For example, if an insider in a firm first appears in our database because of a sale of that firm's stock in 1982 and appears last because of a purchase of the same firm's stock in 1987, we count this insider's tenure as 6 years. Insiders who trade only once during the sample period are considered to have a tenure of 1 year. The trading activity in terms of dollar value is the total dollar value of all purchases made by an insider measured in 1984 constant dollars divided by her or his tenure. Similarly, trading activity in terms of number of shares (number of trades) is the total number of all shares purchased by an insider (total number of purchase transactions by an insider) divided by her or his tenure. Therefore, for each insider in a firm who has purchased shares, there is one observation.

It can be seen that females, in general, purchase less frequently than males overall, although this pattern does not hold for every position.

B. Gender Differences in Profitability: Regression Results

For a formal regression analysis, we compute abnormal insider profitability using the following approach. We use a calendar-time approach similar to that employed by Barber and Odean (2001) and Barber, Lehavy, and Trueman (2007) to form a portfolio for each of the 164,839 executives. An executive's portfolio on any given date consists of all stocks purchased by the executive during the 50 trading days ending on that date. During this interval, if the executive purchases a stock multiple times, then that stock appears multiple times in the portfolio. The portfolio return of executive j on date t is given by

$$R_{jt} \quad = \quad \frac{1}{n_t}\sum_{i=1}^{n_t} R_{i,t},$$

where $R_{i,t}$ is the gross date t return on purchase i, and n_t is the number of purchases in the portfolio corresponding to n_t insider purchase events in the previous 50 trading days. This portfolio is updated daily by deleting stocks purchased more than 50 days earlier. This calculation yields a time series of daily returns for each executive's portfolio.

Abnormal return is calculated as the intercept α_j, from the 4-factor model, in the following time-series regression for each portfolio j (where all daily returns are expressed in basis points):

$$R_{jt} - R_{ft} \quad = \quad \alpha_j + b_j(R_{mt} - R_{ft}) + s_j(\mathrm{SMB}_t) + h_j(\mathrm{HML}_t) + u_j(\mathrm{UMD}_t) + \varepsilon_{jt},$$

where the variables on the right-hand side are from the Carhart (1997) 4-factor model. R_{jt} is the daily return on the calendar-time portfolio, R_{mt} is the return on a value-weighted market index, R_{ft} is the daily return on a 3-month Treasury bill, SMB_t is the difference in returns of a value-weighted portfolio of small stocks and big stocks, HML_t is the difference in returns of a value-weighted portfolio of

high and low book-to-market stocks, and UMD_t is the difference in returns of a value-weighted portfolio of stocks with high and low recent (6 months) returns. The estimate of the intercept α_j provides a test of the null hypothesis that the mean daily return on the calendar-time portfolio is 0.

Distribution of alphas by gender is reported in Table 3, and the cumulative distribution is shown in Figure 2. As Figure 2 indicates, distribution of alphas for female executives is mostly shifted to the left of that for the males, implying a first-order stochastic dominance by males for all practical purposes. The mean alphas for males are greater than those for females, regardless of position, consistent with the statistics in Table 2. It can be seen from Table 3 that the gender difference in median alphas is approximately 2 bps per day, or approximately 1% over 50 days, in favor of the males, which is consistent with the univariate results in Table 2. The male advantage exists at all percentiles except the 99th percentile, indicating that this advantage is not the result of outliers.

Examination of the alphas shows that the tail values of alphas contain mostly extreme estimates. Many of these outliers occur due to missing-data issues. To reduce the impact of these extreme values on our estimates, we trim 2.5% of the insider sample from both right and left tails. The remaining sample of 156,596 executives (hereafter referred to as "whole sample") is used in the remainder of this paper. This trimmed sample contains 148,245 male executives and 8,351 female executives, with the proportion of female executives (5.3%) essentially unchanged from the untrimmed sample.

Table 4 reports the results of the regression analysis of gender differences in insider-trading profitability, with the alphas as the dependent variable and the cross products of gender and position as independent variables. All regressions reported in this paper include firm fixed effects. Column 1 provides the results for the whole sample, with the standard errors provided below coefficient estimates in

TABLE 3

Summary Statistics of Insider-Trading Profits (Alphas) by Males and Females

Table 3 reports the distribution of daily alphas, in basis points (bps), of male and female executives calculated using the Carhart (1997) 4-factor model augmented with the momentum factor

$$R_{jt} - R_{ft} = \alpha_j + b_j(R_{mt} - R_{ft}) + s_j(\text{SMB}_t) + h_j(\text{HML}_t) + u_j(\text{UMD}_t) + \varepsilon_{jt},$$

where R_{jt} is the daily return on the calendar-time portfolio of an executive, R_{mt} is the return on a value-weighted market index, R_{ft} is the daily return on a 3-month Treasury bill, SMB_t is the difference in returns of a value-weighted portfolio of small stocks and big stocks, HML_t is the difference in returns of a value-weighted portfolio of high and low book-to-market stocks, and UMD_t is the difference in returns of a value-weighted portfolio of stocks with high and low recent (6 months) returns. The mean and percentiles are reported for male and female executives of each executive type.

			Alpha Percentiles						
Sample	*N*	Mean Alpha	1st	5th	25th	50th	75th	95th	99th
All									
Males	156,013	11.5	−106.1	−48.8	−8.5	7.0	27.1	86.6	169.7
Females	8,826	9.7	−120.1	−53.4	−9.7	5.0	24.7	84.5	182.6
Officers									
Males	47,105	11.9	−105.9	−48.8	−8.9	7.6	28.9	88.0	170.5
Females	3,572	11.3	−131.4	−60.3	−10.8	6.7	28.5	91.5	200.8
Directors									
Males	75,100	9.5	−98.1	−45.9	−8.4	5.8	23.5	78.1	154.5
Females	3,946	6.6	−100.1	−41.9	−8.9	3.1	18.5	64.6	128.5
Top Executives									
Males	33,808	15.3	−122.8	−55.7	−8.1	9.7	33.9	101.9	196.4
Females	1,308	15.1	−135.3	−61.1	−36.8	9.8	34.2	117.7	215.1

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FIGURE 2
Distribution of Alphas

Figure 2 displays the cumulative distribution of alphas for male and female executives, measured in basis points (bps). Alphas in the range of −100 to +100 bps are shown. The alpha for each executive j is estimated using the Carhart (1997) 4-factor model augmented with a momentum factor

$$R_{jt} - R_{ft} = \alpha_j + b_j(R_{mt} - R_{ft}) + s_j(\mathrm{SMB}_t) + h_j(\mathrm{HML}_t) + u_j(\mathrm{UMD}_t) + \varepsilon_{jt}.$$

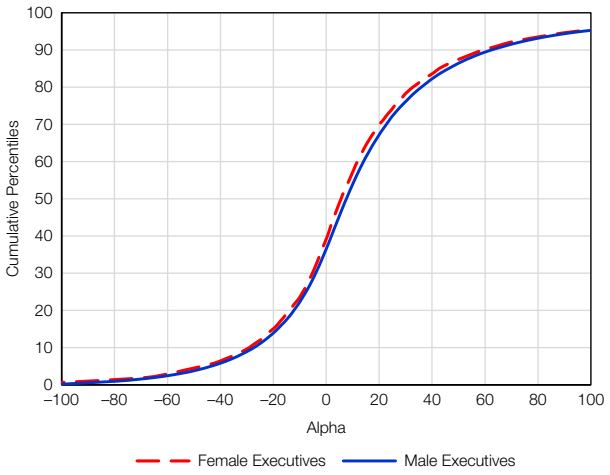


TABLE 4
Gender Differences in Insider-Trading Profitability

Table 4 reports the results of the regression with the alpha of each executive's return, in basis points (bps), as the dependent variable. The independent variables are the cross products of gender (MALE or FEMALE) and executive type (OFFICER, DIRECTOR, or TOP_EXECUTIVE) and include firm fixed effects. MALE × OFFICER is the omitted category. The results in column 1 are for the whole sample, whereas the results in column 2 are for a subsample of firms with trades by both genders. Standard errors are reported in parentheses below the coefficients. The t-statistic for the FEMALE × OFFICER variable provides the significance of the difference in male and female coefficients for OFFICER. F-statistics, with p-values in square brackets, are reported to test the significance of the differences in male and female coefficients for DIRECTOR and TOP_EXECUTIVE. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Whole Sample	Firms with Trades by Both Genders
Variables	1	2
Constant	8.3888***	9.5401***
	(0.15)	(0.22)
FEMALE × OFFICER	−0.15303***	−1.7610***
	(0.56)	(0.63)
MALE × DIRECTOR	−1.6869***	−2.1025***
	(0.19)	(0.28)
FEMALE × DIRECTOR	−3.7872***	−4.3596***
	(0.53)	(0.60)
MALE × TOP_EXECUTIVE	1.7004***	1.9917***
	(0.23)	(0.36)
FEMALE × TOP_EXECUTIVE	0.4605	1.2129
	(0.92)	(1.01)
N	156,596	79,654
Test of (Male–Female) Coefficient Differences (F-statistic, with p-value in square brackets)		
DIRECTOR	4.79	4.59
	[0.029]	[0.032]
TOP_EXECUTIVE	16.35	14.92
	[0.000]	[0.000]

parentheses. It can be seen that in every position, males earn more than females. The coefficient of the cross product of FEMALE and OFFICER is negative and significant at the 1% level, indicating that the male officers earn more than their female counterparts. The F-tests at the bottom of the table indicate that male top executives earn more profits than female top executives, and the difference earned is significant at the 1% level; the same is true in the case of directors at the 5% level. As with the univariate results, the gender difference in returns is greatest at the director level. Not surprisingly, the gender difference is the least at the top-executive level.

One possible explanation for the gender difference in the profitability of insider trades is that there is some systematic gender difference in the choice of firms in terms of size or industry. It is also possible that there are differences in authority and access for a given title and other likely differences between firms chosen by males and females. In order to address these possibilities, we report in column 2 of Table 4 the regression results from a subsample of firms with both male and female trades. There are 79,654 executives in firms with trades by both genders, of which 8,254 (10.4%) are females. The results are unchanged from that of the whole sample: Male executives earn more than females in every position, and the differences are significant at the 1% level for officers and top executives and at the 5% level for directors. Therefore, our results show that male executives earn greater excess returns than females in similar positions. These results imply that the lower female returns are not merely due their underrepresentation in senior positions.

The previous results are based on a subsample of insider purchases only. Because insiders may sell stock for motives other than to profit from information, such as portfolio diversification and liquidity needs, we do not expect to see as strong a gender difference in profits in the sales subsample as in the purchase subsample. Unreported results confirm this. The average size of a male (female) sale is approximately \$152,260 (\$160,900). It appears that females make substantially smaller purchases but slightly higher sales per trade compared with males. The mean 50-day excess return of males' sales is −193 bps, whereas that of females is −173 bps. Both are significantly different from 0, implying that both male and female executives profit from insider sales. The difference in return from sales between males and females is economically small and statistically insignificant. The Kolmogorov–Smirnov test for the equality of the distribution of the insider-trading returns of males and females for sales cannot be rejected. (The D-statistic is 0.00784, and the p-value is 0.517. The t-test statistic is 0.90, and the corresponding p-value is 0.369.) The results indicate that although both males and females earn positive returns from insider sales on average, the possibility that sales are driven by multiple motivations precludes us from providing a clean interpretation of the sales results.

In summary, our results show that male executives earn greater excess returns than females in similar positions. Furthermore, the difference in profitability does not appear to be due to firm or industry effects. We conclude that females earn lower profits compared with males, regardless of their position, in all firm-size groups in a statistically and economically meaningful manner.

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C. Intensity of Trading Activity of Insiders

In this section, we provide results of the regression analysis examining the differences in the trading intensity between males and females. The regressions are similar to those reported in Table 4, except that the dependent variable is trading intensity instead of alphas. We measure trading intensity by the natural logarithm of both the value of the trade as well as the number of shares traded. In Table 5, we report results for the whole sample, as well as the subsample of firms with trades by both genders. Results are similar to those for alphas in Table 4: Males in each position trade more than their female counterparts, and the differences are statistically significant (at the 1% level), both in the whole sample as well as in the subsample of firms with trades by both genders.

The results in Sections IV.B and IV.C imply that the lower intensity of trading and lower returns of female executives are not merely due to the information disadvantage arising from their underrepresentation in senior positions. That leaves two explanations, not mutually exclusive, for the results. The results could imply either that the gender differences in trading intensity and profitability are purely due to dispositional factors or that the formal rank or title of the executive is not a good proxy for access to information. The next section offers a test to distinguish between these two hypotheses.

TABLE 5

Gender Differences in Insider-Trading Intensity

Table 5 reports the results of the regression in which the dependent variable is the trading intensity, measured as the log of the value of trades made as well as the log of the number of shares purchased per year by each executive. Results are reported for the whole sample and the subsample of firms with trades by both genders. The independent variables are the cross products of gender (MALE or FEMALE) and executive type (OFFICER, DIRECTOR, or TOP_EXECUTIVE) and include firm fixed effects. MALE × OFFICER is the omitted category. Standard errors are reported in parentheses below the coefficients. The *t*-statistic for the FEMALE × OFFICER variable provides the significance of the difference in male and female coefficients for OFFICER. *F*-statistics, with *p*-values in square brackets, are reported to test the significance of the differences in male and female coefficients for DIRECTOR and TOP_EXECUTIVE. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Whole Sample		Firms with Trades by Both Genders	
	Dependent Variable			
Variables	ln(Value)	ln(Shares)	ln(Value)	ln(Shares)
Constant	9.06***	6.65***	9.02***	6.41***
	(0.11)	(0.12)	(0.12)	(0.13)
FEMALE × OFFICER	−0.55***	−0.56***	−0.50***	−0.33***
	(0.04)	(0.05)	(0.04)	(0.05)
MALE × DIRECTOR	0.81***	0.69***	0.86***	0.72***
	(0.03)	(0.03)	(0.03)	(0.03)
FEMALE × DIRECTOR	0.32***	−0.10***	0.37***	0.13***
	(0.03)	(0.03)	(0.03)	(0.04)
MALE × TOP_EXECUTIVE	0.87***	1.19***	0.93***	1.18***
	(0.02)	(0.02)	(0.02)	(0.02)
FEMALE × TOP_EXECUTIVE	0.56***	0.97***	0.59***	0.93***
	(0.06)	(0.07)	(0.07)	(0.06)
N	156,596	156,596	79,654	79,654
Test of (Male–Female) Coefficient Differences (F-statistic, with p-value in square brackets)				
DIRECTOR	276.34	773.99	360.87	550.05
	[0.000]	[0.000]	[0.000]	[0.000]
TOP_EXECUTIVE	24.93	10.88	20.49	11.02
	[0.000]	[0.000]	[0.000]	[0.000]

V. Analysis of the Results

Our results collectively indicate that female executives trade less than males and earn lower returns. On the basis of the extant empirical literature, if we assume that males are no less overconfident and no more risk averse than females, our model implies that the results from the previous section (that male executives trade more and earn greater returns) can be due to gender differences in dispositional factors (e.g., confidence, risk aversion) as well as to situational factors, such as limited access to information. In this section, we develop a test and provide evidence that dispositional factors alone can explain the gender differences in trading and profitability. We then proceed to offer evidence that supports the alternative hypothesis that there are gender differences in access to information.

A. Gender Differences in Profitability Conditional on Trading Size

The predictions from our model are that the intensity of insider trading and the resulting expected profit increase with overconfidence, decrease with risk aversion, and increase with the precision of the private information. We use the following reasoning to develop a test to investigate whether dispositional factors alone can explain the gender differences in trading and profitability or whether males have access to better-quality information. As discussed earlier, if there is no gender difference in access to information, then there ought to be no gender difference in expected profits for a given trade size. If we find that male executives earn greater profits when holding trade size the same, then we can conclude that access to information plays a role in the gender difference in profits.

To test whether there are gender differences in profits, controlling for trade size, we divide our sample into trade-size terciles in real-dollar terms. Thus, within each tercile, we treat the trade size to be approximately the same for all executives. Then, we repeat the regression analysis of Table 4 for each tercile, with alpha as the dependent variable. Table 6 provides the results for the whole sample as well as for the subsample of firms with trades by both genders.

The proportions of female trades are 5.9% in the lowest tercile, 5.6% in the middle tercile, and 4.5% in the highest tercile, which are representative of the female trade proportion of 5.3% in the full sample. The corresponding proportions when the sample is limited to firms in which both genders trade are 14.4%, 11.7%, and 8.9%, again representative of the female proportion of 10.4% in the full sample. In tests with the whole sample, male executives earn more than females in each group, regardless of position. In the lowest and highest terciles, the differences are statistically significant at the 5% level for officers and directors and at the 1% level for top executives. In the middle tercile, the differences are statistically significant at the 5% level for officers, 1% level for directors, and 10% level for top executives. The results are similar for the subsample of firms with trades by both genders. Thus, the results suggest that the dispositional factors alone cannot explain the gender differences in trading activity and profits and that male executives have an informational advantage over their female peers with the same titles. The implication, therefore, is that the executive's rank is an imperfect proxy for access to information. If information is not being solely accessed through formal channels, the question that arises is whether information is being accessed through

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TABLE 6

Determinants of Insider-Trading Profits, Controlling for Trade Size

Table 6 reports the gender differences in profits, controlling for trade size, with the alpha of each executive's return in basis points (bps) as the dependent variable. The independent variables are the cross products of gender (MALE or FEMALE) and executive type (OFFICER, DIRECTOR, or TOP_EXECUTIVE) and include firm fixed effects. MALE × OFFICER is the omitted category. Results are reported for the whole sample as well as the subsample of firms with trades by both genders. Each sample is divided into three terciles based on trade size in real-dollar terms, and the regression results are reported for each tercile. Standard errors are reported in parentheses below the coefficients. The *t*-statistic for the FEMALE × OFFICER variable provides the significance of the difference in male and female coefficients for OFFICER. *F*-statistics, with *p*-values in square brackets, are reported to test the significance of the differences in male and female coefficients for DIRECTOR and TOP_EXECUTIVE. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Whole Sample			Firms with Trades by Both Genders		
	Trade Tercile					
Variables	Lowest	Middle	Highest	Lowest	Middle	Highest
Constant	7.31***	9.06***	8.45***	7.02***	8.43***	8.30***
	(0.23)	(0.21)	(0.27)	(0.29)	(0.27)	(0.34)
FEMALE × OFFICER	−1.00**	−1.95**	−2.44**	−0.51*	−1.55**	−2.25**
	(0.48)	(0.83)	(1.19)	(0.28)	(0.74)	(1.14)
MALE × DIRECTOR	−0.81***	−2.31***	−1.60***	−1.01***	−2.25***	−1.75***
	(0.31)	(0.26)	(0.32)	(0.33)	(0.33)	(0.40)
FEMALE × DIRECTOR	−2.39***	−4.47***	−3.47***	−2.51**	−3.65***	−3.40***
	(0.86)	(0.72)	(0.87)	(1.13)	(0.69)	(0.86)
MALE × TOP_EXECUTIVE	1.87***	1.17***	1.48***	1.97***	1.47***	1.24***
	(0.36)	(0.32)	(0.37)	(0.48)	(0.42)	(0.48)
FEMALE × TOP_EXECUTIVE	−2.46**	−0.70	−2.73*	−1.78	−1.14	−2.20*
	(1.40)	(1.28)	(1.42)	(1.33)	(1.23)	(1.27)
N	45,799	63,371	47,426	22,158	32,582	24,914
Test of (Male–Female) Coefficient Differences (F-statistic, with p-value in square brackets)						
DIRECTOR	4.24	9.47	4.89	4.09	4.29	4.08
	[0.039]	[0.002]	[0.027]	[0.043]	[0.038]	[0.043]
TOP_EXECUTIVE	9.44	3.26	8.81	7.68	3.41	6.28
	[0.002]	[0.071]	[0.003]	[0.006]	[0.065]	[0.012]

informal gender networks. We offer a measure of gender network strength using our database to provide some suggestive answers to this question.

B. Gender Differences When Female Trading Is Relatively High

There is considerable research suggesting that formal position or title does not truly reflect female executives' access to information. Social psychologists have argued that what occurs in organizations is only partially related to formal ranks and responsibilities and that interaction networks play a critical role in both individual effectiveness and organizational functioning (see Miller (1986), Ibarra (1993) for excellent expositions of this view and reviews of this literature). Whereas the organizational chart simply indicates the presence or absence of a relationship, it is suggested that networks are the determinants of the nature and strength of the relationship. Although several reasons have been suggested as to why females may be viewed as less desirable network contacts, the relevant reason in our setting is the systemic barriers perspective (Morrison and Von Glinow (1990)), which suggests that gender differences in network access reflect the expectations and biases of organizational members. Furthermore, there is considerable evidence in the social psychology literature that there are gender differences in their tendency to form same-gender network relationships and in rates of return from networks. Ibarra (1992) finds that males are more likely to form same-gender

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ties across multiple networks and to have stronger same-gender ties. Males also reap greater returns from their investment in networks.

Kanter (1977a) argues that when senior executive positions are held disproportionately by males, interactions between the dominant group of males and the "token" group of females are affected. Male executives exaggerate differences between themselves and the "token" female executives. This behavior has several undesirable consequences for female executives, one of them being exclusion from informal interactions with male counterparts. There is broad support for Kanter's predictions (Yoder (1991), Lyness and Thompson (2000), Moore (1988), and Zimmer (1988)) in various professional settings, particularly when females are in traditionally male-held positions, such as senior executive jobs. As stated earlier, the findings of Catalyst (2013a) and our own data confirm that the gender ratio among senior executives is skewed in favor of males.

Finally, gender differences in access to information can arise from differences not only in intrafirm networks but also in interfirm networks. Westphal and Milton (2000) find that investment in external social networks can yield returns by mitigating the negative effects of race and gender with regard to a director's influence over decision making on the board.

As the proportion of female executives increases, one might expect to see some attenuation of tokenism behavior and stronger female networks. Therefore, if lack of access to information is the primary cause of the lower trade sizes and profits of female executives, the gender difference in these two variables should be reduced in firms where the proportions of female executives are higher. We do not have a direct way of measuring the proportion of female insiders. We can, however, use the proportion of trades by female insiders in a firm as a proxy of the proportion of female insiders. Furthermore, because of the low levels of female representation among insiders, we expect to see any mitigation of gender differences only in firms with the highest percentiles of female trades.

We report in Table 7 the gender differences in profits in the subsample of firms that represent female trades in the 90th percentile of all female trades from the original sample. The table is similar to Table 4. For each firm in our sample, we calculate the proportion of the number of female-executive trades to the total number of trades by female and male executives. Using this distribution of the female-executive trade proportions, we construct a subsample of firms in which the female-trade proportion is in the 90th percentile and above.[18] The firms in this subsample have relatively higher ratios of the number of female-executive transactions to the number of all transactions.

There are 3,817 female executives and 14,356 male executives (female proportion 21.0%) in the 90th percentile of firms in the whole sample; the corresponding figures are 2,386 females and 7,067 males (female proportion 25.2%) when we limit the sample to firms where both genders trade. When the sample is limited to firms in which the proportion of female trading falls in the 90th percentile, gender differences in returns are not significant, regardless of position. Consistent with the hypothesis that tokenism is likely to be attenuated when male dominance is relatively low, we see that the male advantage in profitability is elim-

[18] We obtain similar results when we use a 95th-percentile cutoff.

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TABLE 7

Gender Differences in Insider-Trading Profits When Female Trading Is High

Table 7 reports the gender differences in profits in the subsample of firms that represent female trades in the 90th percentile of all female trades. For each firm in our sample, we calculate the number of female-executive trades as a proportion of the total number of trades by both genders. Using this distribution of the female-executive trade proportions, we construct a subsample of firms in which the female-trade proportion is in the 90th percentile and above. The dependent variable is the alpha of each executive's return in basis points (bps). The independent variables are the cross products of gender (MALE or FEMALE) and executive type (OFFICER, DIRECTOR, or TOP_EXECUTIVE) and include firm fixed effects. MALE × OFFICER is the omitted category. Results are reported for the whole sample as well as the subsample of firms with trades by both genders. Standard errors are reported in parentheses below the coefficients. The *t*-statistic for the FEMALE × OFFICER variable provides the significance of the difference in male and female coefficients for OFFICER. *F*-statistics, with *p*-values in square brackets, are reported to test the significance of the differences in male and female coefficients for DIRECTOR and TOP_EXECUTIVE. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Variables	All Firms with High Female Trading	Firms with High Female Trading and Trades by Both Genders
Constant	10.7489***	11.6615***
	(0.65)	(1.01)
FEMALE × OFFICER	−1.3428	−0.6940
	(1.23)	(1.70)
MALE × DIRECTOR	−1.2517	−0.6749
	(0.82)	(1.25)
FEMALE × DIRECTOR	−3.0085**	−3.2069*
	(1.28)	(1.82)
MALE × TOP_EXECUTIVE	2.4183**	2.6266*
	(0.99)	(1.46)
FEMALE × TOP_EXECUTIVE	3.5686**	3.778*
	(1.66)	(2.16)
N	18,173	9,453
Test of (Male–Female) Coefficient Differences (F-statistic, with p-value in square brackets)		
DIRECTOR	0.46	0.15
	[0.496]	[0.698]
TOP_EXECUTIVE	2.12	2.24
	[0.146]	[0.135]

inated when females trade "more." The coefficient on the FEMALE × OFFICER variable is not significant, and the *F*-tests indicate that the differences between the genders in the director and the top-executive positions are also not significant. The results are similar in the subsample of firms where both genders trade. This result is consistent with the notion that females suffer an informational disadvantage despite their titles in firms where they form a small minority, but that disadvantage is attenuated when their numbers increase.

C. Other Tests of the Informational Hypothesis

The results from Section V.A indicate that the gender differences in insider trading and profitability are unlikely to be solely due to dispositional factors, and the results from Section V.B are consistent with the hypothesis that access to information through informal gender-based networks plays a role in these differences through gender-specific networks. In this section, we report the results of additional tests we conduct to investigate the informational hypothesis. All of these tests are conducted using the sample of firms with trades by both genders. Due to space considerations, we provide only a summary of the results.

If the presence of a relatively large number of female executives facilitates information flow through gender-specific networks, we should expect to observe gender differences in insider trading and profitability mitigated in industries with a larger female presence. To test this, we create industry-specific subsamples of firms and regress the alphas against a female dummy in each industry subsample.

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We use the industry groups as specified by the first four digits of the Global Industry Classification Standard (GICS). If the informational hypothesis is true, we should find that in industries with greater female-executive presence, the gender dummy is more likely to be not significantly different from 0. The five industries with the most female trading are Insurance; Media; Pharmaceuticals, Biotechnology, and Life Sciences; Retailing; and Software Services. In each of these industries, female trades exceed 9% of the total trades, compared with 4.4% for the sample as a whole. Although the female dummy is negative in the regressions in all 5 of these industries, it is not significantly different from 0 in 4 of these 5 industries; for the remaining 19 industries, the female dummy is negative in all regressions but not significantly different from 0 in only 58% of the industries. The results are therefore consistent with the informational hypothesis.

Next, we check whether our results are driven by female trades being concentrated in firms with low stock return volatility because of females' greater risk aversion. Volatility is measured as the daily stock return around the trade 50 days before and 50 days after. We regress volatility against a female dummy and find that the coefficient on the female dummy is negative and significant at the 1% level. We also divide firms into two categories, depending on whether their stock volatility is above or below the median value. We then regress the alpha against three independent variables: a female dummy, a volatility dummy (1 if high volatility), and the cross product of female and volatility dummies. We find that the female dummy is negative and significant, the volatility dummy is positive and significant, and the cross-product dummy is negative and significant, indicating that there is no evidence that female returns are lower because they are overrepresented in the firms with low stock volatility.

Finally, we investigate whether gender differences in insider trading have attenuated over time because the proportion of female executives has increased over time (Catalyst (2013a)), resulting in stronger female networks. We find that the proportion of the number (value) of female purchases indeed increases from 2.6% (1.4%) during 1975–1985 to 4.9% (4.2%) during 1997–2012. We find, however, that the difference in alpha between males and females actually increases from 1.4 bps during 1975–1985 to approximately 2.4 bps during 1997–2012. If stronger informal networks are the cause of greater male returns, then these networks appear to be even stronger in recent times relative to those of females, an indication that gender differences in access to information are an ongoing issue. It is also possible that although the proportion of females has increased over time, the number of females has not reached the critical mass in a sufficient number of firms to reduce the gender gap.

In summary, the results of this section enable us to rule out the possibility that gender differences in dispositional factors, such as overconfidence and risk aversion, are the sole explanations for the gender differences in trading intensity and profits and confirm that male executives possess an informational advantage. This section also provides evidence that the gender differences in insider-trading returns vanish when there is a larger female presence in firms, thereby supporting the hypothesis that female executives have better access to information because of stronger informal networks.

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D. Discussion

Using insider-trading data, this paper provides evidence consistent with the hypothesis that female executives, regardless of formal titles, are at a disadvantage with regard to access to information. This disadvantage disappears only when females are well represented in the top echelon of executives. There are several implications of these results. The evidence presented supports the view that there needs to be a critical mass of females for them to have similar access to information as males. Although our evidence is in the context of insider trading, it has implications for gender parity in many settings. For example, token representation on corporate boards may not allow female directors to be very effective contributors to important decisions. We show (Tables 2 and 4) that the information gap is greatest at the director level. Some countries, with Norway taking the lead, seem to recognize the importance of having a critical mass of female directors and are trying to achieve it through quotas for female directors on corporate boards.[19] Our results suggest that despite early evidence from the Norway experience indicating that the quota has led to a deterioration in operating performance (Ahern and Dittmar (2012)), it may be a worthwhile initiative in order to establish stronger female networks within and across firms among directors.

Another implication of this paper is that the lack of equal access to information puts qualified female executives at a disadvantage in competing with males for greater responsibilities and promotion to positions of significance and power. Along with the informal network effect, this might explain why females are not promoted as often as males after controlling for age, education, tenure, and experience, even in female-friendly countries such as Norway (Kunze and Miller (2014)). As our results show, the gender difference in trading profit is greatest at the officer level. This male advantage could be one reason why females are less represented at the higher top-executive level.

Finally, our results raise issues regarding the effect of gender differences in insider-trading profits on compensation differentials between the genders. There is some evidence that insider-trading profits are viewed as substitutes for salary and incentive compensation (Roulstone (2003), Denis and Xu (2013)). If all else were equal, this might suggest that the female-executive disadvantage in insider-trading profit ought to be offset by higher compensation for female executives, adjusted for rank, experience, and other factors. Unfortunately, the issue is not as straightforward. The same reasons that have caused the informational disadvantage might affect female executives' ability to offset this disadvantage via greater compensation. If the informational disadvantage is due to discrimination or a lack of negotiating power as a result of weaker networks, female executives' compensation may also be lower than that of equivalent male executives. Resolving this issue is beyond the scope of this paper.

[19]Norway was the first in Europe to legislate quotas for female directors on corporate boards. It has been joined since by Spain, France, and Iceland with a 40% quota; Italy with 33%; and Belgium and Germany with 30%. Netherlands has a 30% nonbinding target.

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VI. Conclusion

This paper is the first to report gender differences in insider-trading activity and profitability. We find that there are significant gender differences in insider-trading outcomes. The implication of our finding is that the environment in which top female executives operate is different from that of their male counterparts. Our main results are as follows: i) Both male and female insiders earn economically and statistically significant positive returns, on average; ii) males earn greater returns than females (the mean value-weighted return of males is 351 bps over a 50-day window after insider purchase, compared with 238 bps for females); and iii) males trade more frequently than females, and the difference is particularly notable in terms of the value of the trades. These gender differences exist among all ranks: officers, board directors, top executives, and, surprisingly, even CEOs and CFOs.

There can be two types of explanations, not mutually exclusive, for these results: dispositional or situational. The evidence from psychology and sociology literature overwhelmingly supports the notion that females are no more overconfident and no less risk averse than males. Taking these results as given, information-based trading models, such as the one we have provided, suggest that the results may be due to these dispositional factors alone or in combination with males' informational advantage. Given that male executives make more profits within every title category, any informational advantage possibly derives from informal networks.

We rule out gender differences in dispositional factors as the sole explanation of our results and provide evidence of male executives' informational advantage as follows. The prediction from our information-based trading model is that, for a given trade size, better-informed traders should earn greater profits. We find evidence that male executives do earn greater profits adjusted for trade size, even within groups with similar formal titles, thus implying that informational differences play a role in gender differences in insider-trading profits.

An explanation of the result that male executives possess an informational advantage over their female counterparts even when controlling for formal titles is that such informational advantage possibly arises from informal networks. Because the informational disadvantage of female executives might be attenuated in settings where the proportion of female executives is relatively high, we should expect to find the gender differences we observe to be reduced or eliminated in such settings. We find that in settings where the proportion of female trading is very high, proxying for the increased presence of females, the gender differences do indeed disappear. Our results seem to suggest that male executives and female executives have nonoverlapping networks, giving top male executives an edge in gathering asymmetric information.

Overall, using the setting of insider trading, our paper provides evidence that female executives have less access to information, even when controlling for formal titles, and that the lack of informal networks may play a role in this disadvantage. This paper also provides evidence consistent with the notion that the information gap disappears when informal networks are strengthened and highlights the importance of developing such networks.

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