Are men more overconfident than women? Evidence from the Taiwan futures market

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Abstract

Taiwan ranks number two in the world in gender equality using the measures in the United Nations Gender Inequality Index (GII). The US does not rank even among the top ten countries. The results of this study show that the findings of previous studies using the US stock market data showing that men are overconfident compared to women in financial trading does not extend to participants in the Taiwan futures market. Our results show that, unlike the US stock market, the Taiwan futures market does not support the hypothesis of overconfidence in men. For this market, we find evidence that although men tend to trade more than women, they tend to lose less money than women. Moreover, we find even stronger evidence that young women perform worse than young men.

Keyword: overconfidence, gender difference, women, men

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I.   Introduction

Overconfidence models predict overconfident traders will trade more and produce lower returns. For the US stock market past research finds evidence that compared to women, men trade more and the performance of men are hurt more by excessive trading than the performance of women, suggesting that men are more overconfident than women. Using account data from a large US discount brokerage, Barber and Odean (2001) analyze the common stock investments of men and women from February 1991 through January 1997. They find that men trade more than women and that their trading reduces their net returns by higher percentage points a year compared to women.

Odean (1998) and Gervais and Odean (2001) reason high market returns can mislead investors in judging their ability in stock selection and, thus, trade more. Using the stock market to research overconfidence has the weakness in that influences such as industry knowledge and investor knowledge of specific firm's operations and performance of stocks various groupings (i.e. value or growth firms) can confound the results. Because trading in stock markets can be affected by investors' knowledge of industries and their understanding of specific firms, analyzing trader overconfidence using data from stock index futures trading should mitigate these concerns since this data is not confounded by traders' stock selection ability knowledge. Moreover, because of its high margin characteristic, analyses of the futures market rather than the stock market may more easily bring out any evidence of overconfidence for its participants. The high leverage characteristics, daily marking to the market and monthly expiry date for front month contracts are three specific differences between the futures market and the stock investment. These differences force traders in the futures market to be unable to hold on to their

investments for long holding periods compared to stock investors. Futures traders cannot, for example, cannot position themselves as long-term shareholders and hold shares for several years like stock investors such as Warren Buffet.

Although gender may determine a large part a person's proclivity for overconfidence, nurture or environment may change or lessen to some extent its manifestation. The finding of overconfidence in men compared to women in stock trading from research analyzing U.S. stock data may not extend to other countries where gender inequality between men and women may be better than that of the U.S. Taiwan is a natural candidate country to address this issue. Gender inequality is significantly lower in Taiwan than in the U.S. Even though, in the international political front, the U.S. is the perceived vanguard of human rights and women's rights; however, using objective measures developed by the United Nations' Gender Inequality Index (GII), the U.S. lags behind many nations, both developed and developing, in actual gender equality. The computed GII rank for Taiwan using 2012 data is number two in the world using the gender equality criteria of the United Nations' Gender Inequality Index. The U.S. does not even rank in the top ten and lags behind many modern Asian and Nordic countries. In fact, "Taiwan's ranking is noticeably better than both Japan and South Korea, the rankings of which are 22 and 28 respectively."[1] Because the gender inequality is significantly lower in Taiwan than in U.S., whether such environment boosts women's confidence and influences their financial trading behavior is an important research question.

Models of investor overconfidence predict that, since men are more overconfident than women, men will trade more and perform worse than women (Odean, 2001). For the US stock market, Odean (2001) shows that men exhibit overconfidence; they trade more and perform worse than women. Whether these

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[1] http://www.chinapost.com.tw/taiwan/national/national-news/2013/06/11/380930/Taiwan-gender.htm

results extend to other asset market participants and whether men in other cultures also exhibit similar investor overconfidence is not yet known. The results of this study of futures markets in Taiwan should shed some light on these issues.

The futures market is characterized by participants with higher leverage than those for the stock market. This being the case, using this market to examine the issue of investor overconfidence should understandably provide more delineated results than from analysis of the stock market. The detailed dataset used in this study allows us to classify traders not only by every individual account but also by gender.

The study finds several results. Our results show that the findings from previous research showing that men are overconfident in financial trading do not extend to a country such as Taiwan that has one of the highest gender equality rankings in the world. From our analysis of the Taiwan futures market, we find evidence that although men tend to trade more than women, they tend to lose less money than women. Moreover, for the younger traders in this market, we find even stronger evidence that women perform worse than men. Because the overconfidence hypothesis requires evidence of overtrading combined with underperformance, our results show that, unlike the US stock market, the Taiwan futures market does not support the hypothesis of overconfidence in men. In other word, men are not overconfident traders compared to women traders in the Taiwan futures market.

The rest of the paper is as follows. Section two provides a discussion of the related literature. Section three shows sample summary statistics and empirical approach. Section four displays empirical results. The last section is conclusion.

II. Literature review

2.1 Overconfidence

Overconfidence is an important subject in psychology and experimental

economics studies. An important finding in the psychology of judgment is that people are overconfident (DeBondt and Thaler, 1995). Many laboratory studies find that people exhibit overconfidence and often believe that they are better than average for many behaviors. Svenson (1981), for example, find that 93% of American drivers rate themselves as better than the median. Camerer (1997) notes "Dozens of studies show that people ... are generally overconfident about their relative skills." The finding of overconfidence also appears in finance.

A growing body of literature on the topic of investors' overconfidence is being generated. Studies show that such behavioral bias (overconfidence) also affects people's decision making in financial investment (Kahneman and Riepe 1998). In the area of corporate finance, CEO's overconfidence has been pervasively studied. Malmendier and Tate (2005) find overconfident managers often overestimate their ability and the returns to their investment projects. They argue that managerial overconfidence can account for corporate investment distortions.

By using account level data from a national-wide discount brokerage house, Odean (1999) argues "that due to overconfidence, individual investors trade excessively in the sense that they trade even when the expected gains from excessive trading are not enough to cover the trading costs." Barber and Odean (2001), examining the trading activity of households accounts in the same discount brokerage, further show that men trade more excessively than women and, as a result of excessive turnover, men suffer a worse returns than women do.

Given that excess trading due to overconfidence reduces returns, it is logical to expect traders who trade excessively to lose money and eventually exit the market. Barber and Odean's (2000) said, "excess trading is hazardous to your wealth." On the other hand, other researchers examining this issue have come to two opposite conclusions. Sandroni (2005) demonstrates that agents with correct beliefs drive

agents with incorrect beliefs out of the market. However, some studies conclude that overconfident investors not only survive, they also thrive. Kyle and Wang (1997) employ a duopoly game of informed speculation and show that an overconfident trader may dominate his rational opponent.

Although overconfidence leads to overtrading and reductions in investor returns, theoretical studies argue that overconfident investors' willingness to take more risk gives them higher probability to find out potential gains and trade more actively to get profit (Hirshleifer and Luo, 2001). Gervais and Odean (2001) demonstrate that trading success makes investors incorrectly infer their ability and become overconfident. They stay in the market due to their wealth. Although they may eventually lose confidence and wealth and cease to trade, the continuous inflow of inexperienced traders guarantees there will always be overconfident traders in the market who trade excessively.

2.2 Gender Differences on overconfidence

Gender differences have been found in many behavioral studies. The psychological literature generally finds that men are more overconfident than women.

In educational psychology, Bengtsson et al. (2005) use exam data from Stockholm University to test whether males differ from females in terms of self-confidence. They find a clear gender difference in that male students are more inclined than female students to take chances. This difference in self-assessment is more pronounced among younger than among older students. They find that exam behavior is gender-specific: male students are more overconfident to aim a higher grade than female students. Reader's digest[2] reports that in spite of the stereotype

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[2] "Are Men Better Drivers Than Women?", see
http://www.rd.com/advice/relationships/are-men-better-drivers-than-women/#ixzz3ibn42sus

that women are weaker drivers, it is "difficult to determine whether men are truly innately better drivers than women or if they're simply more confident in their driving because they're perceived to be better." On the other hand, a study from a simple natural field experiment based on an economics exam to test whether men are really more overconfident than women at a Swedish university "reports no support for the frequently proposed hypothesis that men are more overconfident than women" (Johansson-Stenman and Nordblom, 2010).

Meece and Painter (2008) examine gender differences in self-regulated learning across different academic subjects and tasks, conclude that girls are generally more self-regulated. Bembenutty and Karabenick (1998) examine whether gender differences exists in self-regulated learning. Their results show that girls perform better than boys. Bembenutty (1999), however, finds that there is not a profound gender difference on GPA. Similarly, another study in gender difference by Bembenutty (2007) investigates college students' learning performance, and finds that gender differences are shown in motivation.

In criminology, men are more likely to commit criminal acts because women are more self-controlled (Gottfredson and Hirchi, 1990). Self-control theory is also applied to many studies in education and in criminal and delinquent behavior to examine gender differences (Burton et al., 1998; LaGrange and Silverman, 1999; Tittle et al., 2003; Higgins, 2004). Self-control theory proposes that females are more self-controlled and are less likely to commit a crime compared to males (Gottfredson and Hirchi, 1990). They reason that this may occur because parents apply different tasks to form self-discipline behavior for males and females. Burton et al. (1998), Higgins (2004) and Higgins and Tewksbury (2006) apply self-control theory for examining behavior difference in gender and find evidence supporting the theory. Overall evidence, however, is mixed. Some studies find girls are more self-controlled

than boys. Other studies find no difference in gender effect. Under different social expectations and culture, the gender differences may differ.

In studies related to finance, Barber and Odean (2001) show that due to men's overconfidence, men trade more excessively than women do. Because men are more impulsive than women, women may perform better than men do in some areas. For example, Huffington Post (2011) argues "Women are better than men because they're not overconfident." The article notes "A new study, conducted by Barclays Wealth and Ledbury Research, has apparently shown that women are less likely to take risks, at least on Wall Street."

2.3 Age Differences and interaction with Gender

Several pieces of research study whether gender differences vary with different age levels (Humphrey, 1982; Cole, 1986; Davis, 1995; Duckman and Seligman, 2006). Duckman and Seligman (2006) examine gender differences and grades of different age level school students. Their results show that young girls earn higher grades than young boys; however, girls do not outperform boys on IQ tests. They conclude that girls may be more self-disciplined than boys, "and this advantage is more relevant to report card grades than to achievement or aptitude tests." Cole (1986) and Davis (1995) examine children's emotional expression control for different age levels. They find girls have higher levels of social monitoring behaviors than boys; especially younger girls demonstrate the greatest self-control. Other studies that test self-control or self-discipline difference among different aged girls and boys include Kendall and Wilcox, 1979; Humphrey, 1982; Eysenck et al., 1984; Mischel et al., 1988; Logue et al., 1996. Most of them find significant differences but some report no gender differences in self-control (Mischel et al., 1988; Logue et al., 1996).

Gottfredson and Hirschi (1990) find that self-control differences between

individuals are static, but self-control within individuals is dynamic. They find that the population of low self-control groups decreases with age.

Turner and Piquero (2002) examine how stable the linkage between self-control and age is and its relation to crime. The results show that self-control is not stable during childhood and relatively fixed after they grow up. Wulfret et al. (2002) also find that self-control is formed gradually in early life and then is going to be stable across the lifespan.

In research related to finance, many experimental economists, as well as survey data studies, examine gender differences in risk preference in household finance or investment decisions. Most of them conclude women are more risk averse than men (Sunden and Surette, 1998; Bajtelsmit et al., 1999; Bernasek and Shwiff, 2001; Hallahan et al., 2004; Campbell, 2006; Charness and Gneezy, 2007; Watson and McNaughton, 2007; Eckel and Grossman, 2008; Hibbert et al., 2008; Olivares et al., 2008; Croson and Gneezy, 2009).

Age is another frequently examined factor linked to risk tolerance. Korniotis and Kumar (2011) examine older investors' performances to see whether the wisdom accumulated over the years is favorable for their investment decisions or the deterioration of the cognitive abilities owing to oldness hinders them from making profitable decision. They find evidence consistent with the generally held belief that risk tolerance decreases with age. McInish (1982) and Hallahan et al. (2004) demonstrate a strong negative, but nonlinear, relationship between age and the risk levels of investors' portfolios. Xiao and Anderson (1997) and Donkers and Van Soest (1999), on the other hand, find evidence showing an inverse relation between risk tolerance and age. In sum, the existing conclusions regarding the relationship between age and risk tolerance are mixed.

Feng and Seasholes (2005) show that investors' disposition effect vary with the

different level of age. They find that the older investors exhibit a stronger disposition effect relative to younger investors and furthermore, men are less likely to display the disposition effect than are women.

III Data and methodology

3.1   Data

This study uses Taiwan Stock Index Futures (hereafter, TXF, the tick symbol) trading data as sample. Our data from Taiwan Futures Exchange (TAIFEX) is a comprehensive trading record. Taiwan futures market is a continuous auction market. Futures contracts are traded by an electronic trading system (ETS) from 8:45 AM to 1:45 PM without taking a break at noon. Orders are matched on a real-time basis according to price and time priority. Basically there are no the designated market makers.

Our data consist of all trading record of the front-month[3] TXF from the TAIFEX that mature between January 2005 and December 2008. We attribute every transaction to the trading account and then calculate open interests (OIs) and weighted average costs. We identify the complete trading records for each trader from her/his first trade of the contract. After marking to market by following each trade, we can identify the realized and unrealized gains/losses with average cost until the contract expires. We have the gross and net gains or losses after transaction costs (commissions and taxes) of trading by each trader.

TXF is the first index product launched on July 21, 1998 in TAIFEX and the most active futures contract, accounting for close to 70% of the trading volume of the TAIFEX futures contracts. TXF is based on the capitalization weighted stock index of

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[3] Contracts listed for trading include the front month, the next calendar month, and the next three quarterly months.

Taiwan Stock Exchange (TWSE), which includes all stocks traded on the TWSE. Each TXF tick represents 200 Taiwan Dollars (about 6.09 US dollars, according to the exchange rate 32.84 in December 31 2007)[4]. Compared to stocks, stock index futures contract can avoid some noisy issues e.g. different sizes of stocks, risk levels and infrequent trading, i.e., some investors hold their shares and do not trade for a long time. We cannot make sure that the cost because of long holding stocks, possibly several years. Maturity and the marking to market feature compel futures traders to offset their positions at least before maturity date.

In addition to the typical information such as the time, date, price, volume—number of contracts, and buy-sell direction of the transaction, each record also includes an account type to identify whether the trader is an individual, institution, or proprietary trader. We focus only on individual traders because many institutions employ more than one trader who trade in rotating shifts. That makes us unable to identify trader's behavior.

Our sample period is from January 2005 to December 2008. We test sample and report the results in the later sections year by year to separate the possible market condition problem. We eliminate many traders who trade very few contracts although it accounts for a substantial part of observations. We leave the traders who trade at least five contracts each month. Each observation is one trader-month, i.e., to summarize these variables by month for one trader. We eliminate those data in which trading days are less than three within a month because too few transactions cannot reflect traders' behavior and it will be difficult for us to make right inference. We summarize the descriptive statistics of traders and observations year by year but summary statistics presented in Table 1 is only for year 2008 owing to saving space. The others are similar. The number of traders trading at least one month is 13,072.

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[4] According to Taiwan's Central Bank data   http://www.cbc.gov.tw/content.asp?CuItem=27029

There are 2,183 traders trading 12 months (i.e., trade in each month of 2008.) The number of traders is 51,774 and among them, men (women) account for 66.3 (33.7) percent. Male traders significantly outnumber female. The number of observation by month-account is 209,389 and the ratio of men to women is similar as above. There are 13,072 traders trading only one month and then quit during 2008; 9,352 traders last trading for two months only. Only 2,183 traders trade every month in 2008. So all of the trader, 51,774, trade at least one month during 2008; 38,702 traders trade at least two months.

<<< Insert Table 1 here >>>

3.2   Methodology

We structure the trading records to classify each trader's record and the trading sequence for each trader. In order to have the necessary statistics, we trace the first trade and calculate the open interests (OIs), weighted average costs (Cost), and the gains and losses by each trade. According to the previous transaction information, we update the OI and calculate the weighted average cost by summing the previous OIs multiplying cost add this transaction's price times number of contracts during the accumulation phrase. We mark to the market to update the realized and paper gains/losses (RG/PG) after each transaction. We constantly update and mark to the market when each trade occurs for every trader.

We sum the total quantity and realized gains/losses as the total trading volume and gross profitability at the end of month for each trader. Performance in Barber and Odean's (2001) paper in stock market is represented by return; however, in futures markets, due to trading by margins the return is difficult to calculate. We divide total gross profit by total trading volume, i.e., unity profit as performance proxy. To test

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whether investors overtrade owing to overconfidence, Barber and Odean (2001) use turnover rate to measure trading frequency. Their turnover rate is gotten by using monthly trading volume divided by prior holding shares for each investor. We follow the methodology and spirit by summing monthly trading volume over prior maximum OI. Because the prior maximum OIs are like the Barber and Odean's (2001) prior holding shares, total trading volume over maximum OIs means the trading frequency and it is the similar proxy to measure whether traders overtrade.

Because the mean and median of maximum OIs in Table 2 is 5.7 and 2.0 contracts respectively, it means most of the individual traders have the less fund. Only very few individual traders invest much capital. For the maximum OI, it is about 6.78 million U.S. dollars. The trading volume within one month are 84.4 (20) contracts for average (median). The result implies that retail traders trade frequently because they use few funds, 5.7 (2) contract margins to trade 84.4 (20) contracts. The mean of gross profit is -61.4 ticks. It shows big loss traders lose much higher money than big profit traders gain in magnitude. Owing to some trades unrealized within the current month, the median is zero. The similar statistics in net profit. However, after adjusting quantity, to see unity gross profit (gross profit over trading volume), its mean value is -2.6, implying the more big loss traders. Their profit, turnover and performance shown in Table 2 have extremely distribution. That makes the several times differences between mean and median value.

<<< Insert Table 2 here >>>

4. Results

Table 3 presents various behavioral and performance statistics for our sample differentiated by gender. The first row, maximum OI, shows men invest slightly more

capital than women do. The difference is significant for the sample period as a whole but insignificant in some years. The turnover rate row shows men exhibit higher turnover rate than women. The difference between men and women under this measure is significant for the entire sample period. It is also significant in each of the four years analyzed. The turnover rate provides the primary measure that shows us that men trade more frequently than women and that the difference is statistically significant. The daily trading volume provides an alternate measure. The last row of Table 3 shows that this measure also shows that men trade more frequently than women and that the difference is statistically significant under this measure also. In short, the results in Table 3 show that in this futures market men trade more than women.

Overconfidence requires overtrading and worse performance. Odean (2001)'s results for the US stock market conclude that in the US, men are overconfident compared to women because they overtrade and produce worse performance. To conclude that men in the Taiwan futures market are overconfident we must also show that the more frequent trading activities by men lead to worse performance. Results in Table 3 do not show this. The gross profit measure in Table 3 shows women lose more money than men. Men's gross profits are higher (less negative) than women's, though not statistically significant for the whole sample period. The net profit measure show men to lose slightly more money than women but the difference is not statistically significant. The previous two measures are not scaled by trading volume. An alternative measure, unity gross profit, scales the gross profit by trading volume. The unity gross profit measure shows a positive and significant difference between men and women with men's unity gross profit higher than women's. The unity net profit measure provides a robustness check of the previous measure. The results for the unity net profit measure are similar to those for unity gross profit – men's

performance is better than women's. These results do not support overconfidence for men in the Taiwan futures market since overconfidence requires evidence of both overtrading and worse performance. Unlike the Odean (2001)'s results for the U.S. stock market, where men overtrade and produce worse returns compared to women, men in the Taiwan futures market overtrade but do not produce worse returns compared to women.[5] Overall, the results suggest that in a Chinese culture based society such as Taiwan, men do not show the behavioral characteristics of overconfidence compared to women in the high-leveraged futures market examined by this study.

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To provide deeper analyses concerning our findings so far, we next, further classify the men and women of our sample into subgroups of younger and older men, and younger and older women. This additional sorting allows us to check for overconfidence in younger and older traders separated by gender. In detail, men older than median age are classified in the older group; otherwise, they are classified in the younger group. For women, the same additional layer of classification is also performed.

We hypothesize that analyses of age should provide additional insights with respect to our findings concerning overconfidence so far. The Chinese culturally based societies of Asia have transformed dramatically in the recent decades. In less than a generation, the educational and employment opportunities for women have expanded dramatically. Prior to the rapid industrialization of Taiwan and the more

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[5] Nonparametric Wilcoxon and K-W tests of statistical significance (not shown) for the various performance measures are also significant for most measures.

recent rise of China, women in Chinese culturally based societies of Asia had few opportunities to have an education or few years' of education. The prevailing attitude was that women did not need to have much education given that their main task according to society is to be a qualified housewife. Under such social mores, most parents did not support young women to obtain more education. Before the 1960s and 1970s, the number of female students in higher education was much less than male students. However, after the 1990s, the concept of gender equality became more and more mainstream and accepted. What's more, the law of gender equality had been enacted in Taiwan in 2002 to punish violators of sexual discrimination and wage inequality in companies. Currently, in Taiwan, the number of female students in major national universities' college of business or social science is often much higher than the number of male students.

The results of subgroup analysis provide evidence supporting our hypothesis. Table 4 shows that younger women have the higher maximum OI than men, and the difference is statistically significant. The turnover rate measure shows that younger men have higher turnover rates than younger women, and the difference statistically significant. This measure shows that younger men appear to trade more than young women. To make inferences with respect to overconfidence, we must show that the overtrading associates with poorer performance.

We next examine performance statistics to check if the overtrading by young men relates to poorer performance. For the performance measures of gross and net profit, the differences between younger men and younger women are positive and statistically significant, meaning that younger men outperform younger women in the Taiwan futures market during our sample period. Similarly, the unity gross profit and unity net profit measures show a significant positive difference between the performance of younger men and younger women. Both measures show that younger

men lose less money than younger women. Overall, in the Taiwan futures market, younger men trade more than younger women. However, they invest less capital than younger women. They also do not lose as much money as younger women. Thus, it cannot be concluded that younger men in the Taiwan futures market exhibit overconfidence since both overtrading and poor performance are necessary for evidence of overconfidence.

It is of interest to note the comparative differences between men and women in the older group and the younger group. In the younger group, the difference between men and women in the maximum OI measure reversed compared to that of the older group. In the younger group women exhibited significantly higher maximum OI than men; whereas, in the older group, men exhibited significantly higher maximum OI than women. As mentioned previously, these differences may be caused by the recent changes in the fabric of Chinese culture based societies in Asia, where the vast proportion of the younger women now have equal if not more educational level compared to men and are economically independent.[6]

Given their comparatively high educational levels, younger women (in Taiwan) no longer have to rely on male partners for economic subsidence. They earn their own money and consume by themselves. They have capital to invest. Fewer and fewer women are full-time housewives. It stands to reason the younger women of our sample are found to invest more capital than then the corresponding younger men.

To summarize, the performance measures of the older group are somewhat different from those of the younger group. The results of the younger group provide even less support for the hypothesis that men are overconfident (trading too much and

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[6] This may be especially true for Taiwan, where because of compulsory military service for males, women in the younger generation often opt to attend graduate school to wait for their significant other to finish their military service, resulting in overall higher educational level for women compared to males for the younger generation.

worse performance). These findings are in line with the our hypothesis that the overconfidence of men found using US stock data may not extend to other countries, especially those with real, tangible gender equality (as opposed to countries such as the US where, for example, gender equality, though much talked about and glorified by the mainstream media, is in actuality lagging behind that of many modern Asian nations). For the case of Taiwan, under criteria used in the United Nations' Gender Inequality Index (GII), Taiwan ranked number 2 in the world when computed using 2012 data, better than most Western countries, including the United States.[7]

<<< Insert Table 4 here >>>

We next run regression tests to provide some additional insights on the effects of gender and age on various measures of this study. Table 5 presents results of regressing various measures on gender and age and the interaction term. In the regressions, gender is defined as one if traders are women; otherwise, zero. The turnover rate was defined earlier. Age is trader's age in years.

The first column of Table 5 shows gender has a negative coefficient, meaning that women have lower turnover rate than men. The result is consistent with those given in previous sections and the previous literature for the US stock market; men trade more than women. In the second column, the negative coefficient of age shows that the older traders have a lower turnover rate compared to younger traders. That seems reasonable because the futures market is comparatively higher levered and more volatile than the stock market, features possibly making it more suitable for younger traders. The interaction term is positive and statistically significant. The fourth column includes a dummy variable "previous profit." This variable controls

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[7] http://www.chinapost.com.tw/taiwan/national/national-news/2013/06/11/380930/Taiwan-gender.htm

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for whether previous gain/loss affects traders subsequent investment behavior. The previous profit dummy variable is set equal to one if traders have previous loss; otherwise, it is set equal to zero.

When unity gross profit is regressed on gender alone the coefficient of gender is significant, suggesting that women, overall, have better performance than men. However, when we control for age, the sign of the coefficient changes and the coefficient becomes insignificant. The coefficient associated with age negative and statistically significant, meaning that older traders generate worse performance than younger traders.

Adding the cross term to the regression does not influence the age coefficient, it remains negative and statistically significant. We include this specification for reference only since adding the cross term causes the regression to have high collinearity, with the model VIF jumping from 1 to 20 after the adding the term. The coefficient for the previous profit is negative and significant, meaning that previous losses negatively correlate with turnover.

Columns 7 and 8 give the results of two regression specifications that regresses unity gross profit on turnover rate. The resulting coefficient should be negative to support the hypothesis of overconfidence. The results of both specifications show that this is not the case. The coefficient for the turnover rate was found to be positive and statistically significant for both specifications. Thus, the results for Taiwan futures markets from these regression specifications do not support the overconfidence hypothesis. These results are line with the results from the previous tables presented in this study. In short, the evidences provided in this study do not support overconfidence in males for the Taiwan futures market.[8]

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[8] Locke and Mann (2005) discuss the relation between trading speed and improved performance.

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We perform robustness checks of the results using gross and net profit before scaled, and daily gross and net profit. The results remain similar to those conducted in the main analysis. We also perform robustness checks of performance under different market states. The results shown in Panel B of Table 3 and 4 are mainly consistent with the results of Panel A. Additional tests by each sub-sample, i.e., each year, also yield the results are that are generally similar to the main tests. It is of interest to note that most of the results for the older group are consistent with previous literature. For Taiwan, this is reasonable because this group (the elderly) grew up in a dramatically different gender equality environment than what exists currently, prior to women in Asia gaining empirically discernible power relative to men, both economically and politically. Conversely, the results also continue to show that for younger women, the results do not support previous literature using women from Western nations.

5. Conclusion

For the US stock market, previous research showed evidence of overconfidence in men; they trade more but perform worse than women. This study shows that these results do not completely generalize for the Taiwan futures market. Our evidence shows that although men tend to trade more than women, they tend to lose less money than women.

The results are quite robust for the younger traders but not so, for the older ones. For the younger group, the evidence is even stronger than the full sample that women perform worse than men. On the other hand, the older group shows insignificant

difference performance and yields results that mostly supports the prior literature. Robustness checks under different performance measures and market situations support the main analysis.

Overconfidence requires overtrading combined with underperformance. In short we cannot conclude that men are overconfident traders in the Taiwan futures market.

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Table 1. Descriptive statistics

The table reports sample and trading account's distribution. Sample consists of retail traders. Data is from Taiwan Futures Exchange. Sample period is from January 2005 to December 2008, forty eight months but only 2008 data is reported in this table for saving space. Panel A reports gender's distribution; Panel B, age's distribution; Panel C, month's distribution.

Panel A: Data distribution: by gender

By trader(account)

trader type	Frequency	%
Male	34,325	66.30%
Female	17,449	33.70%
Total	51,774	100.00%

By observations (monthly*account)

trader type	Frequency	%
Male	140,273	66.99%
Female	69,116	33.00%
Total	209,389	100.00%

Panel B: Data distribution: by age

By trader (account)

	Age (years)
obs.	51,774
Mean	44.27
Median	43.8

By observations (monthly account)

	Age (years)
obs.	209,389
Mean	44.94
Median	44.7

Panel C: Data distribution: trading month

By trader (account)

traders trading months	1	2	3	4	5	6	
obs.	13,072	9,352	6,926	4,914	3,714	3,072	
traders trading months	7	8	9	10	11	12	Total
obs.	2,371	1,892	1,695	1,420	1,163	2,183	51,774

By observations (monthly account)

traders trading months	1	2	3	4	5	6	
obs.	51,774	38,702	29,350	22,424	17,510	13,796	
traders trading months	7	8	9	10	11	12	Total
obs.	10,724	8,353	6,461	4,766	3,346	2,183	209,389

Table 2. Descriptive statistics

The table reports sample's descriptive statistics. Data is from Taiwan Futures Exchange. Panel A covers full sample period. Panel B reports 2005 for one year snapshot. N is the observations. Q1 and Q3 is the first and third quartile statistics. Max_OI is the maximum open interest for each account during monthly sample period. Turnover, the turnover rate; Trading volume, the total contracts of trade; Gross profit, sum of the profit before commission fee and tax; Net profit, sum of the profit after commission fee and tax; Unity gross profit, gross profit per contract; Unity net profit, net profit per contract; Daily gross, the average daily gross profit; Daily net, the average daily net profit; Daily vol, the average daily contracts of trade.

Panel A: 2005-2008

	Max_ OI	Turn-over	Trading volume	Gross profit	Net profit	Unity gross profit	Unity net profit	Daily gross	Daily net	Daily vol
N	742,399	678,165	743,653	738,627	738,638	738,627	738,638	738,627	738,638	743,653
Missing	1,254	65,488	-	5,026	5,015	5,026	5,015	5,026	5,015	-
Mean	5.7	18.9	84.4	-61.4	-172.3	-2.6	-3.9	-20.9	-30.6	7.3
Median	2.0	10.0	20.0	0.0	-32.7	0.0	-1.3	0.0	-5.0	2.9
Max	2,450	15,746	113,954	351,094	347,605	1,760.8	1,758.8	121,821	120,831	5,426.4
Min	1	1	5	-1,501,517	-1,509,007	-1,911.7	-1,914.9	-469,249	-470,346	1
Q1	1	5	10	-218.9	-275.0	-9.5	-10.9	-30.5	-36.7	1.86
Q3	4	19	48	193.0	147.4	8.5	7.2	26.4	21.1	5.43

Panel B: 2005

	Max_ OI	Turn-over	Trading volume	Gross profit	Net profit	Unity gross profit	Unity net profit	Daily gross	Daily net	Daily vol
N	186,694	172,402	187,250	185,096	185,122	185,096	185,122	185,096	185,122	187,250
Missing	556	14,848	0	2,154	2,128	2,154	2,128	2,154	2,128	0
Mean	5.94	10.61	48.87	8.93	-58.37	-1.63	-3.01	-9.65	-17.0	5.35
Median	2	7	14	9	-13.73	0.55	-0.81	1.44	-2.1	2.25
Max.	1657	617	40375	241,564	195,934	970.4	967.76	31,698	30,732	1927
Min.	1	1	5	-197,646	-201,376	-551	-553.69	-103,162	-104,245	1
Q1	1	4	8	-158	-190.2	-9.4	-10.8	-23.4	-27.6	1.6
Q3	4	12	31	155	125.3	9.2	7.9	22.3	18.5	4

Table 3 t-test between gender differences

The table tests sample's gender differences and report the t-test and nonparametric Wilcoxon test. Data is from Taiwan Futures Exchange. Panel A covers full sample period. Panel B divides sample period into bull and bear market. Max_OI is the maximum open interest for each account during monthly sample period. Turnover, the turnover rate; Trading volume, the total contracts of trade; Gross profit, sum of the profit before commission fee and tax; Net profit, sum of the profit after commission fee and tax; Unity gross profit, gross profit per contract; Unity net profit, net profit per contract; Daily gross, the average daily gross profit; Daily net, the average daily net profit; Daily vol, the average daily contracts of trade.

Panel A: Full sample period

	Sex	Obs.	Mean	Mean Difference	t-value	Sig. (2-tailed)	Wilcoxon asymp Z value	Asymp. Sig.(2-tailed)
max_OI	Male	489,253	5.73	0.19	3.49	<.001	-27.78	<.001
	Female	254,400	5.54					
turnover	Male	451,207	19.39	1.81	16.56	<.001	-16.14	<.001
	Female	233,677	17.57					
Unity gross profit	Male	485,893	-2.42	0.23	1.94	0.05	7.51	<.001
	Female	252,734	-2.66					
unity net profit	Male	485,895	-3.72	0.24	2.00	0.05	7.37	<.001
	Female	252,743	-3.96					
Gross profit	Male	485,893	-54.72	1.46	0.10	0.92	6.46	<.001
	Female	252,734	-56.18					
Net	Male	485,895	-161.4	-0.88	-0.06	0.95	11.11	<.001

	Sex	Obs.	Mean	Mean Difference	t-value	Sig.	Wilcoxon asymp. Z	Asymp. Sig.
profit	Female	252,743	-160.5					
daily_gross	Male	485,893	-20.45	-0.46	-0.14	0.88	6.79	<.001
	Female	252,734	-19.99					
daily_net	Male	485,895	-29.95	-0.99	-0.31	0.76	10.72	<.001
	Female	252,743	-28.96					
trading volume	Male	489,253	85.19	2.28	1.46	0.14	-37.76	<.001
	Female	254,400	82.91					
daily_vol	Male	489,253	7.48	0.43	5.10	<.001	-55.20	<.001
	Female	254,400	7.05					

Panel B: Bull and Bear sample period

		Bull							**Bear**						
	Sex	Obs.	Mean	Mean Difference	t-value	Sig.	Wilcoxon asymp. Z	Asymp. Sig.	Obs.	Mean	Mean Difference	t-value	Sig. (2-tailed)	Wilcoxon asymp. Z	Asymp. Sig.
max_OI	Male	149,243	5.88	0.29	3.15	<.01	-14.63	<.001	135,080	5.57	0.13	1.26	0.21	-13.34	<.001
	Female	78,073	5.59						68,320	5.44					
turnover	Male	137,926	17.91	1.62	8.63	<.0001	-9.52	<.001	123,220	26.41	2.90	10.45	<.0001	-9.47	<.001
	Female	71,853	16.30						61,820	23.50					
unity gross profit	Male	148,042	-1.76	-0.11	-0.59	0.56	8.91	<.001	134,543	-2.26	1.18	3.73	0.00	-3.93	<.001
	Female	77,435	-1.65						68,053	-3.44					
unity net	Male	148,054	-3.14	-0.10	-0.56	0.57	8.90	<.001	134,513	-3.32	1.19	3.74	0.00	-3.98	<.001

profit	Female	77,444	-3.04						68,040	-4.51					
gross profit	Male	148,042	14.22	-12.27	-0.74	0.46	7.34	<.001	134,543	-179.9	91.03	2.02	0.04	-3.64	<.001
	Female	77,435	26.49						68,053	-270.9					
net profit	Male	148,054	-92.27	-17.63	-1.07	0.28	10.58	<.001	134,513	-301.9	91.39	2.02	0.04	-1.65	0.09
	Female	77,444	-74.64						68,040	-393.3					
daily_gross	Male	148,042	-8.14	-1.90	-0.46	0.64	7.80	<.001	134,543	-39.32	13.53	1.34	0.18	-3.44	<.001
	Female	77,435	-6.24						68,053	-52.849					
daily_net	Male	148,054	-17.76	-2.59	-0.63	0.53	10.46	<.001	134,513	-49.148	13.10	1.29	0.20	-1.83	0.07
	Female	77,444	-15.17						68,040	-62.247					
trading volume	Male	149,243	78.14	3.45	1.54	0.12	-20.56	<.001	135,080	113.50	1.22	0.3	0.76	-19.53	<.001
	Female	78,073	74.69						68,320	112.30					
daily_vol	Male	149,243	7.07	0.46	3.53	<.001	-32.03	<.001	135,080	9.11	0.44	2.12	0.03	-28.26	<.001
	Female	78,073	6.61						68,320	8.67					

Table 4 t-test gender differences interaction between gender and age

The table tests sample's gender differences and report the t-test and nonparametric Wilcoxon test under different age groups. Data is from Taiwan Futures Exchange. Panel A reports the gender differences under the younger and older groups for whole sample period and. Panel B reports the gender differences under the younger and older groups after dividing sample period into bull and bear market. Trader's age below the whole sample's median is classified as the younger groups, otherwise, as older group. Max_OI is the maximum open interest for each account during monthly sample period. Turnover, the turnover rate; Trading volume, the total contracts of trade; Gross profit, sum of the profit before commission fee and tax; Net profit, sum of the profit after commission fee and tax; Unity gross profit, gross profit per contract; Unity net profit, net profit per contract; Daily gross, the average daily gross profit; Daily net, the average daily net profit; Daily vol, the average daily contracts of trade.

Panel A: Age group test

age_group		sex	N	Mean	Mean Diff.	t-value	Sig.	Wilcoxon asymp. Z	Asymp. Sig.
younger	max_OI	Male	252,605	5.09	-0.376	-6.34	<.001	-3.44	<.001
		Female	121,267	5.47					
	turnover	Male	228,811	21.30	2.38	13.13	<.001	-13.26	<.001
		Female	109,693	18.92					
	unity gross profit	Male	251,001	-1.98	0.38	2.25	0.02	4.29	<.001
		Female	120,382	-2.36					
	unity net profit	Male	251,004	-3.28	0.38	2.28	0.02	4.23	<.001
		Female	120,392	-3.66					
	gross profit	Male	251,001	2.31	41.29	2.67	<.01	2.87	<.001

			N						
		Female	120,382	-38.98					
	net profit	Male	251,001	-116.10	33.87	2.2	0.03	5.74	<.001
		Female	120,392	-149.90					
	daily_gross	Male	251,001	-11.81	8.38	2.70	<.01	3.51	<.001
		Female	120,382	-20.19					
	daily_net	Male	251,004	-22.14	7.67	2.47	0.01	6.16	<.001
		Female	120,392	-29.82					
	trading	Male	252,605	94.93	6.71	2.95	<.01	-13.33	<.001
	volume	Female	121,267	88.23					
	daily_vol	Male	252,605	8.19	0.59	4.82	<.001	-25.14	<.001
		Female	121,267	7.59					
older	max_OI	Male	236,648	6.41	0.8	9.01	<.001	-35.33	<.001
		Female	133,133	5.61					
	turnover	Male	222,396	17.41	1.03	8.37	<.001	-7.97	<.001
		Female	123,984	16.38					
	unity gross	Male	234,892	-2.89	0.04	0.21	0.84	6.50	<.001
	profit	Female	132,352	-2.92					
	unity net	Male	234,891	-4.19	0.04	0.25	0.80	6.37	<.001
	profit	Female	132,351	-4.23					
	gross profit	Male	234,892	-115.70	-43.82	-1.84	0.07	6.86	<.001
		Female	132,352	-71.83					
	net profit	Male	234,891	-209.90	-39.71	-1.66	0.09	10.12	<.001

	sex	N	Mean	Mean Diff.	t-value	Sig.	Wilcoxon Z	Asymp. Sig.
	Female	132,351	-170.20					
daily_gross	Male	234,892	-29.69	-9.87	-1.83	0.07	6.57	<.001
	Female	132,352	-19.82					
daily_net	Male	234,891	-38.29	-10.11	-1.87	0.06	8.97	<.001
	Female	132,351	-2818					
trading volume	Male	236,648	74.78	-3.28	-1.59	0.11	-38.66	<.001
	Female	133,133	78.06					
daily_vol	Male	236,648	6.73	0.16	1.47	0.14	-49.21	<.001
	Female	133,133	6.57					

Panel B: age group under bull and bear market

age_group		sex	Bull							Bear						
			N	Mean	Mean Diff.	t-value	Sig.	Wilcoxon asymp. Z	Asymp. Sig.	N	Mean	Mean Diff.	t-value	Sig.	Wilcoxon asymp. Z	Asymp. Sig.
younger	max_OI	Male	77,301	5.27	-0.26	-2.44	0.01	-1.15	0.25	69,558	5.00	-0.58	-4.58	<.001	-1.69	0.09
		Female	37,095	5.54						32,583	5.58					
	turnover	Male	70,179	19.40	2.11	6.55	<.001	-8.25	<.001	62,049	29.82	4.29	9.83	<.001	-6.97	<.001
		Female	33,614	17.29						28,907	25.53					
	unity gross	Male	76,735	-2.18	0.16	0.60	0.55	5.10	<.001	69,318	-0.40	1.47	3.47	<.001	-3.16	0.001

			N							N						
	profit	Female	36,743	-2.34						32,454	-1.87					
	unity net	Male	76,740	-3.56	0.17	0.63	0.53	5.09	<.001	69,304	-1.45	1.47	3.46	<.001	-3.17	0.001
	profit	Female	36,748	-3.73						32,449	-2.92					
	gross	Male	76,735	12.29	31.72	1.44	0.15	3.42	<.001	69,318	26.7	161.9	3.50	<.001	-3.49	<.001
	profit	Female	36,743	-19.43						32,454	-135.2					
	net profit	Male	76,740	-103.90	21.50	0.98	0.33	5.51	<.001	69,304	-113.7	157.5	3.40	<.001	-2.18	0.03
		Female	36,748	-125.40						32,449	-271.2					
	daily_	Male	76,735	-8.91	8.83	1.31	0.19	4.42	<.001	69,318	-10.05	26.12	3.49	<.001	-3.49	<.001
	gross	Female	36,743	-17.74						32,454	-36.17					
	daily_net	Male	76,740	-19.31	7.99	1.19	0.24	6.21	<.001	69,304	-21.12	25.53	3.41	<.001	-2.26	0.02
		Female	36,748	-27.30						32,449	-46.65					
	trading	Male	77,301	85.32	6.81	2.08	0.04	-6.89	<.001	69,558	131.20	7.04	1.14	0.25	-7.17	<.001
	volume	Female	37,095	78.50						32,583	124.10					
	daily_vol	Male	77,301	7.65	0.58	2.95	0.00	-14.25	<.001	69,558	10.36	0.68	2.13	0.03	-14.79	<.001
		Female	37,095	7.07						32,583	9.68					
older	max_OI	Male	71,942	6.53	0.90	5.96	<.001	-19.20	<.001	65,522	6.17	0.86	5.35	<.001	-16.79	<.001
		Female	40,978	5.63						35,737	5.31					
	turnover	Male	67,747	16.37	0.95	5.03	<.001	-4.44	<.001	61,171	22.95	1.23	3.58	<.001	-5.38	<.001
		Female	38,239	15.42						32,913	21.72					
	unity gross	Male	71,307	-1.31	-0.28	-1.12	0.26	6.92	<.001	65,225	-4.24	0.63	1.35	0.18	-1.63	0.10
	profit	Female	40,692	-1.03						35,599	-4.88					
	unity net	Male	71,314	-79.75	-50.95	-2.04	0.04	6.93	<.001	65,209	-5.31	0.64	1.37	0.17	-1.69	0.09

		N	Mean						N	Mean					
profit	Female	40,696	-28.81						35,591	-5.95					
gross	Male	71,307	16.30	-51.66	-2.06	0.04	6.50	<.001	65,225	-399.40	-4.79	-0.06	0.95	-0.47	0.63
profit	Female	40,692	67.96						35,599	-394.60					
net profit	Male	71,314	-2.70	-0.28	-1.13	0.26	8.71	<.001	65,209	-501.90	2.70	0.04	0.97	0.78	0.43
	Female	40,696	-2.42						35,591	-504.60					
daily_ gross	Male	71,307	-7.31	-11.46	-2.28	0.02	6.13	<.001	65,225	-70.43	-2.38	-0.13	0.90	-0.36	0.71
	Female	40,692	4.14						35,599	-68.05					
daily_net	Male	71,314	-16.09	-11.87	-2.36	0.02	7.79	<.001	65,209	-78.94	-2.47	-0.14	0.89	0.43	0.66
	Female	40,696	-4.22						35,591	-76.47					
trading volume	Male	71,942	70.43	-0.81	-0.27	0.79	-21.52	<.001	65,522	94.72	-6.74	-1.31	0.19	-19.39	<.001
	Female	40,978	71.24						35,737	101.50					
Daily_vol	Male	71,942	6.45	0.26	1.52	0.13	-28.94	<.001	65,522	7.80	0.04	0.16	0.87	-22.87	<.001
	Female	40,978	6.19						35,737	7.75					

Table 5 Regression test

The table reports regression results. Data is from Taiwan Futures Exchange. Variable gender equals one if trader is female; otherwise, 0. Age equal 1 if trader's age is not below median; otherwise 0. D_pre_profit is equal to 1 if trader has a prior loss; otherwise 0. Turnover, the turnover rate; Unity gross profit, gross profit per contract; Daily vol, the average daily contracts of trade.

	(1) turnover	(2) Turnover	(3) turnover	(4) turnover	(5) unity gross profit	(6) unity gross profit	(7) unity gross profit	(8) unity gross profit	(9) unity gross profit
(Constant)	19.39***	26.85***	28.04***	23.91***	-3.08***	-3.08***	-0.29	-0.80**	-0.05
	(277.33)	(106.63)	(91.58)	(81.15)	(-47.54)	(-47.54)	(-1.19)	(-2.46)	(-0.18)
gender	-1.81***	-1.68***	-5.22***	-4.42***		0.02***	-0.19	-0.71	-0.84
	(-15.15)	(-14.06)	(-9.87)	(-8.83)		(17.19)	(-1.64)	(-1.26)	(-1.63)
age		-0.17***	-0.19***	-0.15***			-0.05***	-0.05***	-0.05***
		(-30.84)	(-29.04)	(-23.93)			(-8.98)	(-6.94)	(-8.06)
gender*age			0.08***	0.06***				0.01	0.01
			(6.87)	(5.86)				(-0.97)	(1.29)
D_pre_profit				-2.12***					
				(-19.75)					
daily_vol				0.44***					-0.002
				(288.69)					(-1.24)
turnover					0.02***			0.02***	
					(17.19)			(16.84)	
adj_R^2(%)	0.03	0.17	0.18	11.12	0.04	0.04	0.01	0.05	0.01
obs.	684,884	684,884	684,884	683,658	680,828	738,627	738,627	680,828	738,627
Max VIF	1.000	1.923	20.345	20.347	1.000	1.000	1.001	20.342	19.988

***: below 1% significant level; **: below 5% significant level