6-2018

Executives' gender, prospect theory bias and insider trading

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This version: November 2017

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Abstract

This study provides evidence that insider trading by female executives is subject to higher behavioural bias than male executives. Using a sample of legal insider trading from year 2000 to 2016, we find that female insider trades are more likely to be affected by prospect theory. These results hold even after we divide our sample into three categories: (i) routine trades, (ii) opportunistic trades, and (iii) non-classified trades. Moreover, 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 (System 2) may override their intuitive thinking (System 1) when critical decisions are to be made. The findings are robust to insider and firm characteristics. Our study differentiates from the existing literature on gender disparities among behavioural biases because we consider the setting of insider trading which is originally influenced by the decisions of highly experienced professionals who have access to superior private information of their firms. The findings contribute to the understanding of academics, investors, practitioners and policy makers by explaining that insider trading tends to be either more or less behaviourally biased depending upon the gender of executives.

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

Executives' Gender and Prospect Theory

1. Introduction

In this study, we explore gender differences in behavioural biases and their effect on insider trading decisions by top executives. Both male and female insiders are highly trained professionals with superior knowledge and experience of making cautious investment decisions at corporate level. Although, literature describes that market experience and sophistication tend to diminish the impact of behavioural biases on trading decisions[1]. However, various cognitive skills and behavioural biases of insiders may influence the motives and patterns of insider trading (Kallunki, Nilsson and Hellstrom, 2009). Our study finds that insider trading by female executives is subject to higher behavioural bias than male executives. The results indicate that female insiders are more likely to make buy or sell decision of the stocks according to prospect theory. Following (Barberis, Mukherjee, & Wang, 2016), we measure prospect theory value (PTV) and conclude that female insiders tend to buy (sell) stock with high (low) PTV which earns a low (high) subsequent return. We use the insiders' categorisation methodology of (Cohen, Malloy, & Pomorski, 2012) to identify routine, opportunistic and non-classified trades. The 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 the routine trade is carried by a female insider.

More interestingly, the study highlights that buying company's own stock by female insiders is subject to lesser behavioural bias as compared to selling. We provide explanation in context of thinking process of human brain in decision making described by (Kahneman, 2011), where System 1 (Intuition) makes a fast and automatic decision based on a "heuristic" while System 2 (Reasoning) is more logical and decisions are made after putting efforts. Female insiders have access to limited information as informal networks may play a crucial role (Inci, Narayanan, & Seyhun, 2017), therefore they may tend to make trading decision based on System 1 which is efficient and requires little information, but such decision is subject to high biases. However, thinking process based on System 2 dominates the decision of purchase by female executives because purchases tend to be motivated by material non-public information, hence they are considered significant to earn abnormal profit.

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 utilised to identify gender of insiders to examine gender differences in behavioural biases based on prospect theory and their impact on insider trading. 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 5.79% of the total insiders.

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

The importance of investigating cognitive skills and behavioural disparities among gender has been acknowledged in behavioural finance literature due to the increasing presence of females at corporate level[2]. Behavioural biases among gender have been analysed in experimental and financial market studies. Individual as well as professional females are more risk averse, shy away from competition, involve in less frequent trading and less overconfident than their male counterparts (Neisen and Ruenzi, 2007; Barber and Odean, 2001; Huang and Kisgen, 2013).

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; Hibbert, Lawrence and Prakash, 2016).

In the context of insider trading, studies suggest that along-with other characteristics, gender of insiders also play an important role in explaining variability in insider trading performance and information for future return (Kallunki, Nilsson and Hellstrom, 2009; Hillier, Korczak and Korczak, 2015). A recent 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 access informal networks of information, therefore they tend to possess less information, earn less abnormal profits and involve in less trading as compared to male counterparts. 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 on insider trading decision. Consistent with the literature, our study provides evidence that trading decisions of female insiders are strongly biased according to prospect theory as compared to their male counterparts.

Several experimental studies provide evidence that loss aversion and narrow framing play a crucial role in defining risk attitudes among risky choices. Barberis and Huang (2001) suggest that while doing mental accounting, investor involves in narrow framing to narrowly describe gains and losses, therefore risk attitudes are influenced by individual stock's past performance. The decision making based on 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) suggest 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 the distribution of the stock's future returns. Moreover, prospect theory value (PTV) is high when distribution of the past returns is positive and lower subsequent return is associated with

[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).

purchase of a high PTV stock. A well-known study of De Bondt and Thaler (1985) suggests that long-term prior losing stocks on average outperform winning stocks with a high mean return over past few years.

We use cumulative prospect theory and apply probability weights to historical return distribution of stocks for measuring prospect theory value (PTV). Our results show that female executives exhibit similar behaviour as a regular investor when thinking about the risk associated with insider trade decision. They are most likely to engage in narrow framing and mentally represent the associated risk by evaluating the past return distribution of the stock. Subsequently, stock with high (low) PTV is more appealing (unattractive) to these female executives and they are most likely to make a biased decision by purchasing (selling) this stock which may earn lower (higher) subsequent return.

There are several contributions of this study. First, behavioural biases among gender are well documented but exploring trading decisions of professional female insiders is a valuable contribution in behavioural finance literature. 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. 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 mental representation under prospect theory. Third, we provide explanation of our results based on System 1 and System 2 of thinking process, which is a valuable addition for 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 can potentially influence market liquidity and price movement.

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. Conclusion of the study is given in Section 5.

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). 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 (2016) 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). 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).

Insider trading is viewed as trading by sophisticated and well-informed insiders. A sufficient number of studies have concluded that insiders trade on contrarian beliefs and their trading behaviour is against the market's overreaction to past performance (Seyhun, 1992; Rozeff and Zaman, 1998).

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, 2013). 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 underconfident 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; Gneezy and Potters, 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 executives and directors of the company. 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 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 from year 1995 to 2016. The time series data from CRSP is starting from year 1995 because five-year data prior to each of the insider trade is required to measure prospect theory value. 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 14,360 top executives in 5579 publicly listed firms from 2000 to 2016.

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

[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 28,965 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 32,044 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.

executive in our sample using Factset excel API and retrieve required data points including gender.[4]

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 Behavioural Bias according to Prospect Theory Value (PTV):

Tversky and Kahneman (1992) describe cumulative prospect theory to assign value to the outcomes by aggregating value and probability weighting functions of gains and losses:

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

where

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

whereas υ (.) is the value function:

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

and $w^+(.)$ & $w^-(.)$ are probability weighting functions:

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

The parameters of value and probability weighting functions are estimated by Tversky and Kahneman (1992):

$$\alpha = 0.88, \lambda = 2.25,$$

$$\gamma = 0.61, \delta = 0.69.$$

Barberis, Mukherjee and Wang (2016) describe 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

[4] 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.

Kahneman, 1992), their study evaluates the distribution of stock's past five-years monthly returns in the following manner:

$$\mathrm{TK} \equiv \sum_{i=-m}^{-1} v(r_i)\left[w^{-}\left(\frac{i+m+1}{60}\right)-w^{-}\left(\frac{i+m}{60}\right)\right]$$

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

Kallunki, Nilsson and Hellstrom (2009) provides evidence that insider transactions are influenced by behavioural biases (over-confidence and disposition effect) in the same manner as regular investors. Subsequently, 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 measure prospect theory value, we follow the methodology of Barberis, Mukherjee and Wang (2016).

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)[5]. This window keeps rolling for every month of each stock till the last month of year 2016[6]. 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 mentioned above, "m" is the number of negative and "n" is the number of positive past monthly returns in each window of every stock[7]. We consider "i" as a simple counter element with values ranging from 1 to 60 for each window of sorted past sixty returns. r_i is the monthly return.

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[8]. For simplicity, we use term PTV instead of excess PTV in our study.

[5] 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.

[6] 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.

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

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

Barberis, Mukherjee and Wang (2016) conclude that individual investors engage in "narrow framing", therefore buying a stock with high prospect value causes the stock to become over-valued and earns low subsequent returns. We hypothesize that when an insider decides to purchase stock tempted by its' high PTV and if this trade earns low subsequent returns, this decision is subject to behavioural bias. We define Bias as follows:

- PTV = High, and Transaction = Buy, and Future Return = Low
  Bias: PTV > 0 and Trade = Buy and R(t+1) < 0

OR

- PTV = Low, and Transaction = Sell, and Future Return = High
  Bias: PTV < 0 and Trade = Sell and R(t+1) > 0

where High and Low are decided by considering threshold equal to zero, any value greater than zero is high and vice versa. Future Return is stock rerun excess to market in next month (t+1).

3.2.2 Model: Behavioural Bias and Gender

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:

$$Bias = \alpha + \beta_1 \, Gender\_dummy + \varepsilon \qquad (1)$$

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

3.3 Summary Statistics

All the variables are defined in Table 1.

Insert Table 1

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

Insert Figure 1

Table 2 is the correlation matrix, describing relationship among all main variables of the study. We find that the variables are related to dependent variable i.e. Bias positively and significantly.

Insert Table 2

Table 3 consists of Panel A and Panel B that provides detailed description of our insiders' data set. Panel A highlights information about total insider transaction, trades by males and by females separately. We can see 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 5.79% 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 the 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.

Table 3, Panel B is based on descriptive statistics of the sample insider trading. Retex_future and PTV are monthly future excess return and prospect theory value respectively. It is evident that the average age of insiders in our sample is 56 years.

Insert Table 3

4. Empirical Results and Discussion

4.1 Effect of Female Insider Trading on Behavioural Bias under Prospect Theory:

Table 4 consists of the results of regression of our main model developed in Eq (1). We examine the effect of insider trading by female on behavioural bias under prospect theory in four different models. Table 4, model (1) is a simple linear regression with only two variables, bias and female. The result shows a positive and significant relationship between these two variables. In model (2), we use the same Eq (1) but now apply two-way fixed effect for firm and month. The result still holds. In Table 4, model (3) and (4) we control for insider and firm specific characteristics, and test the main hypothesis with and without fixed effects respectively.

The findings support the conjecture that insider trades by female executives are subject to behavioural bias. They are affected by narrow framing while mentally representing stock's gains and losses. They evaluate risk related to the stock based on the distribution of past returns of the stock. Prospect theory plays an important role to describe behavioural bias associated with female decision making. These results are economically significant and based on robust standard errors to deal with heteroscedasticity.

Insert Table 4

4.2 Buy Trade and Effect of Female Insider on Behavioural Bias under Prospect Theory:

Table 5 shows regression results of relationship between bias and insider trade by female to buy stock of the company. We again test this relationship by developing four models. Model (1) and model (2) are describing regression results of simple linear regression with and without firm and month fixed effects respectively. Whereas, model (3) and model (4) include firm and insider specific characteristics as control variables.

The findings 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 "Buy_Female" (product of buy trades and gender dummy). This shows that when female insiders make purchase decision, they behave like their male counterparts.

We explain these results in context of psychology literature on dual process theory. 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" (System 1) and "Reasoning" (System 2) (Kahneman, 2003). System 1 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, System1 asks System 2 to answer in a more logical 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 and is followed by high abnormal future returns, 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.

Insert Table 5

4.3 Routine, Opportunistic and Non-Classified Trades and Effect of Female Insider on Behavioural Bias under Prospect Theory:

To provide support to our main findings, we follow the same technique developed by Cohen, Malloy and Pomorski (2012). 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 6, we examine the relationship of routine trades made by female insiders and the bias. The results of our study hold for routine trades as well. Although routine trades are less prone to behavioural biases because routine insiders trade by following a regular discipline, without exploiting internal non-public information. However, we describe that when these routine trades are made by females, they are subject to biases. The coefficients of interaction term “Routine_Female” (product of routine trade and female) is positively associated with the dependent variable in model (1) as well as in model (2).

Insert Table 6

5. Conclusion

Our study aims to empirically analyse disparities in behavioural biases of gender in the 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. Therefore, these transactions by insiders are considered as a source of information about company's prospects, hence they have the tendency to influence future returns. In such an environment, effect of behavioural biases might be weaken but our findings show that insider trading by female executives are prone to higher bias.

Consistent with the literature, we find that disparities in behavioural bias of gender exist and insider trading by female executives is subject to higher behavioural bias as compared to male executives. These results show that female insiders make trading decision like a regular investor as they involve in "narrow framing" and their buy or sell decision is affected by prospect theory value. We categorise insiders as routine, opportunistic, and non-classified (Cohen, Malloy and Pomorski, 2012), and find the same results. However, our study sheds light that a significant decrease in behavioural bias is observed in insider trading by female when a decision to purchase stock is made.

We provide explanation of these results in context of dual process theory and the way human brain functions as described by Kahneman (2011) in his book "Thinking Fast and Slow". Human mind operates in two parallel systems, referred as "Intuition" (System 1) and "Reasoning" (System 2) (Kahneman, 2003). System 1 functions automatically without any sense of voluntary control, while System 2 requires a conscious and full of effort mental activity. We argue that female insiders, in normal situations, make heuristic decision about insider trading. But when a trade is crucial and requires conscious efforts, they engage in logical thinking process of System 2. The purchase of stock by insiders is generally due to strong internal information possessed by executives. The literature describes that insiders may sell stock due to various reasons like diversification or liquidity, but purchase is normally based on some good news about the company, therefore it is followed by high abnormal future returns. Have access to limited informal network of information (Inci, Narayanan, & Seyhun, 2017), female insiders mostly rely on Intuitions and their decisions are subject to behavioural bias.

This study contributes in the literature of behavioural finance as well as provides an insight to investors, practitioners and policy makers who expect insider trading to convey information about company's future prospects and they make predictions about future market returns based on these trades.

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Figure 1: Pattern of Movement in Bias and Female Insiders Over Time

Figure 1 shows a trend in behavioural bias along-with insider trading by female executives from year 2000 to 2016. Bias_Mean and Gender_dummy_Mean are cross-section averages of bias and female insider trades respectively over time.

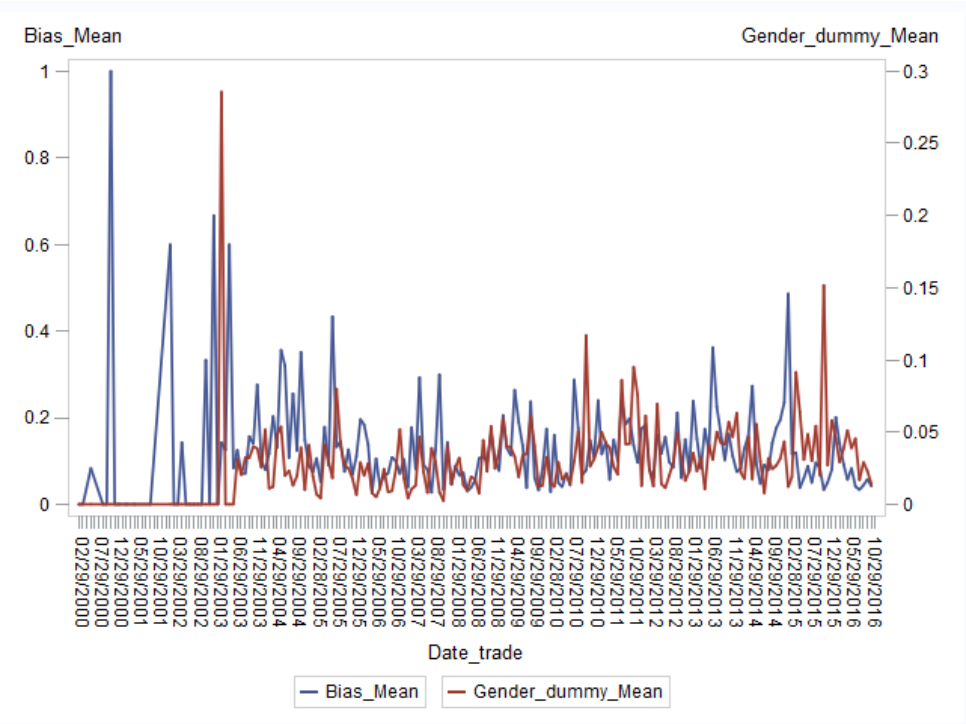

Table 1: Description of Variables

Table 1 defines all the main variables of this study.

Variables	Description
Bias	Dependent variable - Measure of behavioral bias under prospect theory. Bias is equal to 1 if any of the following conditions is met, and 0 otherwise. Bias: PTV > 0 and Trade = Buy and Retex_Future < 0 OR Bias: PTV < 0 and Trade = Sell and Retex_Future > 0
PTV	Prospect theory value measured by following Barberis, Mukherjee and Wang (2016).
Retex_Future	Measure of monthly return in excess to market return at time t+1.
Gender_dummy	Independent Variable – Measure of Female Insider. Gender_dummy is equal to 1 if insider trading is carried by a female, and 0 otherwise.
Buy	Measure of buy transaction. Buy is equal to 1 if insiders purchase the stock, and 0 otherwise.
Buy_female	Interaction term. Measures transaction of buying the stock by female insiders.
Age_insider	Control Variable - Insider's age at the time of transaction.
PhD	Control Variable – equals 1 if the insider has Doctorate degree, and 0 otherwise.
Grad	Control Variable – equals 1 if the insider has Graduate degree, and 0 otherwise.
MBA	Control Variable – equals 1 if the insider has MBA degree, and 0 otherwise.
UnderGrad	Control Variable – equals 1 if the insider has Under Graduate degree, and 0 otherwise.
Retexlag1	Control Variable – Monthly return in excess to market return at time t-1.
Retexlag12	Control Variable - Monthly return in excess to market return at time (t-2, t-12).

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

Table 2: 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	Gender_dummy	Buy	Buy_female
Bias	1.000			
Gender_dummy	0.024[a]	1.000		
Buy	0.077[a]	0.027[a]	1.000	
Buy_female	0.014[a]	0.568[a]	0.159[a]	1.000

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

Table 3: Summary Statistics

Panel A:

Table 3 Panel A provides statistics of insider trading by male and female executives for the period of 2000-2016.

	Total	Trade by Males	Trade by Females	Trades by Females (%)
Number of Firms	5579	5492	800	14.34%
Number of Executives	14360	13529	831	5.79%
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	-
Age of Executives-Average	-	56	50	-

Panel B:

Table 3 Panel B provides summary statistics of all insider transactions without categorising them for gender of executives for the period of 2000-2016. See Table 1 for the explanation of all the variables.

Variable	No. of Obs.	Mean	Median	Std. dev.	Min	Max
Bias	265504	0.120	0	0.324	0	1
Gender_dummy	265504	0.026	0	0.159	0	1
Buy	265504	0.255	0	0.436	0	1
retex_future	264210	0.005	-0.002	0.130	-0.897	3.905
PTV	224237	0.010	0.015	0.034	-0.229	0.583
Value ($)	265504	238280.2	20650	2253180.6	0	594064226.4
Age_insider	257108	56	56	9.4	20	92

Table 4: Insider Trading by Female and Behavioural Bias

Table 4 presents the findings of regression of bias on female dummy. The dependent variable is behavioural bias under prospect theory. See Table 1 for the definitions of the variables. The t-statistics based on White robust standard errors are presented in the parentheses. Two-way fixed effects are used for firm and month. We supress intercept for two-way fixed effect.

$$Bias = \alpha + \beta_1 Gender\_dummy + \varepsilon$$

$$Bias = \alpha + \beta_1 Gender\_dummy + \beta_2 Age\_insider + \beta_3 PhD + \beta_4 Grad + \beta_5 MBA + \beta_6 UnderGrad + \beta_7 retex\_lag1 + \beta_8 retex\_lag12 + \varepsilon$$

	Insider Trading by Female and Bias			
	With no fixed effects and no controls (1)	With fixed effects but no controls (2)	With controls but no fixed effects (3)	With controls and fixed effects (4)
Gender_dummy	0.0483***	0.0308***	0.0472***	0.0267***
	(12.21)	(6.53)	(11.09)	(5.21)
Age_insider			0.0010***	0.0006***
			(14.9)	(5.13)
PhD			0.0837***	-0.0068
			(7.67)	(-0.41)
Grad			0.0589***	-0.0090
			(13.52)	(-1.25)
MBA			0.0471***	-0.0045
			(6.15)	(-0.43)
UnderGrad			0.0032**	0.0162***
			(2.10)	(6.08)
retex_lag1			0.0173***	0.0473***
			(3.93)	(10.82)
retex_lag12			-0.0695***	-0.0577***
			(-14.78)	(-12.48)
Constant	0.1183***		0.0567***	
	(185.47)		(13.42)	
No. of Obs.	265504	265504	256242	256242
R-squared	0.0006	0.3015	0.0032	0.3003

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

Table 5: Insider Trading to Buy Stock by Female and Behavioural Bias

Table 5 presents the findings of regression of bias on female dummy when insider females decide to buy the stock of their company. The dependent variable is behavioural bias under prospect theory. See Table 1 for the definitions of the variables. The t-statistics based on White robust standard errors are presented in the parentheses. Two-way fixed effects are used for firm and month. We supress intercept for two-way fixed effect.

$$Bias = \alpha + \beta_1\, Gender\_dummy + \beta_2\, Buy\_Female + \beta_3\, Buy + \varepsilon$$

$$Bias = \alpha + \beta_1\, Gender\_dummy + \beta_2\, Buy\_Female + \beta_3\, Buy + \beta_4\, Age\_insider + \beta_5\, PhD + \beta_6\, Grad + \beta_7\, MBA + \beta_8 UnderGrad + \beta_9 retex\_lag1 + \beta_{10} retex\_lag12 + \varepsilon$$

	Insider Trading to Buy Stock by Female and Bias			
	With no fixed effects and no controls (1)	With fixed effects but no controls (2)	With controls but no fixed effects (3)	With controls and fixed effects (4)
Gender_dummy	0.0613***	0.0449***	0.0519***	0.0361***
	(12.76)	(7.88)	(10.05)	(5.91)
Buy_Female	-0.0530***	-0.0351***	-0.0269***	-0.0229**
	(-6.29)	(-3.74)	(-2.97)	(-2.22)
Buy	0.0584***	0.0628***	0.0633	0.0704***
	(39.9)	(26.29)	(41.59)	(28.29)
Age_insider			0.0011***	0.0007***
			(16.63)	(6.22)
PhD			0.0787***	-0.0165
			(7.22)	(-1.01)
Grad			0.0481***	-0.0101
			(11.06)	(-1.40)
MBA			0.0428***	-0.0112
			(5.61)	(-1.08)
UnderGrad			0.0058**	0.0114***
			(3.85)	(4.27)
retex_lag1			0.0544***	0.0641***
			(12.16)	(14.53)
retex_lag12			-0.0619***	-0.0533***
			(-13.20)	(-11.54)
Constant	0.1035***		0.0322***	
	(140.68)		(7.57)	
No. of Obs.	265504	265504	256242	256242
R-squared	0.0065	0.303306	0.0099	0.302547

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

Table 6: Routine Insider Trading by Female and Behavioural Bias

Table 6 presents the findings of regression of bias on female dummy when insider trades are classified as routine, opportunistic and non-classified categories. The dependent variable is behavioural bias under prospect theory. Routine trades and behaviour of female insiders are compared with opportunistic trades including non-classified trades. See Table 1 for the definitions of the variables. The t-statistics based on White robust standard errors are presented in the parentheses. Two-way fixed effects are used for firm and month. We supress intercept for two-way fixed effect.

$$Bias = \alpha + \beta_1 Routine + \beta_2 Gender\_dummy + \beta_3 Routine\_Female + \varepsilon$$

$$Bias = \alpha + \beta_1 Routine + \beta_2 Gender\_dummy + \beta_3 Routine\_Female + \beta_4 Age\_insider + \beta_5 PhD + \beta_6 Grad + \beta_7 MBA + \beta_8 UnderGrad + \beta_9 retex\_lag1 + \beta_{10} retex\_lag12 + \varepsilon$$

	With fixed effects but no controls (1)	With controls and fixed effects (2)
Routine	-0.1075***	-0.1091***
	(-28.78)	(-28.93)
Gender_dummy	0.0282***	0.0258***
	(5.97)	(5.02)
Routine_Female	0.1172***	0.1239***
	(3.40)	(3.56)
Age_insider		0.0008***
		(7.69)
PhD		-0.0068
		(-0.42)
Grad		-0.0085
		(-1.19)
MBA		-0.0050
		(-0.48)
UnderGrad		0.0180***
		(6.79)
retex_lag1		0.04603***
		(10.54)
retex_lag12		-0.0566***
		(-12.25)
No. of Obs.	265504	256242
R-squared	0.3037	0.3026

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