Executives' Gender, Prospect Theory Bias and Insider Trading

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Abstract

This study provides evidence that insider trading by female executives is subject to higher behavioural bias than male executives. We find that trades by female insiders are more likely to be affected by prospect theory bias as they buy (sell) their company's stocks due to high (low) prospect theory value and earn subsequent lower (higher) returns. Despite the evidence of female insiders' biased trading, our study indicates that the bias is reduced significantly when female executives buy stocks of their own company. This implies that although female insiders' decision making is influenced by heuristic system of thinking, however the rational brain may override their intuitive thinking when critical decisions are to be made. The positive relation between prospect theory bias and female insiders' trading holds for routine trades, all executive positions, sub-periods and various market conditions. The findings are robust to insider and firm characteristics. Overall, our study suggests that highly experienced insiders' possession of superior information cannot eliminate behavioural biases among gender. The findings contribute to the understanding of academics, investors, practitioners and policy makers by explaining gender differences in behaviourally biased insider trading.

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

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1. Introduction

In this study we explore gender differences in behavioural biases and their effect on insider trading decisions by top executives. Unlike widely examined behavioural biases among gender, e.g. risk taking and overconfidence, we measure bias according to prospect theory value (PTV). Moreover, we test whether motives for insider transaction influence the positive relation of prospect theory bias and female trading. According to the existing literature, several motives may influence insider trading decision. One of the most renowned motives of insider trading is executives' access to private information about the prospects of the firm and exploitation of this information to earn subsequent abnormal returns (e.g. Jaffe, 1974; Seyhun, 1986; Rozeff and Zaman, 1988; Lakonishok and Lee, 2001; Jeng, Metrick and Zeckhauser, 2003). Both male and female insiders are highly trained professionals with superior knowledge and experience of making cautious investment decisions at corporate level. However, to the best of our knowledge, there is no detailed empirical work that examines gender gap among behavioural biases of insiders and more specifically influence of prospect theory bias on insider trading decision. The reason might be that male and female inside executives seek opportunistic profits due to the possession of superior non-public information of firm's future prospects, therefore, it is less likely to suspect any behavioural disparity in insider trading decision. As the literature describes that market experience and sophistication tend to diminish the impact of behavioural biases on trading decisions[1].

Contrary to the above argument, there are few studies in the literature which motivate our research work by providing empirical evidence that various behavioural biases and

[1] See for example: List (2003), Feng and Seasholes (2005).

personality traits of insiders influence the performance of insider trading (Hillier, Korczak and Korczak, 2015). Kallunki, Nilsson and Hellstrom (2009) suggest that in addition to other characteristics, gender of insiders also plays an important role in explaining variability in insider trading performance and information for future return. Moreover, 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. Hence, our research work aims to examine gender differences in behaviourally biased insider trading.

The importance of investigating cognitive skills and behavioural biases among gender has been acknowledged in behavioural finance literature due to the increasing presence of females at corporate level[2]. Our study also aims to contribute to the controversial issue of behavioural disparities among gender, specifically in professional settings. We find conflicting arguments in the literature regrading differences in risk taking and overconfidence behaviours among gender. 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; Neisen and Ruenzi, 2007; Huang and Kisgen, 2013). 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 behaviour 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). Consequently, the

[2] 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).

objective of our study is to explore this debatable issue of behavioural disparities among gender for insider trading decision. The findings of our study show that behavioural biases exist among gender and insider trading by female executives is subject to higher behavioural bias than male executives.

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). As opposed to expected utility, prospect theory narrates that individuals derive utility by considering gains and losses instead of absolute wealth level, and apply a value function to evaluate these outcomes. The value function highlights attitude of individuals towards risk, as they tend to be risk averse over potential gains and risk seeking over moderate probability of losses. According to the limited literature on impact of loss aversion and prospect theory on female behaviour, females are more loss averse and become more risk averse than males after prior losses (Schmidt and Traub, 2002; Brooks and Zank, 2005).

Several experimental studies provide evidence that narrow framing and mental representation of investors play a crucial role in defining risk behaviour among risky choices. Barberis and Huang (2001) suggest that investors who involve in narrow framing are more likely to consider each decision as unique and therefore their risk behaviour is influenced by individual stock's past performance. The decision making based on stock's past performance or prior gains and losses involves a process of mental representation of the associated risk i.e. how do investors represent the stock in their minds. Barberis, Mukherjee and Wang (2016) describe that mental representation of stock is the distribution of the stock's prior returns as it is the easily accessible proxy for investors to predict distribution of the stock's future returns. Investors tilt to the stock having high distribution of past returns and high prospect value, hence the overvalued stock results in low subsequent returns. Their study shows that probability

weighting component of cumulative prospect theory enhances prospect theory value's predictive power for returns.

Motivated by Barberis, Mukherjee and Wang (2016) we develop measure of behavioural bias based on prospect theory value (PTV). To measure PTV, we use cumulative prospect theory and apply probability weights to historical return distribution of all stocks bought or sold by our sample insiders. This value is high (low) when distribution of stock's past returns is positive (negative). A high PTV represents the stock to be less risky and with good past performance, which is a motivation for biased insider to buy the company's stock. However, such insider purchase is not based on any confidential information or good news about company's future, therefore it is less likely to generate subsequent lower returns. Hence, we consider a trade to be biased when inside executives buy (sell) their company's stock based on its high (low) PTV, which results in subsequent lower (higher) return.

By analysing gender differences in bias, our results show that the degree of prospect theory bias is higher for insider trading by female executives than male executives. Considering the fact that female executives have a limited access to internal information (Inci, Narayanan and Seyhun, 2017), we conclude that female executives exhibit behaviour similar to regular investors when thinking about the risk associated with insider trade decision. They are more likely to engage in narrow framing and make insider trades which are highly biased and are less likely to generate abnormal returns for them. Our findings support the existing literature on behavioural differences among gender (e.g. Barber and Odean, 2001; Brooks and Zank, 2005; Beckmann and Menkhoff, 2008).

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) database, we finally have 5579 firms with insider trading data and female executives are 5.73% of total insiders. To deal with the concerns of spurious results or omitted variable, we employ various methods to estimate the regression of behavioural bias and female 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 the regression models with month and firm fixed effects. Our all regression estimates are consistent with the main conjecture.

The literature provides evidence that insiders may trade for motives other than just maximising 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 require careful decision making because purchases tend to be correlated with more valuable insider information and strong predictability power about future returns (Lakonishok and Lee, 2001). Hence, for testing whether different motives of insider trading influence prospect theory bias of female trades, we analyse buy and sell transactions separately. Interestingly, the results highlight that buying company's own stock by female insiders is subject to lesser behavioural bias as compared to selling the stock. We provide explanation in context of thinking process of human brain in decision making, where intuition makes a rapid and automatic decision based on "heuristic" and scholars consider such decisions to be highly biased (Kahneman, 2003; Kahneman, 2011). While rational or analytical decision making requires logical and conscious manipulation of decision-relevant information, evaluating associated costs and benefits and making a decision through deliberation, hence, viewed as less vulnerable to bias than intuition (Alexander, 1979). 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).

Therefore, we describe that female insiders tend to make trading decision based on intuition due to possession of limited information. However, analytical thinking process dominates the decision of purchase by female executives because purchases are motivated by important non-public information that can strongly predict future returns of stock.

For robustness, we examine whether the positive relationship between behavioural bias and female insider trading prevails in different categories of insider trades, positions of executives, sub-periods and various market conditions. We follow insiders' categorisation 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. We then run regression to examine whether prospect theory bias increases or decreases in insider trading of female executives in different identified positions. The results support our main finding that insider trading by female is subject to higher behavioural bias than male insiders in same executive positions. Thirdly, to address the sensitivity of higher behavioural bias of female insider trading with rising or depreciating market, we divide our sample time window into three sub-periods starting from year 2003 till year 2016. We also test for the trend in the relationship of bias and female insider trading. Finally, our study considers four proxies to measure macro-level market conditions; (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. Using all measures, we conclude that our main finding holds and female insider trades are prone to higher prospect theory bias than trades by male counterparts.

There are several contributions of this study. First, behavioural biases among gender are well documented but exploring decisions of professional female insiders is a valuable contribution in behavioural finance literature (e.g. Niessen and Ruenzi, 2007; Hibbert, Lawrence and Prakash, 2016; Huang and Kisgen, 2013). In a setting where executives earn abnormal profits based on extensive private information about firm's prospects, it might be expected that the trades are less likely to be driven by behavioural biases. Nonetheless, our study provides an insight that access to superior information is not the sole reason of insider trading. Insiders' buy or sell decision is influenced by behavioural biases which are significantly higher in trading by female executives (e.g. Kallunki, Nilsson and Hellstrom, 2009; Hillier, Korczak and Korczak, 2015; Lee and Piqueira, 2016). Second, this study adds to the limited literature of behavioural biases among gender under prospect theory. Biases like risk aversion and over-confidence have been extensively analysed but literature is scant for behaviour disparities among gender regarding loss aversion and mental representation under prospect theory (e.g. Schmidt and Traub, 2002; Hibbert, Lawrence and Prakash, 2016). Third, we provide explanation of our results based on thinking and information processing system, which is a valuable addition to various field of studies, e.g. economic psychology. Finally, examining behavioural discrepancies among male and female insider trading may provide an insight to academics, investors, practitioners and policy makers who consider that insider trading is purely based on superior non-public information which can potentially influence market liquidity and price movement. Our study shows that insider trading is not only based on information advantage to insiders, but it can be influenced by behavioural biases.

Organisation of the Study

The rest of the study is structured as follows:

The literature has been reviewed in Section 2. Section 3 comprises of establishing methodology, and details about the data. The applications of diagnostic tests, analysis and discussion of results have been included in Section 4. Section 5 comprises of description of additional tests and results. Conclusion of the study is given in Section 6.

2. Literature Review:

2.1 Insider Trading, Behavioural 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. A large number of studies have attempted to analyse whether insiders earn abnormal profits by exploiting non-public information about the prospects of their company and whether their trading activity is informative regarding future returns of the stock (Seyhun, 1986; Jeng, Metrick, and Zeckhauser, 2003; Huddart, Ke, and Shi, 2007). 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) categorises 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 behavioural 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 behavioural biases like anchoring and disposition effect.

2.2 Behavioural Biases among Gender:

The literature on gender differences suggests that systematic dispositional disparities exist among male and female but to the best of our knowledge there is no detailed empirical analysis carried on behavioural variances of male and female based on prospect theory specifically in the context of insider trading. Hibbert, Lawrence and Prakash (2016) have contributed by investigating whether any gender discrepancy exists in the impact of realized gains and losses from recent past investments on future stock market participation and expectation of future market conditions. The survey is conducted 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 unfavourable market conditions than men irrespective of whether they have made gains or incurred losses in their recent past investments.

Lam and Ozorio (2013) examine gender differences in the effect of prior gains or losses on risk taking behaviour 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 behaviour.

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. Investigating a preference condition for loss aversion in the framework of cumulative prospect theory, Schmidt and Traub (2002) also 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.

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.

In order to investigate gender gap in evaluation of prospect theory value for insiders' trading, in addition to loss aversion we consider a substantial body of research work on gender differences in risk taking behaviour and overconfidence. These dispositional factors may affect the mental representation and assessment of prior gains and losses in male and female insider trading. The dissimilarities in risk related behaviour 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, 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. Niessen and Ruenzi (2007) 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.

The literature also examines how gender of directors, CEO or other senior executives of a firm affects risk. 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. Huang and Kisgen (2013) analyse 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.

Although empirical evidence supports less risk taking behaviour 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 behaviour among males and females. Johnson and Powell (1994) argue that all managers undergo formal management education, therefore, no gender difference in risk taking behaviour and quality of decisions in a managerial population of potential and actual managers is detected. 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 behaviour 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. Bannier and Neubert (2016) examines the relevance of actual and perceived financial literacy with gender differences in financial risk-taking.

Another prominent and extensively tested behavioural bias among gender, which affects investment decisions, is overconfidence. Barber and Odean (2001) investigate trading behaviour 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). Boys are found to be overconfident whereas girls are under-confident in their mathematics performance (Dahlbom et al., 2011). Huang and Kisgen (2013) analyse 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 and Behaviours 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. The experimental results of Thaler and Johnson (1990) provide support to the quasi-hedonic editing hypothesis and indicate that individuals turn to be risk seeker after prior gains and risk averse after having prior losses under certain circumstances, whereas risk seeking after prior losses is induced for the outcomes which offer an opportunity to breakeven. Prospect theory's proposed risk seeking behaviour in the domain of losses is not observed in the study because according to "house-money effect" of Thaler and Johnson (1990) risk aversion may increase after prior losses as subsequent losses cannot be integrated with prior outcomes. On the other hand, risk seeking behaviour might be observed after prior gains as small subsequent losses can be integrated with prior gains.

Advances in literature have been made to understand how professional investors make decisions within a dynamic context of facing sequence of tasks. Liu et al. (2010) show that

prior positive trading outcomes induce subsequent risk taking of market makers. Controlling for other factors, the findings indicate that market makers with morning profits are 15% more likely to take above-average risks in afternoon trading. The study shows consistency with the empirical work of Barberis and Xiong (2009), which argues 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 realising 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. O'Connell and Teo (2009) analyse 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 behavioural 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. The findings of experimental tests provide support that risk taking behaviour is affected by manipulating degree of myopia (Thaler et al., 1997; Langer and Weber, 2005)

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), analysing behaviour 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.

Berberis and Huang (2008) test pricing implication of cumulative prospect theory by focuses on its probability weighting component. The results shed light on the theory's novel prediction that a security's own skewness can be priced. 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. The study examines how investors form "mental representation" of gains and losses of taking the risk and how this representation (distribution

of the stock's past return) is evaluated to see if it is attractive. Investors tilt to the stock having high distribution of past returns and high prospect value, 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.

Although a large number of studies provide empirical evidence that prior gains reduce loss aversion and induce investors to take risk, however we find some contradictory literature on risk taking behaviour. Abdellaoui, Bleichrodt, and Kammoun (2013) explain that professional investors (private bankers and fund managers) behave according to prospect theory as they are found to be risk averse for gains and willing to take risk for losses. These professionals are loss averse but less than the results observed in laboratory studies. Coval and Shumway (2005) analyse the trading behaviour of professional traders in the Treasury Bond futures contract at the Chicago Board of Trade (CBOT). The study concludes that traders are "loss averse" and take significantly more risk after prior losses than prior gains. Traders with mid-day losses subsequently increase risk taking and execute trades poorly. Using high-frequency transactions data of professional futures traders on the Chicago Mercantile Exchange (CME), Locke and Mann (2005) find results consistent with "disposition effect" (Odean, 1998a). They conclude that professional traders hold onto losses significantly longer than gains, sell winners quickly and are less likely to be successful in future. The behavioural bias of investors wherein they are prone to selling the winning stock (risk averse for gains) and hold on the losing one (risk seeker for losses) is referred to disposition effect. Empirical studies have been carried on various investor groups as well as factors which are likely to influence disposition effect such as mean reversion, transaction cost concerns, tax motivated selling, trading experience, sophistication, gender and age (Shefrin and Statman, 1985; Odean, 1998a; Grinblatt and Keloharju, 2001; Feng and Seasholes, 2005).

One of the well-established behavioural biases affecting investors' decision of risk taking and loss aversion from risky investments is "overconfidence" (Odean, 1998b; Daniel, Hirshleifer, and Subrahmanyam, 2001). Prior gains motivate investors to take further risks as they become more confident after gaining more skills and private information. Overconfidence increases trading volume but decreases the expected utility of overconfident traders. Mispricing, under and overreaction to information are widely observed in the presence of overconfident investors in the market.

By reviewing relevant literature about insider trading, gender gap in behavioural biases and their effect on decision making by professionals, and prospect theory, we develop conjecture that female insiders are more likely to behave differently than male insiders and their trading decisions are also prone to high behavioural biases based on prospect theory.

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[3]. 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

[3] 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-years 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 265,504 insider transactions by 15,049 top executives in 5579 publicly listed firms from 2000 to 2016[4].

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 capitalisation 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

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

French's data library[5]. Several websites are used to obtain data on macro-level market factors. Data on CBOE Volatility Index is obtained from Global Financial Data[6]. Investors Sentiments data is collected from American Association of Individual Investors (AAII)[7]. The monthly U.S. unemployment data come from the Bureau of Labor Statistics[8].

3.2 Variables Definition and Model Development

In this section, we describe our main variables along-with the models used to examine disparities of behavioural bias among gender of executives and their influence on insider trading decisions.

3.2.1 Prospect Theory Value (PTV):

We develop a conjecture that female insider trades are subject to higher behavioural bias based on prospect theory. Female executives form mental representation from distribution of historic returns of the stock and evaluate this representation to decide upon riskiness of the stock. To measure prospect theory value, we follow the methodology of Barberis, Mukherjee and Wang (2016). Their study describes decision making under prospect theory which involves two steps, (i) representation - distribution of stock's past returns, and (ii) valuation. The distribution of a stock's historic returns is a good and easily available proxy for individual investors to develop a mental representation. Using cumulative prospect theory (Tversky and Kahneman, 1992), their study evaluates the distribution of stock's past five-years monthly returns in the following manner:

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

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

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

The equation above is developed by following Tversky and Kahneman (1992) who describe cumulative prospect theory to assign value to the outcomes by aggregating value and probability weighting functions of gains and losses:

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

Where:

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

Here $w^+(.)$ and $w^-(.)$ are probability weighting functions for gains and losses, i.e. weights are assigned to the aggregate probabilities of outcomes. The following expressions are developed to overweight the most extreme outcomes in the tails:

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

Whereas υ (.) is the value function:

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

The parameters of value and probability weighting functions are estimated by Tversky and Kahneman (1992)[9].

We measure our sample stocks' monthly returns in excess of the market return. For each stock, every month (starting from 01-01-2000) we select prior sixty months' returns (past five years)[10]. This window keeps rolling for every month of each stock till the last month of year 2016[11]. 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[12]. We consider "i" as a simple counter element with values ranging from 1 to 60 for each window of sorted past sixty returns. $Retex_i$ is the monthly excess return.

3.2.2 Measurement of Bias:

We develop prospect theory bias measure by considering the fact that when inside executives buy (sell) their company's stock based on its high (low) PTV, such trade is made according to behavioural bias and risk attitude of executives and with a limited material information about company's prospects. Therefore, inside stock's buy(sell) earns subsequent lower (higher) returns. Insider transactions matching this criterion are considered to be biased. To identify high or low PTV or subsequent future returns, we consider the threshold to be zero; values greater than zero are high and vice versa. We define Bias as follows:

[9] $\alpha = 0.88$, $\lambda = 2.25$, $\gamma = 0.61$, $\delta = 0.69$

[10] 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.

[11] 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.

[12] "n= 60-m". For example, negatives are 10 so m=10 & n= (60-10).

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

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. The PTV based decision of executives to buy or sell their company's share might be affected by the distribution of past returns of other stocks in the market. Therefore, we expect that behaviourally biased decision of insider trading is made when excess PTV is appealing to them[13]. For simplicity, we use term PTV instead of excess PTV in our study.

To test the conjecture that female executives make insider trading decisions according to prospect theory value and their trades are subject to high behavioural bias, we develop the following model:

$$Bias_{i,t} = \alpha + \beta \, Female_{i,t} + \varepsilon_{i,t} \quad (2)$$

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

3.3 Summary Statistics

All the variables are defined in Table 1.

Insert Table 1

[13] Excess PTV = PTV – cross-section mean of PTV

Figure 1 describes a pattern of movement of insider trading by female executives and behavioural 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 2 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 14.34% 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 5.73% of our sample top executives are female. Moreover, this percentage goes down further when we observe that just 2.6% 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 the number of trades that are biased in our total sample of insider trading. We find that 11.96% (approximately 12%) of the transactions are behaviourally biased under prospect theory. More interestingly, it shows that 16.66 % of the trades made by female insiders are biased, whereas this figure is smaller for trades made by males (11.83%). It gives us an insight that female insiders are more likely to made behaviourally biased trades.

Panel A shows that top executives of our sample more frequently make Sale transactions as compared to Purchase. However, female executives buy the stock of their company with a percentage higher than their male counterpart, i.e. they have made 32.82%

Buy transactions, whereas the percentage is 25.32% for males from year 2000 to 2016. The average value of trades in $ provides an insight that male insiders are most likely to make large trades with high value involved as compared to female insiders. All these facts signal towards the existing literature on behavioural disparities among gender like less risk taking and less over-confidence of females.

Panel B of Table 2 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. 11879. However, in terms of trades by females, the category of Director displays the maximum percentage i.e. 6.94%. 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. 2.26% in Chairman category.

Panel C of Table 2 is descriptive statistics of our main variables. To provide a clear picture, we present the results by categorising 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 51, whereas males' age is 56. 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 (2.077) traded by male insiders as compared to females (1.794). We also find gender gap in book to market ratio, where female insiders' traded stocks have higher book to market ratio of 0.628 than male counterparts i.e. 0.546.

Insert Table 2

Table 3 is the correlation matrix, describing relationship among all main variables of the study. We find that insider trades by female executives, senior insiders in terms of age and trading of high book to market ratio stocks are positively and significantly correlated with prospect theory bias. On the other hand, firm size and volume turnover are negatively and significantly correlated with the bias.

Insert Table 3

4. Empirical Results and Discussion

4.1 Effect of Female Insider Trading on Prospect Theory Bias:

Table 4 (a) consists of the results of regression of our main model developed in Eq (2). 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 bias increases by 4.83% 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 5579 and 12 months in each year of our study period. By applying fixed effects to the model developed in Eq (2), we observe an improvement in goodness of fit i.e. 30.15%. Column (3) of Table 4 (a) presents a positive and significant coefficient which supports the conjecture and describes that prospect theory bias increases by 3.08% 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. Column (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; Column (4), (5) and (6) provide evidence that bias of female insider trades is 1.4% higher than the trades by male when we combine all the control variables. We also observe that bias is higher and statistically significant for stock with previous month's high excess return, high turnover volume, high book to market ratio (value stock), and insider with under-graduate degree and senior in age. Whereas, there exists a significantly negative relationship between bias 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.

Although the magnitude of bias 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. This result is consistent with the literature which suggests that behavioural biases exist among gender and females are more risk averse, loss averse, and less overconfident than males (Brooks and Zank, 2005; Beckmann and Menkhoff, 2008; Huang and Kisgen, 2013). As opposed to the literature which describes that experience and knowledge reduce the impact of behavioural biases (e.g. Feng and Seasholes, 2005), we find that insider trading decision of highly professional female executives is affected by prospect theory bias. They represent risk related to the stock based on the distribution of stock's past returns. Being more risk averse, female insiders prefer to buy stock with positive distribution of past returns because such stock is considered to be less risky. Hence, we conclude that female insider trades are biased and therefore they earn smaller future

returns than male counterparts. Inci, Narayanan and Seyhun (2017) provides evidence that males earn significantly more than females in equivalent positions.

Insert Table 4 (b)

4.2 Effect of Motives of Female Insider Trading on Prospect Theory Bias:

Literature describes that there are different motives that regulate insider trading. Insiders sell inside stocks normally for diversification or liquidity purpose (Huddart and Ke, 2007; Huddart, Ke and Shi, 2007; Kallunki, Nilsson and Hellstrom, 2009). These motives do not exploit non-material information of the firm. But when it comes to buying of inside stocks, this decision is considered to be critical as it is most likely to be motivated by information. 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 and with and without 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 behavioural bias increases when females make trade decision but we observe that this bias 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 1.57% decreased when female insiders decide to buy stock of their company and this coefficient is significant at 10% 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 for Table 4.

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). Intution 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 apply the same thinking process while making decisions for trade. But as purchase decisions are based on superior internal information, is followed by high abnormal future returns and monitoring concerns are high, therefore female insiders become more careful, they take maximum advantage of the accessible internal information and are less prone to be affected by behavioural 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).

Insert Table 5

4.3 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 713 firms in our sample with 6445 transactions by female insiders whereas 39887 trades are carried by male insiders. We observe a higher percentage of insider trading by female executives for our subsample of firms i.e. 13.91%, 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 1.72% increase in bias when the trade is carried by female 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 improved to 35.31%.

In Table 6, Column (4), (5), and (6) we present the findings for effect of purchases by female insiders and bias. All three regressions show consistent results that female insiders make a careful and logical decision when it comes to inside stock purchases. Therefore, prospect theory bias is reduced for female purchase. Considering all the controls and fixed effects, bias is reduced to 3.31% when female insiders buy stock of their own company as compared to their male counterparts. The coefficient of bias is statistically significant. Hence, we conclude that decisions of insider trading by female executives are subject to higher bias whether they function independently or in mixed gender firms.

Insert Table 6

5. Additional Investigation

To provide support to our main findings, we run some additional tests.

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

We follow the same technique developed by Cohen, Malloy and Pomorski (2012) to categorise our sample in different classes of insiders based on their trading patterns and examine whether bias is affected by females belonging to 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 no fixed effects, whereas Column (2) and (3) take into account fixed effects of firm and month. The results of all three regressions, with and without firm and insider specific characteristics, report negative association of routine trades with bias. We explain that routine trades are less prone to behavioural biases because routine insiders trade by following a regular discipline, without exploiting internal non-public information. The coefficient of routine trades is negatively and significantly associated to bias in all of our models. However, we describe that when these routine trades are made by female insiders, they are subject to higher bias. The coefficients of interaction term, Female_Routine (product of routine trade and female), is positively associated with the dependent variable in all three regressions. Column (3) describes that the coefficient of Female_Routine is statistically significant at 1% level. This result provides evidence that behavioural biases

associated with female affect their decision making of insider trades irrespective of their trade patterns.

Insert Table 7

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

Inci, Narayanan and Seyhun (2017) analyse gender differences in profitability of insider trading. Following their categorisation 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 transactions by exhibiting higher behavioural bias than males in the same positions. The coefficient of the cross product of Female_ChiefOfficer is positive and statistically significant at 1% level, indicating that insider trades by female chief officers are prone to higher bias than male chief officers.

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 almost every position and the coefficients are significant. Our

results also indicate that stronger bias is not related to the proportion of females presented in various types of executive positions.

Insert Table 8

5.3 Sub-periods and Trend Analysis of the Relationship between Female Insider Trading and Bias:

To address the concern that the bias and female transaction regression estimates might be sensitive to the rising or depreciating market during our study time window, we re-estimate the main regression (Eq. 2) for 2003–2006, 2007-2010 and 2011–2016 sub-periods. We do not consider first three years of our sample due to very limited insider trades by female executives. We divide years in 3 groups where first two groups are based on four years, whereas because of the lesser number of observations of female insider transactions, the last period comprises of six years.

Table 9 (a) presents the results of main model in all three sub-periods with fixed effects. We find that the sub-period coefficient estimates of bias due to female insider trades are reasonably similar to the full-sample results and they support the hypothesis of highly biased female insider trading. The coefficients are significant at 1% level.

Insert Table 9 (a)

The coefficients are statistically significant in Table 9 (a) but we notice variations in the magnitude of bias coefficients over three sub-periods. Consequently, we run a regression by introducing Trend variable which increases by month for all the years during our study period. The purpose of this analysis is to test whether positive relationship between bias and female insider transactions is increasing or decreasing over time. Table 9 (b) shows a negative and statistically significant coefficient of Female_trend variable, which indicates that there is a

diminishing trend between bias and female trades' association. Although the negative coefficient is economically insignificant, however, we anticipate that increasing number of females on corporate level and higher knowledge of investment decisions might cause females to control their behavioural biases and make analytical trade decisions over time.

Insert Table 9 (b)

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

Considering the fact that behavioural biases can be affected by varying market conditions like market level uncertainty (Kumar, 2009). 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 fixed effects. Column (2) describes that bias in insider trades becomes significantly stronger when market volatility is lower, or investor sentiment, unemployment rate and VIX are higher. Among the four uncertainty measures, investor sentiment appears to be the strongest, while volatility has the weakest coefficient estimates.

In Column (3), we find similar effects on bias when female executives involve in insider trading during these market conditions. The prospect theory bias is significantly stronger when female insiders trade in lower volatile market, or during higher investor sentiment,

unemployment and VIX market conditions. We observe that overall bias of female insider trade is decreased by 4.03% when market uncertainty factors are considered and the coefficient is significant at 5% level.

Insert Table 10

6. Conclusion

Our study aims to empirically analyse disparities in behavioural biases of gender in context of insider trading. Several behavioural biases have been examined in the literature e.g. risk taking and over-confidence, but we provide a unique evidence of differences in behavioural bias among gender based on prospect theory. Moreover, considering insider trading provides a distinctive setting to our analysis because highly professional executives make these trading decisions to earn abnormal profits by using superior material non-public information, hence these trades have tendency to influence future returns. In such an environment, effect of behavioural biases might fade away but our findings show that insider trading decisions are affected by bias and transactions by female executives are prone to higher bias than male executives.

Following the literature on gender difference in access to information, we describe that female insiders make trading decisions like an individual investor and narrowly frame their investment choices. Female insiders are loss averse and analyse a stock by mentally representing its past distribution of returns. By applying probability weighting of cumulative prospect theory, their decision to buy a high PTV or sell a low PTV inside stock results in subsequent lower or higher returns respectively. Therefore, we show that highly professional female insiders, even in the same hierarchy position of their male counterparts, are prone to make insider transactions which are highly biased. We have estimated regression coefficients in several ways, e.g. considering our sample executives based on their hierarchical positions, trades as routine, opportunistic, and non-classified, sub-periods and macro-level market factors. All the tests are consistent with main conjecture.

However, our study sheds light that a significant decrease in behavioural bias is observed in insider trading by female 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 behavioural bias to diminish.

This study contributes in the literature of behavioural finance as well as provides an insight to investors, practitioners and policy makers by showing that insider trading by female executives is subject to higher behavioural bias, therefore, these trades might 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 behavioural bias along-with insider trading by female executives from year 2000 to 2016. Bias and Gender_dummy are cross-section averages of bias and female insider trades respectively over time.

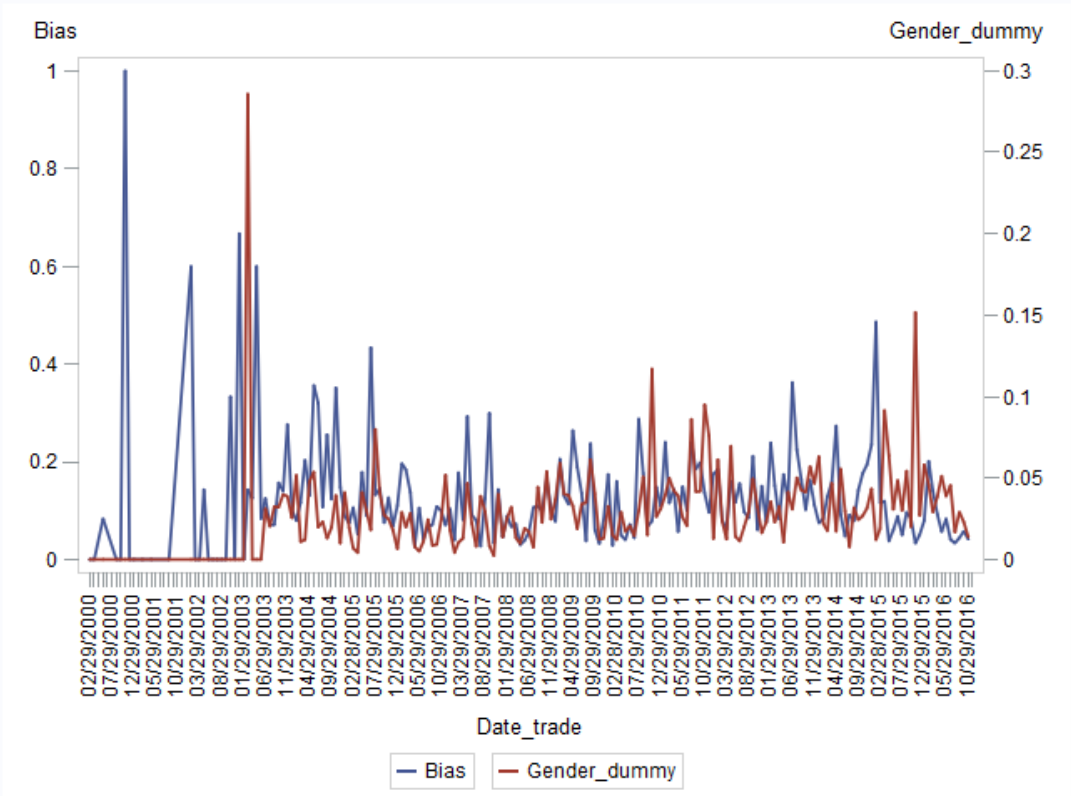

Table 1: Description of Variables

Table 1 defines all the main variables of this study.

Variables	Description
Bias	Measure of prospect theory bias. Equal to 1 if any of the two conditions mentioned in Eq (1) is met, and 0 otherwise.
PTV	Prospect theory value measured by following methodology of Barberis, Mukherjee and Wang (2016).
$Retex_{t+1}$	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 (t-1) = no. of shares traded/no. of shares outstanding.
Book_Mkt	(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.

Table 2: Summary Statistics

Panel A:

Table 2 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	5579	5492	800	14.34%
Number of Executives	15049	14187	862	5.73%
Number of Trades	265504	258594	6910	2.60%
Number of Biased Transactions	31743	30592	1151	16.66%
Percentage of Biased Transactions	11.96%	11.83%	16.66%	-
Number of Buy Transactions	67752	65484	2268	32.82%
Percentage of Buy Transactions	25.52%	25.32%	32.82%	-
Number of Sell Transactions	197752	193110	4642	67.18%
Percentage of Sell Transactions	74.48%	74.68%	67.18%	-
Value($) of Transactions-Average	-	240455	156895	-

Panel B:

Table 2 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	3053	2984	69	2.26%
Chief Officer	11879	11122	757	6.37%
Director	648	603	45	6.94%

Panel C:

Table 2 Panel C provides summary statistics of all variables by categorising them for gender of executives for the period of 2000-2016. See Table 1 for the explanation of all the variables.

Gender	Variable	No. of Obs.	Mean	Median	Std. dev.	Min	Max
Male	Bias	258594	0.118	0	0.323	0	1
Male	PTV	218476	0.010	0.015	0.0339	-0.229	0.583
Male	$Retex_{t+1}$	257372	0.005	-0.002	0.130	-0.897	3.905
Male	Age_insider	251119	56.013	56	9.376	20	92
Male	Size	257690	13.932	13.823	2.151	8.421	17.843
Male	Turnover	257108	2.077	1.656	1.867	0.031	10.002
Male	Book_Mkt	245907	0.546	0.385	0.542	0.033	4.351
Female	Bias	6910	0.167	0	0.373	0	1
Female	PTV	5761	0.005	0.011	0.035	-0.135	0.138
Female	$Retex_{t+1}$	6838	0.009	0.002	0.118	-0.674	1.043
Female	Age_insider	5989	51.309	50	9.268	25	81
Female	Size	6855	13.149	13.133	2.028	8.421	17.843
Female	Turnover	6834	1.794	1.252	1.869	0.031	10.002
Female	Book_Mkt	6448	0.628	0.465	0.627	0.033	4.351

Table 3: Correlation Matrix

Table 3 presents correlation matrix for the main variables of sample insider transactions from year 2000 to 2016. See Table 1 for the explanation of all the variables.

	Bias	Female	Age_insider	Size	Turnover	Book_Mkt
Bias	1					
Female	0.024[a]	1				
Age_insider	0.029[a]	-0.075[a]	1			
Size	-0.064[a]	-0.058[a]	0.072[a]	1		
Turnover	-0.018[a]	-0.024[a]	-0.046[a]	0.189[a]	1	
Book_Mkt	0.063[a]	0.024[a]	0.039[a]	-0.410[a]	-0.083[a]	1

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

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, whereas Table 4 (b) shows results with firm and insider specific controls. The dependent variable is behavioural bias under prospect theory. 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 supress 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 by month are presented.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Retex\_m_{i,t-1} + \beta_3 Retex\_y_{i,(t-12,t-2)} + \beta_4 Size_{i,t-1} + \beta_5 Turnover_{i,t-1} + \beta_6 Book\_Mkt_{i,t-1} + \beta_7 Age\_insider_{i,t} + \beta_8 PhD_{i,t} + \beta_9 Grad_{i,t} + \beta_{10} MBA_{i,t} + \beta_{11} UnderGrad_{i,t} + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{5578} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	With no fixed effects and no controls (1)	Robust Standard Errors with no fixed effects and no controls (2)	With fixed effects but no controls (3)
Female	0.0483*** (12.21)	0.0483*** (10.66)	0.0308*** (6.53)
Constant	0.1183*** (185.47)	0.1183*** (186.27)	-
No. of Obs.	265504	265504	265504
R-squared	0.0006	0.0006	0.3015

Table 4 (b):

	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	0.0371*** (7.78)	0.0451*** (9.66)	0.0311*** (6.40)	0.0188*** (3.77)	0.0257*** (5.02)	0.0140*** (2.59)	0.0427** (2.75)
Retex_m	0.0129*** (2.64)		0.0190*** (3.76)	0.0407*** (8.55)		0.0434*** (8.91)	0.0136 (0.28)
Retex_y	-0.0097*** (-6.01)		-0.0084*** (-5.14)	-0.0365*** (-18.40)		-0.0331*** (-16.34)	-0.0133 (-1.22)
Size	-0.0082*** (-24.14)		-0.0093*** (-25.72)	-0.0309*** (-18.50)		-0.0319*** (-18.74)	-0.0021 (-0.60)
Turnover	-0.0009** (-2.59)		-0.0004 (-1.06)	0.0059*** (10.09)		0.0064*** (10.76)	0.0004 (0.12)
Book_Mkt	0.0239*** (15.23)		0.0217*** (13.68)	0.0097*** (4.96)		0.0099*** (4.98)	0.0362*** (3.11)
Age_insider		0.0010*** (15.07)	0.0008*** (11.24)		0.0005*** (4.83)	0.0006*** (5.12)	0.0020** (2.71)
PhD		0.0861*** (6.64)	0.1105*** (7.54)		-0.0064 (-0.39)	-0.0086 (-0.47)	0.1215 (0.89)
Grad		0.0570*** (11.39)	0.0477*** (9.16)		-0.0096 (-1.33)	-0.0038 (-0.50)	0.0592 (1.45)
MBA		0.0454*** (5.23)	0.0374*** (4.08)		-0.0050 (-0.48)	-0.0158 (-1.42)	0.0524 (0.60)
UnderGrad		0.0026* (1.73)	0.0139*** (8.78)		0.0159*** (6.01)	0.0191*** (6.86)	0.0195* (1.99)
Constant	0.2264*** (42.21)	0.0557*** (13.33)	0.1829*** (29.38)	-	-	-	-
No. of Obs.	247809	257108	240606	247809	257108	240606	240606
R-squared	0.0074	0.0023	0.0089	0.3108	0.2997	0.3100	0.1273

*** 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 behavioural bias under prospect theory. Female_Buy is the product of buy transaction and female dummy variable. 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 supress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Female\_Buy_{i,t} + \beta_3 Buy_{i,t} + \beta_4 Retex\_m_{i,t-1} + \beta_5 Retex\_y_{i,(t-12,t-2)} + \beta_6 Size_{i,t-1} + \beta_7 Turnover_{i,t-1} + \beta_8 Book\_Mkt_{i,t-1} + \beta_9 Age\_insider_{i,t} + \beta_{10} PhD_{i,t} + \beta_{11} Grad_{i,t} + \beta_{12} MBA_{i,t} + \beta_{13} UnderGrad_{i,t} + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{5578} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	With no controls and no fixed effects (1)	With Firm Controls but no fixed effects (2)	With Insider Controls but no fixed effects (3)	With All Controls but no fixed effects (4)	With no controls but fixed effects (5)	With Firm Controls and fixed effects (6)	With Insider Controls and fixed effects (7)	With All Controls and fixed effects (8)
Female	0.0613***	0.0492***	0.0492***	0.0322***	0.0449***	0.0301***	0.0349***	0.0204***
	(11.16)	(8.80)	(9.03)	(5.94)	(7.88)	(5.02)	(5.72)	(3.18)
Female_Buy	-0.0530***	-0.0400***	-0.0239***	-0.0071	-0.0351***	-0.0285***	-0.0222**	-0.0157*
	(-5.45)	(-3.78)	(-2.30)	(-1.03)	(-3.74)	(-2.84)	(-2.16)	(-1.82)
Buy	0.0584***	0.0605***	0.0591***	0.0614***	0.0628***	0.0619***	0.0658***	0.0666***
	(36.52)	(25.88)	(36.29)	(25.79)	(26.29)	(22.81)	(26.87)	(23.98)
Retex_m		0.0425***		0.0500***		0.0551***		0.0589***
		(8.23)		(9.39)		(11.49)		(12.01)
Retex_y		0.0035**		0.0052***		-0.0284***		-0.0244***
		(2.01)		(2.94)		(-14.10)		(-11.86)
Size		-0.0043***		-0.0053***		-0.0246***		-0.0253***
		(-11.55)		(-13.31)		(-14.59)		(-14.69)
Turnover		-0.0006*		-0.0001		0.0051***		0.0055***
		(-1.76)		(-0.18)		(8.77)		(9.34)
Book_Mkt		0.01786***		0.0154***		0.0088***		0.0088***
		(11.07)		(9.43)		(4.52)		(4.46)
Age_insider			0.0012***	0.0009***			0.0006***	0.0007***
			(16.77)	(11.88)			(5.82)	(6.05)
PhD			0.0804***	0.1095***			-0.0163	-0.0156
			(6.10)	(7.39)			(-1.00)	(-0.85)
Grad			0.0475***	0.0396***			-0.0104	-0.0076
			(9.55)	(7.64)			(-1.44)	(-0.98)
MBA			0.0415***	0.0381***			-0.0117	-0.0218**
			(4.68)	(4.08)			(-1.12)	(-1.96)
UnderGrad			0.0047***	0.0123***			0.0112***	0.0151***
			(3.12)	(7.76)			(4.22)	(5.40)
Constant	0.1035***	0.1594***	0.033***	0.1124***	-	-	-	-
	(149.33)	(26.93)	(7.79)	(16.60)				
No. of Obs.	265504	247809	257108	240606	265504	247809	257108	240606
R-squared	0.0065	0.0116	0.0085	0.0132	0.3033	0.3122	0.3018	0.3117

*** 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 behavioural bias under prospect theory. Female_Buy is the product of buy transaction and female dummy variable. 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 supress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \gamma Controls + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{712} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Female\_Buy_{i,t} + \beta_3 Buy_{i,t} + \gamma Controls + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{712} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	Main Model with Controls but no fixed effects (1)	Main Model with no controls but fixed effects (2)	Main Model with Controls and fixed effects (3)	Buy Model with Controls but no fixed effects (4)	Buy Model with no controls but fixed effects (5)	Buy Model with Controls and fixed effects (6)
Female	0.03438***	0.0349***	0.0172***	0.0336***	0.0548***	0.0300***
	(6.46)	(7.55)	(3.28)	(5.72)	(9.58)	(4.78)
Female_Buy				0.0106	-0.0502***	-0.0331***
				(0.86)	(-5.18)	(-2.98)
Buy				0.0849***	0.0809***	0.1206***
				(12.92)	(14.07)	(18.21)
Retex_m	0.0279**		-0.0352***	0.0659***		-0.0031
	(2.12)		(-3.13)	(4.93)		(-0.27)
Retex_y	0.0257***		0.0498***	0.0480***		0.0651***
	(6.86)		(11.23)	(11.32)		(14.46)
Size	-0.0100***		-0.0420***	-0.0023**		-0.0331***
	(-12.21)		(-12.06)	(-2.28)		(-9.46)
Turnover	-0.0075***		-0.0076***	-0.0063***		-0.0089***
	(-9.57)		(-5.78)	(-8.06)		(-6.77)
Book_Mkt	0.0010		-0.0456***	-0.0043		-0.0532***
	(0.31)		(-9.90)	(-1.28)		(-11.56)
Age_insider	0.0008***		0.0001	0.0008***		0.0002
	(4.24)		(0.09)	(3.97)		(0.78)
PhD	0.4317***		0.0399	0.4424***		0.0230
	(15.33)		(1.52)	(15.36)		(0.88)
Grad	0.1573***		-0.0292**	0.1062***		-0.0364***
	(15.05)		(-2.39)	(9.88)		(-2.98)
MBA	0.3643***		-0.0061	0.3709***		-0.0166
	(15.15)		(-0.28)	(14.96)		(-0.78)
UnderGrad	0.0327***		0.0342***	0.0254***		0.0248***
	(8.77)		(5.55)	(6.77)		(4.02)
Constant	0.1912***	-	-	0.0661***	-	-
	(11.28)			(3.47)		
No. of Obs.	41384	46332	41384	41384	46332	41384
R-squared	0.0477	0.3407	0.3531	0.0552	0.3435	0.3584

*** 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 behavioural 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 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 supress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Female\_Routine_{i,t} + \beta_3 Routine_{i,t} + \beta_4 Retex\_m_{i,t-1} + \beta_5 Retex\_y_{i,(t-12,t-2)} + \beta_6 Size_{i,t-1} + \beta_7 Turnover_{i,t-1} + \beta_8 Book\_Mkt_{i,t-1} + \beta_9 Age\_insider_{i,t} + \beta_{10} PhD_{i,t} + \beta_{11} Grad_{i,t} + \beta_{12} MBA_{i,t} + \beta_{13} UnderGrad_{i,t} + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{5578} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	With controls but no fixed effects	With no controls but fixed effects	With all controls and fixed effects
	(1)	(2)	(3)
Female	0.0282***	0.0282***	0.0129**
	(5.79)	(5.97)	(2.38)
Female_Routine	0.1627***	0.1172***	0.1328***
	(3.25)	(3.40)	(3.73)
Routine	-0.0202***	-0.1075***	-0.0971***
	(-6.29)	(-28.78)	(-24.33)
Retex_m	0.0191***		0.0411***
	(3.78)		(8.45)
Retex_y	-0.0088***		-0.0338***
	(-5.33)		(-16.73)
Size	-0.0091***		-0.0291***
	(-24.92)		(-17.07)
Turnover	-0.0004		0.0064***
	(-1.22)		(10.85)
Book_Mkt	0.0215***		0.0113***
	(13.55)		(5.71)
Age_insider	0.0008***		0.0008***
	(11.23)		(7.04)
PhD	0.1107***		-0.0087
	(7.53)		(-0.47)
Grad	0.0471***		-0.0042
	(9.05)		(-0.55)
MBA	0.0371***		-0.0166
	(4.04)		(-1.49)
UnderGrad	0.0142***		0.0201***
	(8.92)		(7.20)
Constant	0.1814***	-	-
	(29.05)		
No. of Obs.	240606	265504	240606
R-squared	0.0091	0.3037	0.3117

*** 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 types. The dependent variable is behavioural 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 supress 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	0.0497***	0.0502***
	(4.45)	(4.55)
Male_Chairman	0.0123***	-0.0329***
	(6.74)	(-7.07)
Female_Director	0.0156	0.0094
	(0.87)	(0.53)
Male_Director	-0.0542***	-0.0639***
	(-14.89)	(-7.64)
Female_ChiefOfficer	0.0283***	0.0181***
	(5.29)	(3.33)
No. of Obs.	265504	46332
R-squared	0.3024	0.3420

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

Table 9 (a): Sub-Periods and Trend Analysis of Insider Trading by Female and Bias

Table 9 (a) presents the findings of regression of bias on female insider trades for three sub-periods, i.e. 2003-2006, 2007-2010 and 2011-2016. First two periods consist of four years, whereas because of the lesser number of observations of female insider transactions, the last period comprises of six years. Table 9 (b) provides the results of trend analysis of the relationship between bias and female insider trading. The dependent variable is behavioural 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. Two-way fixed effects are used for firm and month. We supress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

	2003-2006 With fixed effects (1)	2007-2010 With fixed effects (2)	2011-2016 With fixed effects (3)
Female	0.0519***	0.0281***	0.0349***
	(5.99)	(4.47)	(3.62)
No. of Obs.	95885	120300	49210
R-squared	0.6290	0.6921	0.6705

Table 9 (b):

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Female\_Trend_{i,t} + \beta_3 Trend_{i,t} + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{5578} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	Complete Model with no fixed effects (1)	Trend Variable with fixed effects (2)	Complete Model with fixed effects (3)
Female	0.0724***	0.0314***	0.0504***
	(8.23)	(6.65)	(5.63)
Female_Trend	-0.0003***		-0.0003**
	(-3.23)		(-2.49)
Trend	-0.0002***	-.0002***	-0.0002***
	(-13.75)	(-7.09)	(-6.60)
Constant	0.1338***	-	-
	(100.90)		
No. of Obs.	265395	265395	265395
R-squared	0.0015	0.3020	0.3020

*** 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 macro-level market factors. The dependent variable is behavioural bias under prospect theory. The independent variables include Market Volatility (Vlty) measured as cross sectional average of monthly standard deviation of stocks' daily returns, Investors Sentiment Index (Sntmt) is monthly measure from American Association of Individual Investors (AAII), National unemployment rate (Unempl) is monthly data from the Bureau of Labor Statistics, and CBOE Volatility Index (VIX) data is obtained from Global Financial Data. These market independent variables are measured at time t-1. Female_Vlty is the product of Market Volatility and female dummy variable, Female_Sntmt is the product of Investors Sentiment Index and female dummy variable, Female_Unempl is the product of National unemployment rate and female dummy variable, and Female_VIX is the product of Volatility Index and female dummy variable. Two-way fixed effects are used for firm and month. We supress intercept for two-way fixed effect. The t-statistics based on White robust standard errors are reported in parentheses.

$$Bias_{i,t} = \alpha + \beta_1 Female_{i,t} + \beta_2 Female\_Vlty_{i,t} + \beta_3 Female\_Sntmt_{i,t} + \beta_4 Female\_Unempl_{i,t} + \beta_5 Female\_VIX_{i,t} + \beta_6 Vlty_{i,t-1} + \beta_7 Sntmt_{i,t-1} + \beta_8 Unempl_{i,t-1} + \beta_9 VIX_{i,t-1} + \sum_{m=01}^{11} \beta_m MonthDummy_{i,t} + \sum_{f=01}^{5578} \beta_f FirmDummy_{i,t} + \varepsilon_{i,t}$$

	Complete Model with no fixed effects (1)	Macro Factors with fixed effects (2)	Complete Model with fixed effects (3)
Female	0.0242	0.0293***	-0.0403**
	(1.05)	(6.21)	(-2.10)
Female_Vlty	-0.0234**		-0.0130
	(-2.43)		(-1.56)
Female_Sntmt	-0.0917***		0.0779***
	(-3.40)		(3.47)
Female_Unempl	0.0069**		0.0102***
	(2.15)		(3.94)
Female_VIX	0.0029**		0.0021*
	(2.37)		(1.86)
Vlty	0.0048***	-0.0106***	-0.0100***
	(3.01)	(-6.74)	(-6.31)
Sntmt	0.0515***	0.0407***	0.0386***
	(13.93)	(10.58)	(9.93)
Unempl	0.0033***	0.0041***	0.0038***
	(8.13)	(8.47)	(7.69)
VIX	-0.0008***	0.0007***	0.0006***
	(-3.88)	(3.44)	(3.05)
Constant	0.0964***	-	-
	(31.42)		
No. of Obs.	265504	265504	265504
R-squared	0.0018	0.3023	0.3024

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