Executives' Gender, Prospect Theory Bias and Insider Trading

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Abstract

This study compares insider trading decisions made by female and male executives. While recent literature contends that behavioral biases diminish with knowledge and experience, we find that executive insiders tend to buy (sell) their company's stock due to high (low) prospect theory value as compared to the benchmark which results in 0.34% (0.12%) lower (higher) subsequent returns than average. Moreover, while past researches show male is more overconfident resulting in inferior trading decisions, we show that 20.02% of insider trades by female executives are subject to behavioral bias as compared to 13.86% of the trades by male executives. The results indicate cautious behavior of female insiders in critical decision making as the bias is reduced significantly when female executives buy stock of their own company. The findings are robust to routine trades, all executive positions, sub-periods, market conditions and firm characteristics. Overall, our study suggests that highly experienced insiders' possession of superior information cannot eliminate behavioral biases among gender.

Keywords: Insider Trading, Female Executives, Behavioral Bias, Prospect Theory Value.

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1. Introduction

In this study we examine whether all insiders equally possess perfect private information about their firm's fundamentals and make bias-free trading decisions, or they may have a tendency to time buy and sell of the inside stock due to personal preferences and behavioral biases. Furthermore, we explore gender differences in behavioral biases and their effect on insider trading decisions by top executives. Many studies provide various reasons of insider trading activity. One of the most renowned motives of insider trading is the access of executives to superior non-public information of firm's prospects and exploitation of this information to earn subsequent abnormal returns.[1] Therefore, it is hard to expect that behavioral biases may stimulate the insiders to trade at a specific time. Moreover, both male and female executives are highly trained professionals with superior knowledge and experience of making cautious investment decisions at corporate level. The literature describes that market experience and sophistication tend to diminish the impact of behavioral biases on trading decisions (List, 2003; Feng and Seasholes, 2005). Subsequently, there may be less suspicion of any behavioral preference or disparity among trading decisions of male and female executives.

However, in this study we provide empirical evidence that not all the insider trades are driven by perfect information, rather the decisions are made according to prospect theory. We also find that insider trades which are influenced by prospect theory value, earn lower subsequent returns than average. We make prediction that insiders show tendency to involve in narrow framing and derive utility by evaluating stock-level return distribution. Although, insiders are highly knowledgeable and their trades of inside stock reveal strong information

[1] See for example: Seyhun (1986), Rozeff and Zaman (1998), Lakonishok and Lee (2001), Jeng, Metrick and Zeckhauser (2003), and Agrawal and Cooper (2015).

about future stock returns, however, our results indicate that insiders' trading decisions are affected by probability weighting function of prospect theory, just like individual investors. The probability weighting function describes personal preferences towards lottery-like gambles. These findings are consistent with the limited literature regarding effect of behavioral biases on insider trading performance (Kallunki, Nilsson and Hellstrom, 2009; Lee and Piqueira, 2016). Following Wang, Shin, and Francis (2012), we describe that all insiders may not possess the same level of private information due to different executive positions, therefore, their trades tend to be influences by personal choices.

We measure behavioral bias among gender according to prospect theory value (PTV) and conclude that insider trading by female executives is subject to higher behavioral bias than male executives. In our data, 20.02% trades by female insiders are biased, whereas the number is 13.86% for male insider trades. Existing literature labels male investors to be more risk seeker and overconfident than females because they trade more and earn lower returns.[2] With these depositional factors, one may anticipate male insiders to carry biased trades more frequently than females. Conversely, our study setting comprises of trades of inside stock by top level executives who have informational advantage over outside traders/investors, subsequently, our findings of behavioral bias among gender are not consistent with the literature. The "information access hypothesis" developed by Inci, Narayanan and Seyhun (2017) explains our results and we conclude that female inside executives are less likely to have access to informal networks of information, therefore, availability of limited private information may encourage female executives to involve in biased trades more frequently as compared to male executives. This justification is consistent with the literature that investors

[2] See for example: Barber and Odean (2001), Niederle and Vesterlund (2007), Croson and Gneezy (2009), Huang and Kisgen (2013), and Niessen-Ruenzi and Ruenzi (2018).

exhibit stronger behavioral biases in valuing stocks for which information is scarce and uncertainty is high (Hirshleifer, 2001; Kumar, 2009b).

Additionally, we distinguish buy and sell trades of female insiders to analyze whether the motive of trade affects tendency of female executives to carry biased trades. The literature provides evidence that insiders may trade for motives other than just maximizing their profits, more specifically, they sell their insider stocks for portfolio diversification or personal liquidity purpose (Huddart and Ke, 2007; Huddart, Ke and Shi, 2007; Kallunki, Nilsson and Hellstrom, 2009). Whereas, insiders' purchases tend to be correlated with more valuable private information and strong predictability power about future returns (Lakonishok and Lee, 2001). Interestingly, our results highlight that buying inside stock by female executives is subject to lesser behavioral bias as compared to selling the stock. The finding supports the literature on gender differences in information processing, which indicates that women more comprehensively process information than men in the same task context and even make effortful analysis of all available information in a complex task (Chung and Monroe, 2001).

Furthermore, experimental evidence shows that people are more likely to use intuition and make rapid decisions on heuristics. Such decisions are often connected with stronger behavioral biases (Kahneman, 2003; Kahneman, 2011). While analytical decision making requires logical and conscious manipulation of decision-relevant information, hence, viewed as less vulnerable to bias than intuition (Alexander, 1979). Thus, our study implies that female insiders are more likely to make trading decisions based on "rules of thumb" due to the possession of limited information. However, their brain's analytical thinking process dominates the decision of buying inside stock because purchases convey strong non-public information, as well as, exploitation of this information may encounter a threat of criminal penalties.

The decision making under uncertainty is well described by prospect theory (Kahneman and Tversky, 1979) which is later extended and referred as cumulative prospect theory (Tversky and Kahneman, 1992). The main feature of "weighting function", a component of cumulative prospect theory, is to apply decision weights to objective probabilities and use transformed probabilities for decision making. The main effect of probability weighting function is to overweight the tail events of any distribution, which captures individual's preference for lottery-like gambles (Barberis, Mukherjee and Wang, 2016). Barberis and Huang (2008) provide a new evidence that skewness in a stock return distribution can be priced, hence, investor's preference to overweight tails makes a positively skewed stock overpriced, which will earn a lower average return. This prediction has been supported by various studies using multiple measures of skewness.[3] Barberis, Mukherjee and Wang (2016) suggest that investors may form a mental representation of a stock by observing its past returns distribution and evaluate according to cumulative prospect theory. Their model describes that in the cross section, investors are attracted to a stock with a high prospect theory value, which results from very positively skewed past returns. Hence, probability weighting component of prospect theory may contribute significantly to make such a stock overvalued and earn low subsequent returns.

The prospect theory value model is discussed in a framework where individual investors engage in "narrow framing" and evaluate each investment decision separately, instead of considering the broad impact on their portfolio (Benartzi and Thaler, 1995). In our study, the data of insider trading neither provides information about portfolio holdings of each insider, nor does it specify the impact of each trade on the value of their portfolio. Considering the available information of insiders' buy or sell of only inside stock at one point in time, we

[3] See for example: Kumar (2009a), Boyer, Mitton, and Vorkink (2010), Bali, Cakici, and Whitelaw (2011), and Conrad, Dittmar, and Ghysels (2013).

assume that insiders may involve in narrow framing and apply prospect theory to evaluate past gains and losses distribution of their inside stock. More specifically, we develop a measure of behavioral bias according to prospect theory value (PTV) model (Barberis, Mukherjee and Wang, 2016). We hypothesize that a trade is biased when an insider is attracted to buy (sell) a stock due to its high (low) PTV and earns lower (higher) future return. We provide a simple probability weighting function of prospect theory, where we assume that a positively skewed return distribution of inside stock may become attractive to the insider who prefers to overweight tails, instead of exploiting superior private information. To the best of our knowledge, there is no detailed empirical work that examines the influence of prospect theory bias on insider trading decisions, more specifically, bias discrepancies among male and female executives' trades.

The data of insider trading is collected from year 2000 to 2016 by using the accurate and comprehensive source of 2iQ Research - Global Insider Transaction Data (2iQ ITD). Factset database is used to identify gender of insiders. Matching 2iQ Research data with CRSP (Center for Research in Security Prices) and Compustat databases, we finally have 4198 firms with insider trading data and female executives are 5.71% of total insiders. To deal with the concerns of spurious results or omitted variable, we employ various methods to estimate the regression of behavioral bias and insider trading. The regression is estimated by controlling for firm specific as well as insider specific characteristics. To understand whether time or firm-level factors are driving the main results, we run all regression models with month and firm fixed effects. Our all regression estimates are consistent with the main conjecture.

For robustness, we examine whether the positive relationship between behavioral bias and female insider trading prevails in different categories of inside trades, positions of executives, sub-periods and uncertain market conditions. We follow insiders' categorization methodology introduced by Cohen, Malloy and Pomorski (2012) to identify (i) routine, (ii)

opportunistic, and (iii) non-classified trades. Our findings show that routine trades are less prone to bias as compared to opportunistic trades because routine insiders follow a regular pattern of trading irrespective of any information advantage. However, there is an increase in bias when routine trade is carried by a female insider. Secondly, motivated by Inci, Narayanan and Seyhun (2017), we divide whole sample in three hierarchical positions; (i) Chairman, (ii) Chief Officer, and (iii) Director. The results support our main finding that insider trading by female is subject to higher behavioral bias than male insiders in same executive positions. Thirdly, we examine the trend in the relationship of bias and female insider trading over time, and indicate that with passage of time the association of female executives with biased insider trades is decreasing. Finally, our study considers four proxies to measure macro-level market uncertainity; (i) Market Volatility, (ii) Chicago Board Options Exchange Volatility Index (VIX), (iii) American Association of Individual Investors (AAII) Investor Sentiment Data, and (iv) National Unemployment Rate. We conclude that our main finding holds for most of the proxies of uncertain market condition.

The importance of investigating cognitive skills and behavioral biases among gender has been acknowledged in finance literature due to an increasing presence of females at corporate level.[4] Our study contributes to the controversial issue of behavioral disparities among gender, specifically in professional settings. On one hand, studies describe that females are more risk averse, less overconfident**,** shy away from competition, and involve in less frequent trading than their male counterparts in financial as well as corporate decisions (Barber and Odean, 2001; Niederle and Vesterlund, 2007; Huang and Kisgen, 2013; Niessen-Ruenzi and Ruenzi, 2018). In contrast, there are studies that provide empirical support that education, financial literacy, and experience play an important role in decreasing differences in risk taking

[4] As per Catalyst report, in year 2016 women held 51.5% of management, professional and related positions in the United States (Catalyst, 2017). The percentage of women chief executive officers (CEOs) in Fortune 500 firms increased from 0.4% in 2000 to 6.4% in 2017 (Catalyst, 2017).

behavior among gender (Halko, Kaustia and Alanko, 2012; Hibbert, Lawrence and Prakash, 2016). Moreover, women who choose to participate in male dominated environment are likely to be highly competitive and equally confident in decision making (Nekby, Thoursie and Vahtrik, 2008).

Most importantly, Fehr-Duda, De Gennaro and Schubert (2006) describe that gender disparities in risk taking behavior are based on specific circumstances. They indicate that difference in risk taking decision according to prospect theory among gender is more vivid in probability weighting functions than value functions. Moreover, women tend to underestimate large probabilities for positive outcomes (gains) more strongly than losses. These are the findings of an experimental study, whereas, our study analyzes real market setting where traders are highly sophisticated and possess superior information. Hence, our results provide a new insight in probability weighting preferences of professional male and female executives in investment decisions.

Our study contributes in several ways. First, in a setting where executives enjoy informational advantage over outside investors and earn abnormal profits, our study provides empirical evidence that insider trades are prone to behavioral bias and they tend to analyze outcomes according to prospect theory (e.g. Kallunki, Nilsson and Hellstrom, 2009; Hillier, Korczak and Korczak, 2015; Lee and Piqueira, 2016). Second, behavioral biases among gender are well documented but exploring trading decisions of sophisticated female insiders and concluding that female trades are subject to higher bias than male, is a valuable contribution to finance literature (e.g. Huang and Kisgen, 2013; Hibbert, Lawrence and Prakash, 2016; Niessen-Ruenzi and Ruenzi, 2018). Moreover, this study provides insight to the limited literature of gender differences in loss aversion and probability weighting preferences under prospect theory (e.g. Schmidt and Traub, 2002; Fehr-Duda, De Gennaro and Schubert, 2006;

Hibbert, Lawrence and Prakash, 2016). Finally, this study assists investors, and market regulators who use insider trading to assess information.

The rest of the study is structured as follows. Section 2 reviews the literature while Section 3 establishes the research methodology and provides the details of our data. The applications of diagnostic tests, analysis, and discussion of results are shown in Section 4. Section 5 runs several robustness checks and Section 6 concludes.

2. Literature Review

2.1 Insider Trading, Behavioral Biases, and Gender

The literature on insider trading highlights several firm and market related components which may affect buying and selling decisions and profitability of insider trading. The purchase of stock by insiders is normally based on superior information and possesses predictive ability to forecast cross sectional stock returns (Lakonishok and Lee, 2001; Jiang and Zaman, 2010). Cohen, Malloy and Pomorski (2012) categorizes insiders in routine and opportunistic groups based on the information content and abnormal returns earned by their trading pattern. Ali and Hirshleifer (2017) have also introduced another methodology to identify routine and opportunistic trades, hence they conclude that opportunistic trades earn abnormal profits by exploiting private information. It is evident in the literature that insiders may sell because of several reasons other than just profit maximization. These reasons might be diversification or rebalancing of portfolio, liquidity, wealth, income or tax selling (Huddart and Ke, 2007).

Terpstra, Rozell and Robinson (1993) describes that in addition to many personality and demographic variables, gender may also be considered to influence the ethical decisions related to insider trading where men are more likely to involve in insider trading than women. Using Swedish market data, Kallunki, Nilsson and Hellstrom (2009) examine behavioral biases along-with situational motives and conclude that selling by wealthy insiders is informative for future returns. Moreover, portfolio rebalancing, tax strategies, and disposition play the most important roles in insider trades, where male insiders trade more aggressively than female (over-confidence). Hillier, Korczak and Korczak (2015) provides evidence that personal attributes including insider's year of birth, education and gender explain up to a third of the variability in insider trading performance. Using a stock's 52-week high, Lee and Piqueira

(2016) show that insider trading is affected by behavioral biases like anchoring and disposition effect.

The research study of Inci, Narayanan and Seyhun (2017) analyses gender differences in insider trading profitability and concludes that female inside executives are less likely to have access to informal networks of information, therefore they tend to possess less information, earn less abnormal profits and involve in less trading as compared to their male counterparts.

2.2 Behavioral Biases among Gender

The literature on gender differences suggests that systematic dispositional disparities exist among male and female. Investigating a preference condition for loss aversion in the framework of cumulative prospect theory, Schmidt and Traub (2002) indicate that female subjects contribute over-proportionally to the set of strictly loss averse choices and demonstrate a higher degree of loss aversion than their male counterparts. Experiments on binary choices among lotteries involving small scale real gains and losses, Brooks and Zank (2005) describe that relatively more women are loss averse than men. Exploring the sensitivity of women in assessing probabilities, Fehr-Duda, de Gennaro, and Schubert (2006) find women to be more risk averse than men when facing investment choice. This laboratory experiment sheds light that women tend to underweight larger probabilities more than men and the effect is pronounced in the domain of gains.

Lam and Ozorio (2013) examine gender differences in the effect of prior gains or losses on risk taking behavior by playing an experimental betting game. The study finds that women are more likely to take a greater risk after a loss ('escalation of commitment' process, which may be explained by loss aversion and prospect theory), whereas men tend to take greater risk after a gain ('house money' betting process, which may be explained by a combination of

overconfidence, self-attribution, hot hand fallacy and illusion of control). Moreover, irrespective of gender, training, knowledge and on-the-job experiences are more likely to moderate influence of prior gains or losses on risk taking behavior. Hibbert, Lawrence and Prakash (2016) have conducted a survey on finance professors from universities across the USA and it is indicated that after prior losses majority of women tend to avoid investing in stocks, consequently they are more loss averse and more likely to expect unfavorable market conditions than men irrespective of whether they have made gains or incurred losses in their recent past investments.

The dissimilarities in risk related behavior among gender have been tested in carefully designed experiments and various household surveys approve these findings that women are more risk averse than men (Byrnes, Miller and Schafer, 1999; Donkers, Melenberg and Soest, 2001). Croson and Gneezy (2009) review the economics literature on gender differences in risk preferences, social preferences and reaction to competition by comparing the findings of abstract gambles, contextual experiments and field studies. The evidence provides substantial support that women are more risk averse than men.

For detecting whether gender differences exist among financial experts who possess higher skills to manage managerial risk, Niessen-Ruenzi and Ruenzi (2018) compare performance of male and female equity fund managers and find that female fund managers are more risk averse, follow less extreme investment style, have more consistent investments and trade less than their male counterparts. However, the study does not find any gender difference in average performance of funds. Beckmann and Menkhoff (2008) conduct a survey among professional fund managers and conclude that "fund managing women will be women in their profession"; they are more risk averse, shy from competition and are less over confident than men. Huang and Kisgen (2013) analyze financial and investment decisions made by male and female executives. The study provides evidence that female executives are more risk averse in

investment and capital structure decisions as female executives are more likely to exercise deep-in-the-money options early. Faccio, Marchica and Mura (2016) evaluate whether corporate risk taking is affected by CEO gender. They observe a subsequent decrease in risk taking of a given firm around the transition from a male to a female CEO. Moreover, firms with female CEO make less risky financing and investment choices. Hence, women CEOs tend to take on less risk compared to their male counterparts.

Although empirical evidence supports less risk taking behavior of women, however we find controversies in the related literature because studies highlight the fact that differences in age, knowledge, experience, financial literacy and sophistication lead to variations in risk taking behavior among males and females. Dwyer, Gilkeson and List (2002) investigate gender difference in risk taking in mutual fund investment decisions and find that women investors take lesser risk than men in their most recent, largest, and riskiest mutual fund investment decisions. However, gender gap in risk taking behavior decreases substantially after controlling for knowledge of financial markets and investment. Fixed income mutual funds managed by male and female managers do not differ in terms of performance, risk and other fund characteristics (Atkinson, Baird and Frye, 2003). The research studies show that women even with extensive knowledge of finance and experience hold lower proportions of risky assets, they are more risk averse than men, nevertheless, financial knowledge and experience play an important role in controlling gender difference in investment decisions (Halko, Kaustia and Alanko, 2012; Hibbert, Lawrence and Prakash, 2016). Risk taking by banks with female presence in board is evaluated by Berger, Kick and Schaeck (2014) and it is shown that three years following the increase in female board representation, portfolio risk increases marginally. Moreover, these findings are primarily attributable to the less experienced female executives than their male counterparts and the educational degree.

Another prominent and extensively tested behavioral bias among gender, which affects investment decisions, is overconfidence. Barber and Odean (2001) investigate trading behavior of male and female investors and find that men trade more frequently and earn annual risk-adjusted net returns that are lesser than those earned by women. They conclude that the underlying fact of this result is that men are more overconfident than women. Moreover, overconfidence plays an important role in gender differences in willingness to compete and it is observed that women are shy from competition (Niederle and Vesterlund, 2007). Huang and Kisgen (2013) analyze financial and investment decisions made by male and female executives. The study depicts that female executives make value enhancing decisions for shareholders as they involve in less frequent acquisitions and debt issuance and the announcement returns to these firms are higher than the firms with male executives. These results indicate that female executives are less overconfident and more risk averse in investment and capital structure decisions. However, Nekby, Thoursie and Vahtrik (2008) show that women selected to participate in male dominated environment are likely to be highly competitive. Therefore, within the group there is no gender difference in confidence and competitiveness. Deaves, Lüders and Luo (2009) do not find any difference in gender regarding overconfidence or trading activity. They propose that women who are attracted to 'male' disciplines may be different from the overall female population.

2.3 Prospect Theory, Probability Weighting and Behavior towards Prior Gains & Losses

Kahneman and Tversky (1979) and Tversky and Kahneman (1992) describe investors' attitude towards risky choices under Prospect theory. According to the theory, individuals value gains and losses differently in uncertain situations. They underweight uncertain outcomes as compared to outcomes that can be obtained with certainty, and thus become risk averse for potential gains and risk seeker for possible losses. With the application of probability weights

to the value function, results show that, given the concavity across gains and convexity across losses, this weighting function generally places more weight on the tails of the distribution revealing a common preference for lottery-like gains and a dis-preference for low probability extreme losses.

Barberis and Huang (2008) test asset pricing implication of cumulative prospect theory by focusing on its probability weighting component. The results shed light on the theory's novel prediction that a security's own skewness can be priced. They show that investors are attracted to the stocks with positively skewed return distributions. To the extent that preferences for positive skewness are strong, asset tend to be overpriced and result in subsequent underperformance. Barberis, Mukherjee and Wang (2016) indicate that in the cross section, subsequent return is low for a stock whose past return distribution has a high prospect value. Investors overvalue the stock having high positively skewed distribution of past returns, hence the overvalued stock results in low subsequent returns. The study shows that probability weighting component of cumulative prospect theory enhances prospect theory value's predictive power for returns.

Literature on return skewness highlights its importance. Kumar (2009a) classifies lottery stocks as those with the highest idiosyncratic skewness, the highest idiosyncratic volatility and the lowest share prices. The study shows that lottery stocks typically underperform non-lottery stocks. Using a four-factor asset pricing model, he shows that lottery stocks generate negative alpha that is both statistically significant and economically meaningful. Boyer, Mitton, and Vorkink (2010) estimate expected idiosyncratic skewness and show that stocks with the highest expected idiosyncratic skewness underperform other stocks.

Barberis and Xiong (2009) argue that differences in evaluation period, expected level of return and shape of value function are most likely to cause variation in prediction of subsequent risk taking attitudes. Barberis and Xiong (2009) assume that prospect theory

predicts disposition effect only when investors derive utility from realizing gains and losses on some asset. Without this assumption, the change in value function curvature might lead to risk taking after prior gains instead of losses. Advances in the literature have been made to understand how professional investors make decisions within a dynamic context of facing sequence of tasks. O'Connell and Teo (2009) analyze the effect of trading gains and losses on risk-taking attitude of institutional managers. Using a proprietary currency trades' database, the study reports that institutional investors are not prone to disposition effects, they aggressively reduce risk following losses and mildly increase risk following gains. The study argues that institutional investors are more likely to derive utility from their past performance because they are managing other peoples' money and accountable for losses and gains. Moreover, fund age and trading experience plays a role in tempering the risk reaction to gains. Haigh and List (2005) compares behavioral differences among under-graduate students and professional option and future traders from the CBOT. The study concludes that professional traders, despite having vast trading experience, tend to show greater "myopic loss aversion" than students.

Benartzi and Thaler (1995) explain equity premium puzzle by introducing the concept of myopic loss aversion (MLA), which is a combination of loss aversion and mental accounting. MLA suggests that less frequent feedback and binding multi-period decision tend to attract individuals to value stock investments more than bonds, which might result in significantly higher market prices of risky assets. According to MLA, if individuals consider performance over a long period of time the riskier asset is likely to perform better than the safer asset, hence likelihood of incurring a loss is reduced.

Based on loss aversion phenomenon of prospect theory, researchers have extended traditional asset pricing framework and presented various dynamic models to understand how evaluation of prior outcomes (gains/losses) influence risk attitudes as well as future

expectations under uncertainty. Motivated by the findings of Benartzi and Thaler (1995), a dynamic equilibrium model is presented by Barberis, Huang, and Santos (2001) which suggests that investors derive utility from fluctuations in the value of their financial wealth, hence become more risk tolerant when their risky asset holdings earn returns that exceed a historical benchmark. The model explains the equity premium, high means, volatility and predictability puzzle of equity returns in financial market. Additional related finance literature consists of Barberis and Huang (2001), analyzing behavior of firm-level stock returns by introducing two economies populated by investors who are loss averse over the fluctuations of their financial wealth. Under individual stock accounting, individual stock returns have a high mean, are more volatile than their underlying cash flows, and are slightly predictable in the time series. While, in the cross section there is a large value premium. The study indicates that many of such effects are driven from "discount rate" for individual stock that varies as a function of the stock past performance.

By reviewing relevant literature about insider trading, gender gap in behavioral biases and prospect theory, we examine the effect of prospect theory components on trade decisions by insiders and test bias disparities among executives' gender.

3. Data and Methodology

3.1 Data

The study obtains insider trading data from the comprehensive source of 2iQ Research - Global Insider Transaction Data (2iQ ITD). To avoid survivorship or selection bias, 2iQ Research uses S&P BMI benchmarks for orientation. 2iQ Research consists of all listed stocks that must have at least USD 100 million in float-adjusted market capitalization, and a value traded of at least USD 50 million for the past 12 months. Our data set contains all regular open-market "Equity" transactions i.e. buy and sell of shares by top executives of firms. We include transactions of only Top insiders which are classified "A" in insider-level category by 2iQ Research. "A" insiders include executive board, chairman and beneficial owners of top 5% of the company's stock.[5] The study ignores transactions of insiders with Indirect connection-type (e.g. immediate family member or controlled corporations). Option exercises, subscription to new shares, stock awards, transactions by beneficial owners and private transactions are excluded from the data set. In the sample, we ignore share-type other than common and ordinary shares. This sample contains unique transactionID, company name, insiderID, insider name, insider relation to the company, number of shares traded, price, value of shares traded, trade date, input/reporting date to SEC, holdings and exchange where the company is listed. By applying initial filter, we have 307,516 observations of insider trading of publicly traded firms from year 2000 to 2016.

The data on stock market returns and prices (share codes 10 and 11) is retrieved from the Center for Research in Security Prices (CRSP). Time series data is obtained for firms with insider trading and for which stock returns and prices data are available in the CRSP database

[5] Insiders' category "B" of 2iQ Research consists of upper level management e.g. executive committee and beneficial owners of top 20% shares of the company. The number of insider trades is 201,000 in this category which are carried by a total of 29,942 insiders (with initial filters). Insiders' category "C" contains non executives, supervisory board and board of directors. The number of insider transactions is 294,556 in this category which are carried by 39,218 insiders (with initial filters). We can conclude that although top "A" insiders are smaller in number but they more frequently involve in insider trading as compared to the other two categories.

from year 1995 to 2016. The time series data from CRSP is starting from year 1995 because five-year data prior to each of the insider trade is required to measure prospect theory value (PTV). The sample contains 279,278 insider trades by 15,599 top executives of 5,920 firms. Finally, in order to deal with potential outliers and misreports, following Inci, Narayanan and Seyhun (2017) we exclude insider transactions when on trade date: (i) the insider transaction price is higher than twice the closing price of the stock, (ii) the number of shares of the insider transaction is higher than the daily volume of trade of the stock, and (iii) the number of shares of the insider transaction is higher than the outstanding number of shares for the stock. Our sample finally consists of 223,755 insider transactions by 11,488 top executives in 4198 publicly listed firms from 2000 to 2016.[6]

For identifying gender of executives, we use Factset database. Factset maintains a wide-range of personal level data including gender, education, date of birth, employment history, existing job's address, email address etc. We manually match names of our sample executives with Factset individuals' names by verifying their employment history and insider trading information available in Factset database. We identify and allocate Factset –Identifier to each executive in our sample using Factset excel API and retrieve required data points including gender. For those executives with not an appropriate match with Factset database, we have identified their gender by exploring Executive profile and Biography from Bloomberg, LinkedIn and Google's database.

For firm specific control variables, we obtain monthly volume, shares outstanding and market capitalization data from CRSP. Data on annual book to market ratio is from Compustat. To measure excess return for analysis, the data on market return is retrieved from Kenneth

[6] We consider an insider who works for more than one firm during our sample period as more than one observation.

French's data library.[7] Several websites are used to obtain data on macro-level market factors. Data on CBOE Volatility Index is obtained from Global Financial Data.[8] Investors Sentiments data is collected from American Association of Individual Investors (AAII).[9] The monthly U.S. unemployment data come from the Bureau of Labor Statistics.[10]

3.2 Variables Definition and Model Development

In this section, we describe our main variables along-with the model used to measure behavioral bias.

3.2.1 Prospect Theory Value (PTV)

In this study, we predict that insiders derive prospect theory utility from changes in the value of inside stock. We expect that instead of making trade decisions based on superior information, insiders may consider prior gains and losses distribution of inside stock as a good estimate to predict its future return distribution, therefore, they form a mental representation of the stock by observing its past returns distribution and evaluate according to prospect theory. Following Barberis, Mukherjee and Wang (2016), the prospect theory value (PTV) is measured by allocating probability weights to prior sixty months' returns distribution (past five years) of inside stock in the following manner:

$$PTV_{i,t} = \sum_{i=-m}^{-1} v(Retex_i)\left[w^{-}\left(\frac{i+m+1}{60}\right) - w^{-}\left(\frac{i+m}{60}\right)\right] + \sum_{i=1}^{n} v(Retex_i)\left[w^{+}\left(\frac{n-i+1}{60}\right) - w^{+}\left(\frac{n-i}{60}\right)\right] \quad (1)$$

[7] Available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/
[8] Available at https://www.globalfinancialdata.com/
[9] Available at http://www.aaii.com/
[10] Available at https://www.bls.gov/

where $PTV_{i,t}$ is prospect theory value of every "i[th]" stock traded by insider at any point in time "t". $Retex_i$ is monthly return of traded stock in excess to market. m stands for the maximum number of losses when $Retex_i$<0, while n is the maximum number of gains when $Retex_i$≥0 in the distribution of past sixty excess returns of the stock. Hence, $Retex_{-m}$ through $Retex_{-1}$ are losses and $Retex_1$ through $Retex_n$ are gains. $v(Retex_i)$ is the value function, while $w^-(.)$ and $w^+(.)$ are the probability weighting functions for losses and gains respectively. The distribution assigns an equal probability to each of the sixty historical excess returns of the stock i.e. (1/60).

To obtain probability weight for a loss ($Retex_i$<0), Barberis, Mukherjee and Wang (2016) take total probabilities of all losses equal to or worse than $Retex_i$, and the total probability of all losses strictly worse than $Retex_i$, then apply weighting function to each, i.e. $w^-(.)$, and subtract them. For a gain ($Retex_i$≥0), take total probabilities of all gains equal to or better than $Retex_i$, and the total probability of all gains strictly better than $Retex_i$, then apply weighting function to each, i.e. $w^+(.)$, and subtract them. The $w^-(.)$ and $w^+(.)$ are explained by Tversky and Kahneman (1992) as below:

$$w^-(P) = \frac{P^\delta}{(P^\delta + (1-P)^\delta)^{1/\delta}}, \quad w^+(P) = \frac{P^\gamma}{(P^\gamma + (1-P)^\gamma)^{1/\gamma}} \qquad (2)$$

The degree to which individual overweights tails is governed by the parameters γ and δ, lower values of these parameters imply more overweighting of tails (Tversky and Kahneman, 1992). Based on the above expression, if probability of extreme loss (p_{-m}) and probability of extreme gain (p_n) are small, then $w^-(p_{-m})>p_{-m}$ and $w^+(p_n)>p_n$, so that the most extreme outcomes or the outcomes in the tails are over-weighted.

Following the value function of Tversky and Kahneman (1992), we use the following:[11]

$$v(Retex_i) = \begin{cases} -\lambda(-Retex_i)^{\alpha} & for \quad Retex_i < 0 \\ (Retex_i)^{\alpha} & for \quad Retex_i \geq 0 \end{cases} \tag{3}$$

To measure PTV, for each stock, every month (starting from 01-01-2000) we select prior sixty months' returns (past five years).[12] This window keeps rolling for every month of each stock till the last month of year 2016.[13] Then we sort each window of these past sixty monthly returns in increasing order, starting with the most negative through to the most positive for each stock. According to the technique of Barberis, Mukherjee and Wang (2016), "m" is the number of negative and "n" is the number of positive past monthly returns in each window of every stock.[14] We consider "i" as a simple counter element with values ranging from 1 to 60 for each window of sorted past sixty returns. We measure PTV by using Eq (1). Further details are provided in the Appendix.

3.2.2 Measurement of Bias

The fact that under probability weighting function of prospect theory, investors overweight the tails of distribution due to their preference for lottery-like stocks, therefore, a high prospect theory value stock is overvalued which earns subsequent lower return (Barberis, Mukherjee and Wang, 2016).

Considering the above relationship, we develop prospect theory bias measure and expect that when inside executives buy (sell) their company's stock based on its high (low) PTV, such trade is made according to behavioral bias and risk attitude and with a limited

[11] Tversky and Kahneman (1992) estimate γ=0.61, δ=0.69, and λ=2.25 for their median subject. Using experimental data, they estimate α=0.88.
[12] The reason of starting the measurement of prospect theory value from year 2000 is because our insider transaction sample is available from 2000 to 2016.
[13] For example, for a particular stock on date 01-01-2000 the selected past sixty monthly returns' window is from 01-01-1995 till 31-12-1999.
[14] "n= 60-m". For example, negatives are 10 so m=10 & n= (60-10).

material information. Consequently, such buy (sell) trade earns subsequent lower (higher) return. However, in our framework, insiders do not have a choice to choose stock among a portfolio. Hence, our model makes a simple prediction that an insider may time buy or sell by comparing PTV of inside stock with a cross-section average PTV of other stocks in the market (benchmark) at one particular point in time.[15] If inside stock's PTV is more than the benchmark, insider tend to be attracted to buy the stock and vice versa. We define Bias as follows:

$$Bias = \begin{cases} PTV > 0 \; and \; Trade = Buy \; and \; Retex_{t+1} < 0 \\ OR \\ PTV < 0 \; and \; Trade = Sell \; and \; Retex_{t+1} > 0 \end{cases} \quad (4)$$

where $Retex_{t+1}$ is the excess return of inside stock at month t+1.

Prospect theory value (PTV) is calculated for each stock on monthly basis. Trade dates are converted to calendar months so that PTV of the stock can be allocated to every insider trade.

To test whether preferences differ among gender of executives regarding prospect theory based trades, we develop the following model:

$$Bias_{i,t} = \alpha + \beta \, Female_{i,t} + \varepsilon_{i,t} \quad (5)$$

where Bias is dummy variable equal to "1" when conditions of biased behavior are met, and "0" otherwise. Female is an independent variable equal to "1" when insider transaction is made by a female executive, and "0" otherwise.

3.3 Summary Statistics

[15] PTV = inside stock's PTV – cross-section average PTV

Figure 1 describes the pattern of movement of insider trading by female executives and behavioral biases under prospect theory. It is quite visible that cross-sectional bias increases with more female insiders' trades on average over time. This figure provides support to our main findings.

Insert Figure 1

Table 1 consists of Panel A, B and C that provides detailed description of our insiders' data set. Panel A highlights information about total insider transactions, trades by males and females separately, number of biased transactions based on gender of insiders and number of buy and sell trades. The table shows that there are more firms with insider trading by their male executives as compared to females. Firms with female insider trades are only 14.41% of our sample firms. Limited number of women working at corporate level is a prominent issue in terms of gender gap, therefore, we see that only 5.71% of our sample top executives are female. Moreover, this percentage goes down further when we observe that just 2.56% of the insider trades are made by female top executives. This evidence signals the fact that female executives are not involved in frequent trading as compared to their male counterparts (Inci, Narayanan and Seyhun, 2017).

Panel A then describes number of trades that are biased in our total sample of insider trading. We find that 14.01% of the transactions are behaviorally biased under prospect theory. More interestingly, it shows that 20.02% of the trades made by female insiders are biased, whereas this figure is smaller for trades made by males (13.86%). It gives us an insight that female insiders are more likely to made behaviorally biased trades.

Panel A shows that top executives of our sample more frequently make Sale transactions as compared to Purchase. However, female executives buy inside stock with a percentage higher than their male counterpart, i.e. they have made 29.56% Buy transactions,

whereas the percentage is 22.08% for males from year 2000 to 2016. The average value of trades in $ provides an insight that male insiders are most likely to make trades with high value as compared to female insiders.

Panel B of Table 1 provides in depth statistics of male and female insider trades in three executive types named as, Chairman, Chief Officer, and Director. We observe that in our sample data set Chief Officer category makes most of the insider transactions i.e. 8929. However, in terms of trades by females, the category of Director displays the maximum percentage i.e. 7.14%. Our results in context of declining number of female insiders' trades as seniority increases are consistent with Inci, Narayanan and Seyhun (2017), because we find that percentage of trades by female insiders is minimum i.e. 2.39% in Chairman category.

Panel C of Table 1 is descriptive statistics of our main variables. To provide a clear picture, we present the results by categorizing the data based on gender of insiders. It is evident that on average biased trades by females are higher than males. Female insiders on average are younger than male counterparts as average age of female insiders is 52, whereas males' age is 57. We find no bigger difference on average in terms of size of the firms of insiders. The higher volume turnover variable (Turnover) for male insider trades shows consistency with the existing literature of overconfidence (e.g. Barber and Odean, 2001), as we notice higher turnover of stocks (2.108) which are traded by male insiders as compared to females (1.766). We also find gender gap in book to market ratio, where female insiders' traded stocks have higher book to market ratio of 0.624 than male counterparts i.e. 0.545.

Insert Table 1

Table 2 is the correlation matrix, describing relationship among all main variables of the study. We find that insider trades by female executives, and trading of high book to market ratio stocks are positively and significantly correlated with prospect theory bias. On the other

hand, senior insiders in terms of age, firm size and volume turnover are negatively and significantly correlated with the bias. This indicates that transactions of the stocks carried by senior executives in age, belonging to large firms, and having high turnover are less likely to be biased. Moreover, we observe female variable is significantly correlated with small size, low turnover and high book to market stock.

Insert Table 2

4. Empirical Results and Discussion

4.1 Effect of Prospect Theory Value on Insiders' Returns

Table 3 (a) shows the effect of PTV on future returns of insiders when they buy or sell inside stocks. We categorize buy as well as sell transactions based on high and low PTV of stocks. The results show that when insiders buy stocks with high PTV, their future return is decreased by 0.34% on average as compared to the future return of buy trades of low PTV stocks. The finding is significant at 5% level of significance for the assumption of both, equal as well as unequal population variances. Likewise, the results indicate that when low PTV inside stocks are not appealing to the executives and they decide to sell, the future return is 0.12% more on average than future return of selling high PTV stocks. However, this increased future return is a loss for insiders because they already have sold the stock and lost the chance of earning higher return. We test the significance of this result by assuming equal as well as unequal population variances, the mean difference finding is significant at 5% and 10% level of significance respectively.

Insert Table 3 (a)

Table 3 (b) shows regression results of association between stocks' PTV and overall future return of insiders. We run regressions with, as well as, without control variables and fixed effects. Column (1) of Table 3 (b) presents results of the main model and shows a significantly negative relationship between our dependent and independent variables. To give strength to the model, we introduce firm and insider specific control variables and the results are presented in Column (2). To deal with heteroscedasticity, the t-statistics is presented in parentheses with robust standard errors. The results describe that when insiders involve in narrow framing and evaluate past returns distribution of inside stocks to make trading decisions according to PTV, their overall future return is decreased by 14.92%. The same negative

relationship is reported in Column (3), which considers all the control variables and fixed effect for firm and time. The finding demonstrates 12.71% reduction in overall future return of insiders' transactions that are carried according to PTV of inside stocks. These results are significant at 1% level of significance for all the regressions. In terms of firm-level control variables, we find that firm size is negatively, whereas, turnover and book to market ratio are positively associated with future return. For insider-level control variables, executives' age and undergrad education are negatively, whereas, graduation variable is positively related to future return of insider trading. All the findings are significant at 1% level and goodness of fit of the model is 25.44%.

Insert Table 3 (b)

The results reported in Table 3 (a) and (b) provide empirical evidence that insiders are likely to involve in behaviorally biased trading. Their decisions are affected by personal gambling or risk taking preferences, when evaluation of historic returns distribution of inside stock is based on the probability weighting component of prospect theory. Our findings are consistent with Barberis, Mukherjee and Wang (2016). Their study highlights the fact that high PTV stocks have positively skewed past returns distribution and investors may consider the positively skewed stocks as a lottery-like gamble, therefore, they are likely to invest in overpriced stock and accept to earn lower return on average. In our study setting, insiders only are concerned about when to buy/sell own company's stock to make abnormal profits. We expect that the private information insiders possess might be noisy, hence, they assign probability weights according to their personal preferences and keep comparing inside stock's PTV with the cross-sectional average PTV of other stocks in the market. Subsequently, such insiders time the buy (sell) when they find inside stock's PTV higher (lower) than the benchmark, which causes the stock to be overvalued and subsequent future return of such trade is affected negatively.

4.2 Effect of Female Insider Trading on Prospect Theory Bias

We analyze insider trading by female and male executives to find whether the tendency to make biased trades differ among gender of insiders. Table 4 (a) consists of the results of regression of our main model developed in Eq (5). We run our main model with simple OLS first and find that the coefficient of female insiders' trade is positively and significantly associated with prospect theory bias. Column (1) of Table 4 (a) shows that the degree of biased trades increases by 6.17% with female insider trading as compared to male. To deal with heteroscedasticity, in Column (2) the t-statistics is presented in parentheses with robust standard errors. The significance of our finding still holds. To address the concern of impact of time invariant or firm related fixed factors on our results, we apply two-way fixed effects for firm and month to the regression where number of sample firms are 4198 and 12 months in each year of our study period. By applying fixed effects to the model developed in Eq (5), we observe an improvement in goodness of fit i.e. 31.36%. Column (4) of Table 4 (a) presents a positive and significant coefficient which supports the conjecture and describes that prospect theory bias increases by 3.99% with female insider trading.

Insert Table 4 (a)

While analyzing the impact of female insider trading on bias, endogeneity exists due to the possibility of unobserved omitted variables of insider or firm-specific characteristics. Endogeneity can lead to spurious relationship between the variables. Moreover, Hillier, Korczak and Korczak (2014) provide evidence that not only firm or trade specific characteristics affect the performance of insider trading, but corporate insiders' attributes have a strong influence as well in explaining a significant proportion of the variability in insider trading performance. Considering this view, in Table 4 (b) we control for firm specific (previous month and year excess returns, firm size, turnover volume and book to market) and

insider specific characteristics (age and education) and present the results with and without two way fixed effects. Columns (1), (2), and (3) show positive and significant relationship of bias and female insider trading by controlling for firm specific characteristics and insiders' demographics, without considering fixed effects of month and firm. The findings are robust with fixed effects as well; Columns (4), (5) and (6) provide evidence that biased trades by female insiders are 1.96% higher than their male counterparts when we combine all the control variables and fixed effects. We also observe that bias trading is higher and statistically significant for stock with previous month's high excess return, high turnover volume, and insider with under-graduate degree. Whereas, there exists a significantly negative relationship between bias trades and stock's previous annual excess return and firm size. In Column (7) we present results based on clustering, where standard errors are clustered monthly. Although some of the control variables have lost their significance but our main hypothesis of significantly positive relationship between bias and female insider trading is supported.

Insert Table 4 (b)

Although the magnitude of bias trades' coefficient gets smaller by controlling for firm and insider specific characteristics together, however, it is evident that prospect theory bias increases significantly with female insider trading as compared to male trading. As opposed to the literature which describes that experience and knowledge reduce the impact of behavioral biases (e.g. Feng and Seasholes, 2005), we find that professional female executives involve in more frequent biased insider trades than males. Female insiders mentally represent risk related to the stock based on the distribution of stock's past returns. As compared to male executives, females show a greater tendency to overweight tails of returns distribution, and in a hope of earning abnormal profits, they make trading decisions according to PTV of inside stock. Ultimately, they earn smaller future return than male counterparts. Inci, Narayanan and Seyhun (2017) provide evidence that males earn significantly more than females in equivalent

positions. Our finding is consistent with the literature which suggests that behavioral biases exist among gender and females are more risk averse, loss averse, and less overconfident than males (Brooks and Zank, 2005; Huang and Kisgen, 2013; Niessen-Ruenzi and Ruenzi, 2018).

4.3 Effect of Motives of Female Insider Trading on Prospect Theory Bias

Literature describes that there are different motives that regulate insider trading. Insider purchases mostly reflect some good news about company's prospects, hence affecting future abnormal returns. Lakonishok and Lee (2001) describe that insider buying strongly predicts future long-term returns. Jeng, Metrick, and Zeckhauser (2003) find abnormal performance of over 6% annually after insider buys, as contrasted with no significant abnormal performance for insider sells. Kallunki, Nilsson and Hellstrom (2009) indicate that insiders tend to buy stocks that earn high positive abnormal returns on non-trading days as well and these returns are greater than sells. Although, insiders have an information advantage over other investors or market participants, but there is always scrutiny risk associated with insider purchase. Therefore, insiders are more likely to be cautious when timing their purchases than sales, because of the risk of regulatory monitoring (Seyhun, 1998). Consequently, we examine purchase trades by female insiders to test whether the transactions are prone to higher prospect theory bias or the association is opposite to our main conjecture.

Table 5 shows regression results of relationship between bias and insider trade by female to buy stock of the company. We test this relationship by developing different models with or without two-way fixed effects as well as firm and insider specific characteristics. Columns (1), (2), (3), and (4) are describing regression results of simple linear regression without firm and month fixed effects but with firm and insider specific characteristics as control variables. Whereas, columns (5), (6), (7) and (8) include firm and insider specific characteristics as control variables with two-way fixed effects for month and firm.

The findings in Column (8) show an interesting fact about insider trading by females. It is evident that frequency of biased trades increases when females make trade decision but we observe that this frequency significantly diminishes when we introduce interaction term Female_Buy (product of buy trades and gender dummy). This shows that when female insiders make purchase decision, they become conscious and carefully gather information to deal with this critical decision of purchase. The bias is 2.67% decreased when female insiders decide to buy inside stock and this coefficient is significant at 5% level. We do not find support for this significant negative relationship for regression without fixed effects in Column (4). All control variables report similar results as describes in Table 4.

Insert Table 5

We explain these results in context of literature of thinking process of human brain. Kahneman (2011) in his book "Thinking Fast and Slow" sheds light on the way human brain functions. Human mind operates in two parallel systems, referred as "Intuition" and "Reasoning" (Kahneman, 2003). Intuition is a "machine for jumping to conclusions". It digests the data on hand and quickly comes up with a good story. When a difficult question arises, intuition or holistic thinking asks rational thinking to answer in a more analytical and effortful manner. As for System 1, research indicates that its acceptance and tendency to look for confirming evidence induces it to search memory for related answers, hence the decision is subject to biases.

We argue that female insiders rely on intuitions and personal preferences to make trade decisions, therefore, the trades are affected by PTV bias. However, as purchase decisions are based on superior internal information, are followed by high abnormal future returns and monitoring concerns are high, therefore, female insiders become more careful. They are more likely to take maximum advantage of the accessible internal information and are less prone to

be affected by behavioral bias. Moreover, literature on gender differences in information processing narrates that women more comprehensively process information than men in the same task context and even make effortful analysis of all available information in a complex task (Chung and Monroe, 2001).

4.4 Effect of Female Insider Trading on Prospect Theory Bias for Subsample of Firms

We suspect that certain firms may endogenously pair with female insiders. Stocks with female insiders may thus be systematically different from those with male insiders, which may explain the results of the study. Hence, we consider a subsample of firms with insider trading by both female and male executives. We consider an insider who works for more than one firm during our sample period as more than one observation. There are 538 firms in our sample with 5344 transactions by female insiders whereas 34434 trades are carried by male insiders. We observe a higher percentage of insider trading by female executives for our subsample of firms i.e. 13.43%, which indicates that female executives are more likely to carry insider trading for firms where their male counterparts are involved in this practice as well.

We apply fixed effects for firm and month, and control for firm and insider specific characteristics to test the relationship between bias and female insider trading. Table 6, Column (1), (2), and (3) provide results which are consistent to our main findings of whole sample. The firms with trades by both gender, experience 2.75% higher biased trades by female executives than trades by male executives. The magnitude of bias coefficient in subsample firms is higher than the whole sample coefficient which provides evidence for a significantly stronger positive relationship between bias and female insider trading in subsample of firms. Although in Column (3), we observe some changes in the signs of control variables' coefficients but the results are robust and goodness of fit is 35.47%.

In Table 6, Column (4), (5), and (6) we present the findings for effect of purchases by female insiders and bias. The results in Column (4) and (6) show consistent results that female insiders make a careful and logical decision when it comes to inside stock purchases. Therefore, trading based on prospect theory bias is reduced for inside stock purchase. Considering all the controls and fixed effects, bias trading is reduced to 4.59% when female insiders buy stock of their own company as compared to their male counterparts. The coefficient of bias is statistically significant.

Insert Table 6

According to our main findings, female insider trades are subject to higher prospect theory bias than male trades, whether carried in independent or both gender firms. These results do not support the expectation of males involving in biased or less profitable trading decisions because of their overconfidence (Barber and Odean, 2001). Researchers have found that women may be overconfident in estimating their performance in financial decision tasks (Deaves, Lüders and Luo, 2009). However, the framework presented in our study is based on the access of insiders to superior information and knowledge about the task, therefore, the results provide a new insight regarding gender decision making in highly informed environment. Gysler, Brown Kruse, and Schubert (2002) conclude that in financial and complex tasks, as men gain more knowledge about the task, they become more risk averse and less overconfident. Whereas, when women gain knowledge, they become less risk averse and are more confident.

Moreover, the nature of decision as well as gender stereotypes may affect men's and women's beliefs in how they should act in certain tasks (Biais et al, 2005). Hence, our study concludes that dispositional factors, motives and informational differences among gender influence insider trading decision.

5. Robustness Checks

To provide support to our main findings, we run some robustness checks.

5.1 Routine, Opportunistic and Non-Classified Trades and Effect of Female Insider Trading on Bias

The existing literature describes that insiders involve in opportunistic trading to exploit private information and earn abnormal profits (Ali and Hirshleifer, 2017). Opportunistic insiders trade whenever they receive a superior information regarding their company, therefore, these trades do not follow a specific pattern or timings. On the other hand, routine insiders either possess limited or noisy information, or do not tend to exploit informational advantage. Hence, these routine traders trade on specific timings and their transactions follow a regular pattern. As routine trades are not informative about firm's future, so earn lower return as compared to opportunistic trades (Cohen, Malloy and Pomorski, 2012).

We follow the same technique developed by Cohen, Malloy and Pomorski (2012) to categorize our sample in different classes of insiders based on their trading patterns and examine whether female insiders' tendency to carry biased trades differ in these categories. Our sample is divided into Routine trades (trades made by insiders at least once in the preceding three years and in the same calendar month), Opportunistic trades (trades for which we cannot find a definite pattern in preceding three years), and Non-classified trades (all remaining trades with no history of trades in preceding three years). Cohen, Malloy and Pomorski (2012) describes that non-classified trades show the same characteristics as opportunistic trades.

In Table 7, we examine the relationship of routine trades made by female insiders and the bias. Column (1) presents results with fixed effects but without controlling for firm and insider-level variables. We observe that routine trades are less likely to be biased, however,

when routine trades are made by female executives, bias is increased. To make our results robust, in Column (2) and (3) we take into account fixed effects of firm and month, as well as all the control variables. The results of all three regressions report negative and significant association of routine trades with bias, as we notice an 11.34% decrease in biased trades when insiders are routine traders in Column (3). Interestingly, the results show a positive relationship between prospect theory bias and routine trades by female insiders. After controlling for firm and insider specific characteristics as well as fixed effects, there is an increase of 14.86% in biased trading when female insiders carry routine trades and follow a regular pattern of trading. This outcome is significant at 1% level and good ness of fit of the model in Column (3) is 32.67%.

Insert Table 7

Our results already have demonstrated that female insiders are subject to higher behavioral bias. We assume that when they tend to trade on specific timings as routine traders, they are likely to compare inside stock's PTV with the benchmark PTV on that specific time and then based on high or low PTV they decide to either buy or sell the stock. While routine trades do not convey superior information, dispositional factors and preferences may easily affect trading decisions of routine female insiders. This result provides evidence that behavioral biases associated with female affect their decision making irrespective of the trading patterns.

5.2 Executives' Position and Effect of Female Insider Trading on Bias

Inci, Narayanan and Seyhun (2017) analyze gender differences in profitability of insider trading. Following their categorization of executives' positions, we run regression by considering prospect theory bias as dependent variable. The independent variables are the cross products of gender (Male or Female) and executive position (Chairman, Director and Chief

Officer). Male_ChiefOfficer is considered as benchmark category. The results are provided by considering fixed effects for month and firm.

Table 8, Column (1) shows results of whole insider trades' sample data. It is quite evident that except Female_Director category, in other two executive types, females influence insider transactions by exhibiting higher prospect theory bias than males in the same positions. The coefficients of the cross product of Female_Chairman and Female_ChiefOfficer are positive and statistically significant at 1% level, indicating that insider trades by female top executives are prone to higher bias than male executives. In Female_Chairman category the biased trades are 5.79%, while they are 3.26% higher in Female_ChiefOfficer position as compared to the benchmark category. For Female_Director category, the result shows a positive but insignificant relationship i.e. 2.43%. There is a significantly positive association between biased trades and Male_Chairman category, but it is evident that the economic significance is much lower than all the findings for female executive categories.

The systematic gender differences in the selection of firms based on various characteristics like size, industry, differences in authority or availability of information to different executive positions, may influence our results. Therefore, in Table 8 Column (2) we present the regression results of subsample of firms with trades by female and male executives. The findings are consistent with the whole sample; female insider transactions are subject to higher prospect theory bias in every position, except Female_Director, and the coefficients are significant at 1% level of significance. The findings presented in Table 8 Column (2) also highlight significantly negative association of Male_Chairman and Male_Director category with biased trades. Our results provide evidence that stronger bias is not related to the proportion of females presented in various types of executive positions.

Insert Table 8

5.3 Trend Analysis of the Relationship between Female Insider Trading and Bias

We examine the trend existing in highly biased trades by female insiders. It is expected that in our study window, the positive relationship between female executives and tendency of highly biased trades might be changed over time. Or, the regression estimates of biased transactions by female insiders might be sensitive to the rising or depreciating market. Consequently, we run a regression by introducing a Trend variable which increases by month for all the years in the study period.

Table 9 reports the results to identify whether our tested positive relationship is increasing or decreasing over time. In Column (1) and (2), results are reported without control variables. These results describe a negative and statistically significant coefficient of Female_trend variable. Whereas, in Column (3) the estimates are examined in the presence of control variables and fixed effects for time and firm, hence, estimate of Female_Trend variable becomes insignificant. Based on the results of Column (1) and (2), we conclude that the diminishing trend between bias and female insider trades over time is statistically significant at 1% level but the economic significance is not impressive, i.e. 0.04%. Based on these results, one might anticipate that increasing number of females at corporate level and higher knowledge of investment decisions might cause females to control their behavioral biases and make analytical trade decisions over time.

Insert Table 9

5.4 Macro-level Market Uncertainty and Effect of Female Insider Trading on Bias

Considering the fact that behavioral biases can be affected by varying market conditions like market level uncertainty (Kumar, 2009b). Therefore, we develop a model by considering four proxies to measure market level uncertainty and test their impact on female insider trading and

bias. These proxies are Market Volatility, measured as cross sectional average of monthly standard deviation of stocks' daily returns; Investors Sentiments, monthly measure from American Association of Individual Investors (AAII); National unemployment rate, monthly U.S. unemployment data from the Bureau of Labor Statistics; and CBOE Volatility Index (VIX), monthly data is obtained from Global Financial Data. We examine the increase or decrease in bias when female executives trade under these uncertain market conditions.

Table 10 provides results with and without control variables and fixed effects. Column (1) is based on main model regression results with no controls and fixed effects. We observe that majority of the uncertainty proxies show significantly positive relationship with biased trades. Column (2), with fixed effects for time and firm, reports that bias in insider trades becomes significantly stronger when market volatility is lower, or investor sentiment, unemployment rate and VIX are higher. We find similar significant results for these four uncertainty proxies when insider trade is made by female executives. Among these measures, investor sentiment appears to be the strongest, while volatility has the weakest coefficient estimates.

In Column (3), we present results based on all control variables and fixed effects. It is evident that under volatile market biased trades by female insiders are reduced by 4.11%, while under high sentiment and VIX index, female insider trades are subject to higher bias as compared to the trades by males. The positive estimate of Female_Unempl is not statistically significant. We observe that overall bias of female insider trade is decreased by 2.44% when market uncertainty factors are considered, however the coefficient does not show significance. We conclude that various uncertain market conditions influence female insiders' preferences for trading according to prospect theory.

Insert Table 10

6. Conclusion

This study explores that insider trading decisions are affected by the application of prospect theory to stock-level gains and losses. Based on the assumption that sophisticated insiders may involve in "narrow framing", the results show that trades according to prospect theory value earn lower return than average. Moreover, we provide empirical evidence that inside transactions by female executives are prone to higher bias than male executives. In an environment where superior non-public information about firm's prospects is accessible and trading decisions are made by highly experienced executives, effect of behavioral biases is expected to fade away. However, our findings show that insiders, more specifically female, are likely to derive utility by considering past returns distribution of inside stock and then allocating probability weights according to their personal preference, rather than exploiting private information. Their decision to buy a high PTV or sell a low PTV inside stock results in subsequent lower or higher returns respectively.

The study indicates that female insiders, even in the same hierarchy position of their male counterparts, show higher tendency to involve in biased transactions. We have examined this relationship in several ways, e.g. considering our sample executives' hierarchical positions, trades as routine, opportunistic, and non-classified, sub-periods and macro-level market factors. All the results are consistent with main conjecture. We explain these results in the light of research work of Inci, Narayanan and Seyhun (2017), which concludes that female inside executives are less likely to have access to informal networks of information.

Nonetheless, our study sheds light that a significant decrease in prospect theory bias is observed in female insider trading when a decision to purchase inside stock is made. We argue that female insiders make intuitive decision about insider trading. But when they plan a purchase of inside stock, which is normally based on some good news about the company and

predictive of high abnormal future returns, the decision requires conscious information analysis and they engage in rational decision making process, causing behavioral bias to diminish.

This study adds to the limited literature of behavioral biases among gender under prospect theory, specifically, in professional setting. Biases like risk aversion and over-confidence have been extensively analyzed but literature is scant for behavior disparities among gender regarding loss aversion and mental representation under prospect theory. This study contributes in the literature of insider trading as well. It also provides an insight to investors and other market participants that insider trading decisions are likely to be biased, thus, they may not always be conveying information about company's prospects and future market returns.

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Figure 1: Pattern of Relationship of Bias and Female Insider Trading Over Time

Figure 1 shows a trend in behavioral bias along-with insider trading by female executives from year 2002 to 2016. Bias and Gender_dummy are cross-section averages of bias and female insider trades respectively over time.

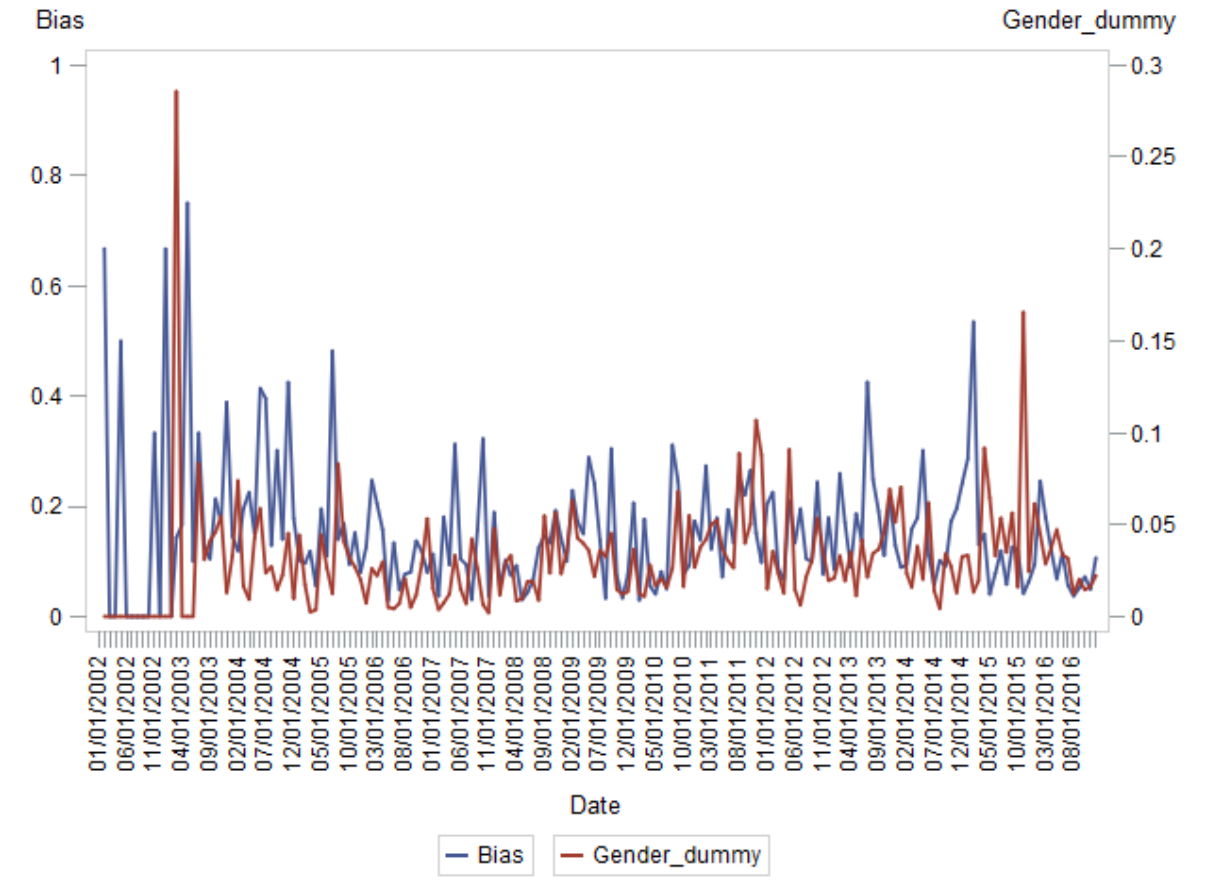

Table 1: Summary Statistics

Panel A

Table 1 Panel A provides statistics of insider trading by male and female executives for the period of 2000-2016. The last column of Panel A describes statistics for female as a percentage of the total. We consider an insider who works for more than one firm during our sample period as more than one observation.

	Total	Trade by Males	Trade by Females	Trades by Females (%)
Number of Firms	4198	4131	605	14.41%
Number of Executives	11488	10832	656	5.71%
Number of Trades	223755	218017	5738	2.56%
Number of Biased Transactions	31359	30210	1149	20.02%
Percentage of Biased Transactions	14.01%	13.86%	20.02%	-
Number of Buy Transactions	49828	48132	1696	29.56%
Percentage of Buy Transactions	22.27%	22.08%	29.56%	-
Number of Sell Transactions	173927	169885	4042	70.44%
Percentage of Sell Transactions	77.73%	77.92%	70.44%	-
Value($) of Transactions-Average	-	254490	156711	-

Panel B

Table 1 Panel B provides statistics of number of insiders in three executive types for the period of 2000-2016. We consider an insider who works for more than one firm or holds more than one positions in the same firm during our sample period as more than one observation.

Position	Total	Male	Female	Female (%)
Chairman	2464	2405	59	2.39%
Chief Officer	8929	8362	567	6.35%
Director	532	494	38	7.14%

Table 1: Summary Statistics

Panel C

Table 1 Panel C provides summary statistics of all variables by categorizing them for gender of executives for the period of 2000-2016. See Table A1 in appendix for the explanation of all the variables.

Gender	Variable	N	Mean	Median	Std. Dev.	Min	Max
Male	Bias	218017	0.139	0	0.345	0	1
Male	PTV	218017	0.010	0.016	0.034	-0.230	0.583
Male	$Retex_{t+1}$	218017	0.006	-0.0007	0.123	-0.897	3.905
Male	Age_insider	212361	56.85	57	9.208	20	91
Male	Size	218017	14.152	14.170	2.153	8.062	17.702
Male	Turnover	218005	2.108	1.725	1.811	0.020	9.819
Male	Book_Mkt	211070	0.545	0.389	0.538	0.033	4.351
Female	Bias	5738	0.200	0	0.400	0	1
Female	PTV	5738	0.006	0.012	0.035	-0.135	0.138
Female	$Retex_{t+1}$	5738	0.013	0.003	0.114	-0.674	1.043
Female	Age_insider	5033	51.86	51	9.409	25	81
Female	Size	5738	13.306	13.276	2.072	8.601	17.702
Female	Turnover	5737	1.766	1.280	1.815	0.020	9.819
Female	Book_Mkt	5446	0.624	0.484	0.630	0.033	4.351

Table 2: Correlation Matrix

Table 2 presents correlation matrix for the main variables of sample insider transactions from year 2000 to 2016. See Table A1 in appendix for the explanation of all the variables.

	Bias	Female	Age_insider	Size	Turnover	Book_Mkt
Bias	1					
Female	0.028[a]	1				
Age_insider	-0.004[b]	-0.081[a]	1			
Size	-0.113[a]	-0.062[a]	0.030[a]	1		
Turnover	-0.025[a]	-0.030[a]	-0.035[a]	0.174[a]	1	
Book_Mkt	0.071[a]	0.023[a]	0.049[a]	-0.443[a]	-0.073[a]	1

[a] $p < 0.01$, [b] $p < 0.05$, [c] $p < 0.10$

Table 3 (a): Buy/Sell Trading Decision based on High/Low PTV and Insiders' Return

Table 3 (a) presents the mean differences of insiders' future returns when buy as well as sell transactions are according to high or low PTV of inside stock. The t-value is measured for both the assumptions, i.e. population variances are equal as well as unequal.

Buy Transactions

	Insiders' Future Return			
	N	Mean	Std. Dev.	Std. Error
High PTV	22313	0.00843	0.135	0.0009
Low PTV	27515	0.0118	0.1817	0.0011
Difference (1-2)		-0.00339**	0.1625	0.00146

Method	Variances	DF	t-value	Pr > |t|
Pooled	Equal	49826	-2.32	0.0205
Satterthwaite	Unequal	49461	-2.39	0.0169

*** p < 0.01, ** p < 0.05, * p < 0.10

Sell Transactions

	Insiders' Future Return			
	N	Mean	Std. Dev.	Std. Error
Low PTV	44239	-0.0055	0.1466	0.0007
High PTV	129688	-0.0043	0.0915	0.00025
Difference (1-2)		-0.0012*	0.1082	0.0006

Method	Variances	DF	t-value	Pr > |t|
Pooled	Equal	173925	-2.07	0.0384
Satterthwaite	Unequal	56444	-1.66	0.0963

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 3 (b)

Table 3 (b) presents the findings of regression of insiders' return on PTV without as well as with firm and insider specific controls. The dependent variable insiders' return earned by trading inside stock. See Table 1 for the definitions of the variables. To ensure that extreme values are not affecting the results, all variables are winsorized at their 1 and 99 percentile levels. Two-way fixed effects are used for firm and month. We suppress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

$$Insider\_Return_{i,t} = \alpha + \beta_1 PTV_{i,t} + \beta_2 Retex\_m_{i,t-1} + \beta_3 Retex\_y_{i,(t-12,t-2)} + \beta_4 Size_{i,t-1} + \beta_5 Turnover_{i,t-1} + \beta_6 Book\_Mkt_{i,t-1} + \beta_7 Age\_insider_{i,t} + \beta_8 PhD_{i,t} + \beta_9 Grad_{i,t} + \beta_{10} MBA_{i,t} + \beta_{11} UnderGrad_{i,t} + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{4197} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	With no controls and no fixed effects	With controls but no fixed effects	With all controls and fixed effects
	(1)	(2)	(3)
PTV	-0.1415***	-0.1492***	-0.1271***
	(-12.01)	(-12.75)	(-10.17)
Retex_m		-0.0037	-0.0012
		(-1.33)	(-0.62)
Retex_y		0.0020*	-0.0002
		(1.80)	(-0.28)
Size		-0.0043***	-0.0024***
		(-24.48)	(-3.47)
Turnover		0.0041***	0.0029***
		(21.29)	(12.66)
Book_Mkt		0.0022***	0.0054***
		(2.61)	(6.97)
Age_insider		-0.0002***	-0.0002***
		(-6.44)	(-5.31)
PhD		-0.0125*	-0.0092
		(-1.68)	(-1.21)
Grad		0.0154***	0.0298***
		(7.41)	(9.69)
MBA		-0.0158***	-0.0023
		(-4.95)	(-0.52)
UnderGrad		-0.0084***	-0.0125***
		(-13.22)	(-11.76)
Constant	0.0002	0.0688***	-
	(0.58)	(24.06)	
No. of Obs.	223755	210675	210675
R-squared	0.0015	0.0176	0.2544

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 4 (a): Insider Trading by Female and Bias

Table 4 (a) presents the findings of regression of bias on female insider trades without controls. The dependent variable is behavioral bias under prospect theory. See Table A1 in appendix for the definitions of the variables. Two-way fixed effects are used for firm and month. We suppress intercept for two-way fixed effect. The t-statistics based on White robust standard errors as well as clustered standard errors for firm and month are reported in parentheses.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{4197} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	With no fixed effects and no controls	Robust standard errors with no fixed effects and no controls	Cluster standard errors with no fixed effects and no controls	With fixed effects but no controls
	(1)	(2)	(3)	(4)
Female	0.0617***	0.0617***	0.2002***	0.0399***
	(13.29)	(11.56)	(6.84)	(7.23)
Constant	0.1386***	0.1386***	-	-
	(186.45)	(187.27)		
No. of Obs.	223755	223755	-	223755
R-squared	0.0008	0.0008	0.0073	0.3136

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 4 (b)

Table 4 (b) presents the findings of regression of bias on female insider trades with firm and insider specific controls. The dependent variable is behavioral bias under prospect theory. See Table A1 in appendix for the definitions of the variables. To ensure that extreme values are not affecting the results, all variables are winsorized at their 1 and 99 percentile levels. Two-way fixed effects are used for firm and month. We suppress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses. In column (7) clustered standard errors for firm and month are presented.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Retex\_m_{i,t-1} + \beta_3 Retex\_y_{i,(t-12,t-2)} + \beta_4 Size_{i,t-1} + \beta_5 Turnover_{i,t-1} + \beta_6 Book\_Mkt_{i,t-1} + \beta_7 Age\_insider_{i,t} + \beta_8 PhD_{i,t} + \beta_9 Grad_{i,t} + \beta_{10} MBA_{i,t} + \beta_{11} UnderGrad_{i,t} + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{4197} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	With firm controls but no fixed effects (1)	With insider controls but no fixed effects (2)	With all controls but no fixed effects (3)	With firm controls and fixed effects (4)	With insider controls and fixed effects (5)	With all controls and fixed effects (6)	With all controls and clustered SE (7)
Female	0.0427***	0.0470***	0.0281***	0.0263***	0.0323***	0.0196***	0.0518*
	(7.82)	(8.70)	(5.12)	(4.67)	(5.38)	(3.18)	(1.81)
Retex_m	-0.0025		0.0052	0.0417***		0.0430***	-0.0023
	(-0.43)		(0.87)	(7.77)		(7.84)	(-0.05)
Retex_y	-0.0205***		-0.0195***	-0.0315***		-0.0289***	-0.0263
	(-10.51)		(-9.81)	(-13.64)		(-12.29)	(-1.61)
Size	-0.0157***		-0.0166***	-0.0515***		-0.0520***	-0.0028
	(-40.34)		(-40.25)	(-26.94)		(-26.67)	(-0.70)
Turnover	-0.0003		-0.0002	0.0058***		0.0063***	0.0011
	(-0.79)		(-0.37)	(8.71)		(9.30)	(0.31)
Book_Mkt	0.0150***		0.0142***	-0.0014		-0.0003	0.0431***
	(8.28)		(7.72)	(-0.66)		(-0.12)	(2.78)
Age_insider		-0.0001	-0.0001		-0.0002	0.0001	0.0022**
		(-1.59)	(-1.14)		(-1.19)	(0.82)	(2.38)
PhD		0.1783***	0.2106***		-0.0175	-0.0192	0.2177
		(9.51)	(10.62)		(-0.86)	(-0.86)	(1.21)
Grad		0.0792***	0.0711***		-0.0190**	-0.0071	0.0889**
		(13.17)	(11.51)		(-2.20)	(-0.80)	(2.18)
MBA		0.0627***	0.0516***		-0.0118	-0.0176	0.0782
		(6.06)	(4.85)		(-0.94)	(-1.37)	(0.79)
UnderGrad		0.0022	0.0206***		0.0135***	0.0164***	0.0294**
		(1.27)	(11.61)		(4.40)	(5.30)	(2.14)
Constant	0.3559***	0.1408***	0.3556***	-	-	-	-
	(56.22)	(27.63)	(47.56)				
No. of Obs.	216503	217394	210675	216503	217394	210675	210675
R-squared	0.0145	0.0025	0.0166	0.3254	0.3121	0.3249	0.1434

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 5: Motives of Female Insider Trading and Bias

Table 5 presents the findings of regression of bias on female insider trading when female executives decide to buy the stock of their company. The table shows results with and without fixed effects as well as firm and insider specific controls. The dependent variable is behavioral bias under prospect theory. Female_Buy is the product of buy transaction and female dummy variable. See Table A1 in appendix for the definitions of the variables. To ensure that extreme values are not affecting the results, all variables are winsorized at their 1 and 99 percentile levels. Two-way fixed effects are used for firm and month. We suppress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Female\_Buy_{i,t} + \beta_3 Buy_{i,t} + \gamma Controls + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{4197} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	With no controls and no fixed effects	With firm controls but no fixed effects	With insider controls but no fixed effects	With all controls but no fixed effects	With fixed effects but no controls	With firm controls and fixed effects	With insider controls and fixed effects	With all controls and fixed effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female	0.0737***	0.0559***	0.0477***	0.0280***	0.0563***	0.0408***	0.0444***	0.0291***
	(11.88)	(9.01)	(8.00)	(4.78)	(8.66)	(6.17)	(6.40)	(4.11)
Female_Buy	-0.0674***	-0.0477***	-0.0277**	-0.0048	-0.0439***	-0.0383***	-0.0335***	-0.0267**
	(-5.59)	(-3.79)	(-2.16)	(-0.36)	(-3.87)	(-3.31)	(-2.66)	(-2.07)
Buy	0.1054***	0.0865***	0.1061***	0.0881***	0.0851***	0.0790***	0.0891***	0.0837***
	(51.60)	(31.36)	(50.93)	(31.29)	(29.66)	(25.54)	(30.32)	(26.47)
Retex_m		0.0398***		0.0494***		0.0600***		0.0625***
		(6.49)		(7.77)		(11.09)		(11.32)
Retex_y		-0.0019		-0.0003		-0.0214***		-0.0182***
		(-0.92)		(-0.14)		(-9.14)		(-7.65)
Size		-0.0105***		-0.0111***		-0.0436***		-0.0437***
		(-24.63)		(-24.70)		(-22.54)		(-22.15)
Turnover		0.0003		0.0005		0.0048***		0.0052***
		(0.79)		(1.22)		(7.19)		(7.65)
Book_Mkt		0.0064***		0.0052***		-0.0026		-0.0017
		(3.43)		(2.71)		(-1.20)		(-0.78)
Age_insider			-0.0001	-0.0001			0.00002	0.0003**
			(-1.07)	(-0.66)			(0.22)	(2.06)
PhD			0.1837***	0.2158***			-0.0250	-0.0226
			(9.60)	(10.74)			(-1.23)	(-1.02)
Grad			0.0592***	0.0561***			-0.0223***	-0.0123
			(9.96)	(9.16)			(-2.60)	(-1.37)
MBA			0.0560***	0.0531***			-0.0154	-0.0193
			(5.26)	(4.89)			(-1.22)	(-1.50)
UnderGrad			0.0061***	0.0175***			0.0071**	0.0112***
			(3.62)	(9.84)			(2.32)	(3.62)
Constant	0.1153***	0.2637***	0.11262***	0.2599***	-	-	-	-
	(148.79)	(38.31)	(22.19)	(32.61)				
No. of Obs.	223755	216503	217394	210675	223755	216503	217394	210675
R-squared	0.0163	0.0217	0.0183	0.0242	0.3163	0.3275	0.3151	0.3272

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 6: Insider Trading by Female, Motives and Bias for Subsample Firms

Table 6 presents the findings of regression of bias on female insider trading overall (Column (1), (2), (3)) and in cases when female executives decide to buy the stock of their company (Column (4), (5), (6)) for a subsample of firms with trades by both gender. The table shows results with and without fixed effects as well as firm and insider specific controls. The dependent variable is behavioral bias under prospect theory. Female_Buy is the product of buy transaction and female dummy variable. See Table A1 in appendix for the definitions of the variables. To ensure that extreme values are not affecting the results, all variables are winsorized at their 1 and 99 percentile levels. Two-way fixed effects are used for firm and month. We suppress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \gamma Controls + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{537} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Female\_Buy_{i,t} + \beta_3 Buy_{i,t} + \gamma Controls + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{537} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	Main Model with fixed effects but no controls (1)	Main Model with controls but no fixed effects (2)	Main Model with controls and fixed effects (3)	Buy Model with fixed effects but no controls (4)	Buy Model with controls but no fixed effects (5)	Buy Model with controls and fixed effects (6)
Female	0.0458***	0.0344***	0.0275***	0.0696***	0.0355***	0.0459***
	(8.58)	(5.67)	(4.65)	(10.85)	(5.52)	(6.64)
Female_Buy				-0.0649***	0.0087	-0.0488***
				(-5.63)	(0.58)	(-3.75)
Buy				0.1191***	0.1214***	0.1641***
				(17.11)	(15.67)	(21.28)
Retex_m		0.0230	-0.0332***		0.0777***	0.0122
		(1.50)	(-2.65)		(4.93)	(0.96)
Retex_y		0.0196***	0.0581***		0.0524***	0.0766***
		(4.00)	(10.97)		(9.61)	(14.35)
Size		-0.0201***	-0.0572***		-0.0092***	-0.0456***
		(-20.05)	(-14.48)		(-7.73)	(-11.51)
Turnover		-0.0067***	-0.0074***		-0.0050***	-0.0103***
		(-7.04)	(-4.78)		(-5.35)	(-6.66)
Book_Mkt		-0.0191***	-0.0587***		-0.0266***	-0.0699***
		(-4.87)	(-11.06)		(-6.68)	(-13.19)
Age_insider		0.0003	-0.0003		0.0001	-0.00004
		(1.30)	(-1.11)		(0.51)	(-0.14)
PhD		0.4517***	0.0355		0.4673***	0.0026
		(16.06)	(1.20)		(16.19)	(0.09)
Grad		0.2007***	-0.0334**		0.1262***	-0.0451***
		(17.15)	(-2.42)		(10.42)	(-3.29)
MBA		0.4192***	-0.0095		0.4253***	-0.0314
		(16.45)	(-0.39)		(16.01)	(-1.32)
UnderGrad		0.0410***	0.0360***		0.0290***	0.0208***
		(9.73)	(5.10)		(6.80)	(2.95)
Constant	-	0.3807***	-	-	0.2115***	-
		(17.39)			(8.96)	
No. of Obs.	39778	36449	36449	39778	36449	36449
R-squared	0.3464	0.0647	0.3547	0.3512	0.0777	0.3630

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 7: Routine Insider Trading by Female and Bias

Table 7 presents the findings of regression of bias on female executives' insider trading when insider trades are classified as routine, opportunistic and non-classified categories. The dependent variable is behavioral bias under prospect theory. Female_Routine is the product of routine trade and female dummy variable. Routine trades of female insiders are compared with opportunistic and non-classified trades. See Table A1 in appendix for the definitions of the variables. To ensure that extreme values are not affecting the results, all variables are winsorized at their 1 and 99 percentile levels. Two-way fixed effects are used for firm and month. We suppress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Female\_Routine_{i,t} + \beta_3 Routine_{i,t} + \gamma Controls + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{4197} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	With fixed effects but no controls	With controls but no fixed effects	With all controls and fixed effects
	(1)	(2)	(3)
Female	0.0360***	0.0245***	0.0175***
	(6.51)	(4.45)	(2.84)
Female_Routine	0.1344***	0.1602***	0.1486***
	(3.68)	(3.20)	(4.00)
Routine	-0.1318***	-0.0483***	-0.1134***
	(-29.18)	(-15.18)	(-23.69)
Retex_m		0.0061	0.0419***
		(1.02)	(7.65)
Retex_y		-0.0205***	-0.0307***
		(-10.29)	(-13.05)
Size		-0.0161***	-0.0481***
		(-38.35)	(-24.58)
Turnover		-0.0004	0.0063***
		(-0.84)	(9.37)
Book_Mkt		0.0141***	0.0014
		(7.63)	(0.63)
Age_insider		-0.0001	0.0003**
		(-1.60)	(2.45)
PhD		0.2109***	-0.0186
		(10.58)	(-0.84)
Grad		0.0698***	-0.0076
		(11.30)	(-0.85)
MBA		0.0509***	-0.0188
		(4.78)	(-1.47)
UnderGrad		0.0207***	0.0174***
		(11.65)	(5.61)
Constant	-	0.3525***	-
		(47.08)	
No. of Obs.	223755	210675	210675
R-squared	0.3163	0.0173	0.3267

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 8: Insider Trading by Female and Bias under Executives' Position

Table 8 presents the findings of regression of bias on female insider trades under three executive positions. The dependent variable is behavioral bias under prospect theory. The independent variables are the cross products of gender (Male or Female) and executive position (Chairman, Director and Chief Officer). Male_ChiefOfficer is considered as benchmark category. Column 1 shows findings of whole sample insider trades, whereas in Column 2 the results are for subsample of firms with trades by both gender. Two-way fixed effects are used for firm and month. We suppress intercept for two-way fixed effect.

$$Bias_{i,t} = \alpha + \beta_1 Female\_Chairman_{i,t} + \beta_2 Male\_Chairman_{i,t} + \beta_3 Female\_Director_{i,t} + \beta_4 Male\_Director_{i,t} + \beta_5 Female\_ChiefOfficer_{i,t} + \beta_6 Male\_ChiefOfficer_{i,t} + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{n} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	Whole sample with fixed effects	Firms with Trade by both gender with fixed effects
	(1)	(2)
Female_Chairman	0.0579***	0.0560***
	(4.69)	(4.66)
Male_Chairman	0.0066***	-0.0435***
	(3.11)	(-8.29)
Female_Director	0.0243	0.0141
	(1.15)	(0.69)
Male_Director	-0.0759***	-0.0974***
	(-18.03)	(-10.64)
Female_ChiefOfficer	0.0326***	0.0220***
	(5.16)	(3.48)
No. of Obs.	223755	39778
R-squared	0.3148	0.3488

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 9: Trend Analysis of Insider Trading by Female and Bias

Table 9 provides the results of trend analysis of the relationship between bias and female insider trading. The dependent variable is behavioral bias under prospect theory. Trend is a time variable which increases by month for all the years during our study period. Female_Trend is the cross product of Trend variable and female dummy variable. See Table A1 in appendix for the definitions of the variables. To ensure that extreme values are not affecting the results, all variables are winsorized at their 1 and 99 percentile levels. Two-way fixed effects are used for firm and month. We suppress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Female\_Trend_{i,t} + \beta_3 Trend_{i,t} + \gamma Controls + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{4197} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	With no controls and no fixed effects (1)	With no controls but fixed effects (2)	With all controls and fixed effects (3)
Female	0.0883***	0.0713***	0.0414***
	(8.47)	(6.77)	(3.55)
Female_Trend	-0.0004***	-0.0004***	-0.0002
	(-2.97)	(-3.16)	(-1.62)
Trend	-0.0003***	-0.0006***	-0.0006***
	(-15.10)	(-23.97)	(-20.64)
Retex_m			0.0286***
			(5.18)
Retex_y			-0.0416***
			(-17.14)
Size			-0.0344***
			(-16.25)
Turnover			0.0064***
			(9.51)
Book_Mkt			0.0151***
			(6.44)
Age_insider			0.0006***
			(4.65)
PhD			-0.0198
			(-0.88)
Grad			-0.0092
			(-1.03)
MBA			-0.0079
			(-0.62)
UnderGrad			0.0253***
			(8.09)
Constant	0.1591***	-	-
	(100.01)		
No. of Obs.	223695	223695	210616
R-squared	0.0021	0.3157	0.3265

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 10: Insider Trading by Female and Bias under Macro-Level Market Conditions

Table 10 presents the findings of regression of bias on female insider trades for various uncertain market conditions. The dependent variable is behavioral bias under prospect theory. The uncertainty variables include Market Volatility (Vlty), Investors Sentiment Index (Sntmt), National unemployment rate (Unempl), and CBOE Volatility Index (VIX). These variables are measured at time t-1. Female_Vlty, Female_Sntmt, Female_Unempl, and Female_VIX are the product of female dummy variable and above mentioned uncertainty variables respectively. See Table A1 in appendix for the definitions of the variables. To ensure that extreme values are not affecting the results, all variables are winsorized at their 1 and 99 percentile levels. Two-way fixed effects are used for firm and month. We suppress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Female\_Vlty_{i,t} + \beta_3 Female\_Sntmt_{i,t} + \beta_4 Female\_Unempl_{i,t} + \beta_5 Female\_VIX_{i,t} + \beta_6 Vlty_{i,t-1} + \beta_7 Sntmt_{i,t-1} + \beta_8 Unempl_{i,t-1} + \beta_9 VIX_{i,t-1} + \gamma Controls + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{4197} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	With no controls and no fixed effects (1)	With fixed effects but no controls (2)	With all controls and fixed effects (3)
Female	0.0479*	-0.0150	-0.0244
	(1.73)	(-0.66)	(-0.97)
Female_Vlty	-0.0313***	-0.0181*	-0.0411***
	(-2.77)	(-1.87)	(-3.99)
Female_Sntmt	-0.1207***	0.0595**	0.2485***
	(-3.81)	(2.27)	(8.49)
Female_Unempl	0.0065*	0.0073**	0.0034
	(1.69)	(2.40)	(1.01)
Female_VIX	0.0038***	0.0029**	0.0067***
	(2.62)	(2.29)	(5.00)
Vlty	0.0068***	-0.0145***	-0.0221***
	(3.59)	(-7.92)	(-11.72)
Sntmt	0.0825***	0.1143***	0.1101***
	(18.19)	(24.94)	(23.48)
Unempl	0.0034***	0.0018***	-0.0024***
	(7.23)	(3.20)	(-3.98)
VIX	-0.0006***	0.0019***	0.0019***
	(-2.59)	(7.75)	(7.75)
Retex_m			0.0398***
			(7.25)
Retex_y			-0.0316***
			(-13.41)
Size			-0.0577***
			(-28.67)
Turnover			0.0089***
			(13.11)
Book_Mkt			0.0030
			(1.27)
Age_insider			0.0003**
			(2.33)
PhD			0.0056
			(0.25)
Grad			-0.0021
			(-0.23)
MBA			-0.0156
			(-1.21)
UnderGrad			0.0194***
			(6.25)
Constant	0.1055***	-	-
	(29.32)		
No. of Obs.	223755	223755	210675
R-squared	0.0028	0.3161	0.3284

*** p < 0.01, ** p < 0.05, * p < 0.10

Appendix

Following Barberis, Mukherjee and Wang (2016):

The equation above follows Tversky and Kahneman (1992) who develop cumulative prospect theory to assign value to gains and losses by aggregating the product of value and probability weighting functions:

$$Value = \sum_{i=-m}^{n} \pi_i \, \upsilon(x_i) \tag{A1}$$

Where υ (.) is value function:

$$\upsilon(x) = \begin{cases} x^{\alpha} & for \quad x \geq 0 \\ -\lambda(-x)^{\alpha} & for \quad x < 0 \end{cases} \tag{A2}$$

Whereas π_i is probability weighting function:

$$\pi_i = \begin{cases} w^{+}\,(p_i + \cdots + p_n) - \, w^{+}\,(p_{i+1} + \cdots + p_n) & for \quad 0 \leq i \leq n \\ w^{-}\,(p_{-m} + \cdots + p_i) - \, w^{-}\,(p_{-m} + \cdots + p_{i-1}) & for \quad -m \leq i < 0 \end{cases} \tag{A3}$$

The w^{+}(.) and w^{-}(.) are explained as below:

$$w^{+}(P) = \frac{P^{\gamma}}{\left(P^{\gamma} + \, (1-P)^{\gamma}\right)^{1/\gamma}}, \quad w^{-}(P) = \frac{P^{\delta}}{\left(P^{\delta} + \, (1-P)^{\delta}\right)^{1/\delta}} \tag{A4}$$

To measure PTV, probability weighting function of each outcome is as below:

$$\pi_i = \begin{cases} w^{+}\left(\frac{n-i+1}{60}\right) - \, w^{+}\left(\frac{n-i}{60}\right) & for \quad 0 \leq i \leq n \\ w^{-}\left(\frac{i+m+1}{60}\right) - \, w^{-}\left(\frac{i+m}{60}\right) & for \quad -m \leq i < 0 \end{cases} \tag{A5}$$

Eq (1) is measured as follows:

$$PTV_{i,t} = \sum_{i=-m}^{-1} [-\lambda(-Retex_i)^{\alpha}] \left[\frac{\left(\frac{i+m+1}{60}\right)^{\delta}}{\left(\left(\frac{i+m+1}{60}\right)^{\delta} + \left(1 - \left(\frac{i+m+1}{60}\right)\right)^{\delta}\right)^{1/\delta}} - \frac{\left(\frac{i+m}{60}\right)^{\delta}}{\left(\left(\frac{i+m}{60}\right)^{\delta} + \left(1 - \left(\frac{i+m}{60}\right)\right)^{\delta}\right)^{1/\delta}} \right]$$

$$+ \sum_{i=1}^{n} [(Retex_i)^{\alpha}] \left[\frac{\left(\frac{n-i+1}{60}\right)^{\gamma}}{\left(\left(\frac{n-i+1}{60}\right)^{\gamma} + \left(1 - \left(\frac{n-i+1}{60}\right)\right)^{\gamma}\right)^{1/\gamma}} - \frac{\left(\frac{n-i}{60}\right)^{\gamma}}{\left(\left(\frac{n-i}{60}\right)^{\gamma} + \left(1 - \left(\frac{n-i}{60}\right)\right)^{\gamma}\right)^{1/\gamma}} \right]$$

(A6)

Table A1: Description of Variables

This table defines all the main variables of this study.

Variables	Description
Bias	Measure of prospect theory bias. Equal to 1 if either of the two conditions mentioned in Eq (4) is met, and 0 otherwise.
PTV	Prospect theory value measured in Eq (1).
$Retex_{t+1}$	Measure of monthly return in excess to market return at time t+1.
Female	Measure of trade by female insider. Equal to 1 if insider trading is carried by female, and 0 otherwise.
Retex_m	Past month return – Monthly return in excess to market return at time t-1.
Retex_y	Past year return – Cumulative past monthly returns in excess to market returns from t-12, t-2. We take log of compounded monthly excess returns and aggregate from t-12, t-2.
Size	Log of monthly market capitalization at time t-1.
Turnover	Monthly volume turnover at time t-1= no. of shares traded/no. of shares outstanding.
Book_Mkt	Book to Market ratio at time t-1= (total assets - total liabilities) / (closing price*number of shares outstanding). Book to Market ratio for June of year t is the book equity for the last fiscal year end in t-1 divided by market equity for December of t-1.
Age_insider	Insider's age at the time of transaction.
PhD	Equals 1 if insider has doctoral degree, and 0 otherwise.
Grad	Equals 1 if insider has graduate degree, and 0 otherwise.
MBA	Equals 1 if insider has MBA degree, and 0 otherwise.
UnderGrad	Equals 1 if insider has under graduate degree, and 0 otherwise.

Note: For linear regression, the variables are measured for the calendar month when insider transaction takes place.